

# 2021 IECC Commercial





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Instructor

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- In the construction industry for over 40 years
- ICC – IRC Plumbing & Mechanical Code Development Committee 2009/2012
- ICC- IECC Commercial Energy Code Development Committee 2015/2018
- ICC- IECC Residential Energy Code Development Committee 2021/2024
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### The Look and Layout of the 2021 IECC

<p><b>Commercial Section</b></p>	<p><b>Residential Section</b></p>
<p>Ch. C1 Scope and Application / Administrative and Enforcement</p> <p>Ch. C2 Definitions</p> <p>Ch. C3 General Requirements</p> <p>Ch. C4 Commercial Energy Efficiency</p> <p>Ch. C5 Existing Buildings</p> <p>Ch. C6 Referenced Standards Index</p>	<p>Ch. R1 Scope and Application / Administrative and Enforcement</p> <p>Ch. R2 Definitions</p> <p>Ch. R3 General Requirements</p> <p>Ch. R4 Residential Energy Efficiency</p> <p>Ch. R5 Existing Buildings</p> <p>Ch. R6 Referenced Standards Index</p>

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### C103.2 Information on construction documents

1. Energy compliance path.
2. Insulation materials and their R-values.
3. Fenestration U-factors and solar heat gain coefficients (SHGCs).
4. Area-weighted U-factor and solar heat gain coefficient (SHGC) calculations.
5. Mechanical system design criteria.
6. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
7. Economizer description.
8. Equipment and system controls.
9. Fan motor horsepower (hp) and controls.
10. Duct sealing, duct and pipe insulation and location.
11. Lighting fixture schedule with wattage and control narrative.
12. Location of daylight zones on floor plans.
13. Air barrier and air sealing details, including the location of the air barrier.

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### C103.2.1 Building thermal envelope depiction

The building thermal envelope shall be represented on the construction drawings

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### New Commercial Definitions to Note:

**CHANGE OF OCCUPANCY.** A change in the use of a building or a portion of a building that results in any of the following:

1. A change of occupancy classification.
2. A change from one group to another group within an occupancy classification.
3. Any change in use within a group for which there is a change in the application of the requirements of this code.

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### New Commercial Definitions to Note:

- **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 of less than 20 watts per square foot (20 watts per 0.092 m<sup>2</sup>) of conditioned floor area or a connected design electronic data equipment load of less than 10 kW.

- To differ from data centers

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### New Commercial Definitions to Note:

**DATA CENTER.** A room or series of rooms that share data center systems, whose primary function is to house equipment for the processing and storage of electronic data and that has a design total ITE equipment power density exceeding 20 watts per square foot (20 watts per 0.092 m<sup>2</sup>) of conditioned area and a total design ITE equipment load greater than 10 kW.

**DATA CENTER SYSTEMS.** HVAC systems and equipment, or portions thereof, used to provide cooling or ventilation in a data center

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### New Commercial Definitions to Note:

**GREENHOUSE.** A structure or a thermally isolated area of a building that maintains a specialized sunlit environment exclusively used for, and essential to, the cultivation, protection or maintenance of plants. Greenhouses are those that are erected for a period of 180 days or more



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### New Commercial Definitions to Note:

**INTERNAL CURTAIN SYSTEM.** A system consisting of movable panels of fabric or plastic film used to cover and uncover the space enclosed in a greenhouse on a daily basis



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### New Commercial Definitions to Note:

**TESTING UNIT ENCLOSURE AREA.** The area sum of all the boundary surfaces that define the dwelling unit, sleeping unit or occupiable conditioned space including top/ceiling, bottom/floor and all side walls. This does not include interior partition walls within the dwelling unit, sleeping unit, or occupiable conditioned space. Wall height shall be measured from the finished floor of the conditioned space to the finished floor or roof/ceiling air barrier above



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### New Commercial Definitions to Note:

**THERMAL DISTRIBUTION EFFICIENCY (TDE).** The resistance to changes in air heat as air is conveyed through a distance of air duct. TDE is a heat loss calculation evaluating the difference in the heat of the air between the air duct inlet and outlet caused by differences in temperatures between the air in the duct and the duct material. TDE is expressed as a percent difference between the inlet and outlet heat in the duct



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**New Commercial Definitions to Note:**

**WALL, ABOVE-GRADE.** A wall associated with the building thermal envelope that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the building thermal envelope that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, peripheral edges of floors, roof knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts



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**Residential VS Commercial**

Definition of Residential per IECC is different than that found in the IRC and IBC:

**RESIDENTIAL BUILDING.**  
For this code, includes detached one and two family dwellings and multiple single family dwellings (townhouses) as well as R-2, R-3 and R-4 buildings three stories or less in height above grade plane.



**COMMERCIAL BUILDING.** For this code, all buildings that are not included in the definition of "Residential buildings."

UPDATED



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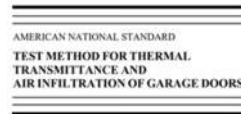
**C303.1.3 Fenestration product rating.**

U-factors of fenestration products shall be determined as follows:

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

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

- U-factors 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).



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And the table

**TABLE C303.1.3(1)  
DEFAULT GLAZED FENESTRATION U-FACTORS**

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

**TABLE C303.1.3(2)  
DEFAULT 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 C303.1.3(3)  
DEFAULT GLAZED FENESTRATION SHGC AND VT**


	SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
	Clear	Tinted	Clear	Tinted	
SHGC	0.8	0.7	0.7	0.6	0.6
VT	0.6	0.3	0.6	0.3	0.6



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**World's Best Window Co.**  
Series "2000"  
Casement  
Vinyl Clad Wood Frame  
Double Strength Angles Fiberglass  
XVC-24-1-20000-00001

**ENERGY PERFORMANCE RATINGS**  
U-Factor (U.S. / I-P)      Solar Heat Gain Coefficient  
**0.35**      **0.32**

**ADDITIONAL PERFORMANCE RATINGS**  
Visible Transmittance      Air Leakage (U.S. / I-P)  
**0.51**      **≤ 0.3**

Condensation Resistance  
**51**      **-**

**NATIONAL FENESTRATION RATING COUNCIL  
LABEL CERTIFICATE**

**PRODUCT LISTING  
FOR CODE COMPLIANCE**

LABEL CERTIFICATE ID: PJ-WT1-5943      Issuance Date: 12/8/2016

**NFRC CERTIFIED PRODUCT RATING INFORMATION: \***  
This is to be completed by an NFRC Approved Calculation Entity (ACE), based on information provided by the Specifying Authority and calculated in accordance with NFRC procedures.

**PRODUCT LISTING:**

Code	Product Name	Existing Ref.	Existing Ref.	Existing Ref.	Total Area	U-Factor	SHGC	VT	CR	Air Leakage
P-CBE 51487	606 1/2" x 47 1/2" x 1 1/2" 606 1/2" x 47 1/2" x 1 1/2" 606 1/2" x 47 1/2" x 1 1/2" 606 1/2" x 47 1/2" x 1 1/2"	SA 100	SA 100	SA 100	100.00	0.35	0.32	0.51	51	0.3
P-CBE 51488	48 1/2" x 60 1/2" x 1 1/2" 48 1/2" x 60 1/2" x 1 1/2" 48 1/2" x 60 1/2" x 1 1/2" 48 1/2" x 60 1/2" x 1 1/2"	SA 100	SA 100	SA 100	100.00	0.35	0.32	0.51	51	0.3

**FRAME, GLAZING and SPACER ASSEMBLIES**

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**IECC Commercial Compliance Options**

**C401.2.1 International Energy Conservation Code**  
Commercial buildings shall comply with one of the following:

1. Prescriptive Compliance. The Prescriptive Compliance option requires compliance with Sections C402 through C406 and Section C408. Dwelling units and sleeping units in Group R-2 buildings without systems serving multiple units shall be deemed to be in compliance with this chapter, provided that they comply with Section R406.
2. Total Building Performance. The Total Building Performance option requires compliance with Section C407.

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

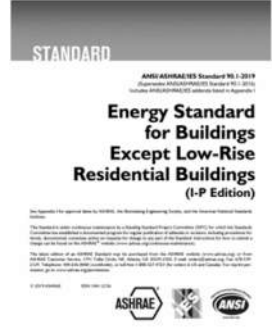


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**IECC Commercial Compliance Options**

**C401.2.2 ASHRAE 90.1**  
Commercial buildings shall comply with the requirements of ANSI/ASHRAE/IESNA 90.1.

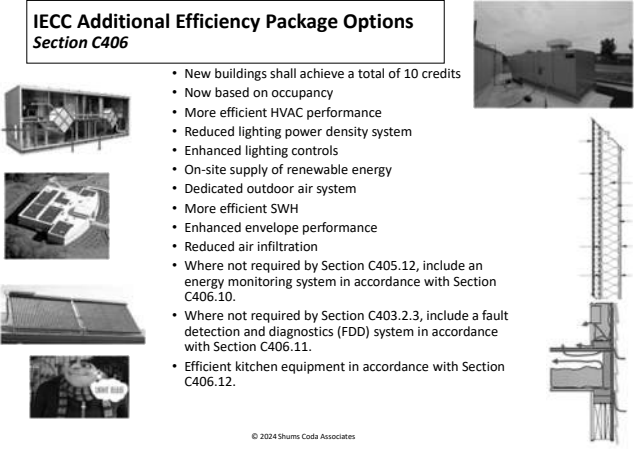


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**IECC Additional Efficiency Package Options  
Section C406**

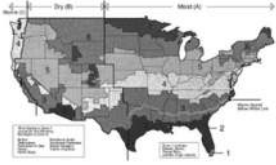

- New buildings shall achieve a total of 10 credits
- Now based on occupancy
- More efficient HVAC performance
- Reduced lighting power density system
- Enhanced lighting controls
- On-site supply of renewable energy
- Dedicated outdoor air system
- More efficient SWH
- Enhanced envelope performance
- Reduced air infiltration
- Where not required by Section C405.12, include an energy monitoring system in accordance with Section C406.10.
- Where not required by Section C403.2.3, include a fault detection and diagnostics (FDD) system in accordance with Section C406.11.
- Efficient kitchen equipment in accordance with Section C406.12.



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**Climate Zones**  
2021 IECC - Chapter 3

Tropical Climate Zone in IECC Includes:  
Hawaii, Puerto Rico, Guam,  
American Samoa, U.S. Virgin Islands,  
Commonwealth of Northern Mariana Islands  
and Islands in the area between the Tropic of  
Cancer and the Tropic of Capricorn.

Still listed as Zone 1A\* -warm humid climate




Determining Your Climate Zone is the First Step in the Process



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Building Thermal Envelope Requirements

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**C402.1.1 Low-energy buildings and greenhouses**



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

1. Those with a peak design rate of energy usage less than 3.4 Btu/h × ft<sup>2</sup> or 1.0 watt per square foot of floor area for space conditioning purposes.
2. Those that do not contain conditioned space



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**C402.1.1.1 Greenhouses**



Greenhouse structures or areas that are mechanically heated or cooled and that comply with all of the following shall be exempt from the building envelope requirements of this code:

1. Exterior opaque envelope assemblies comply with Sections C402.2 and C402.4.5.

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

2. Interior partition building thermal envelope assemblies that separate the greenhouse from conditioned space comply with Sections C402.2, C402.4.3 and C402.4.5.
3. Fenestration assemblies that comply with the thermal envelope requirements in Table C402.1.1.1. The U-factor for a roof shall be for the roof assembly or a roof that includes the assembly and an internal curtain system.

**Exception:** Unconditioned greenhouses

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**Equipment Buildings  
IECC Section C402.1.2**

Buildings that comply with the following are exempt from the building thermal envelope provisions:

- Separate building with floor area < 1200 ft<sup>2</sup>
- Intended to house electric equipment with installed equipment power totaling > 7 watts/ft<sup>2</sup>
- Heating system capacity < 17,000 Btu/hr and a heating thermostat set point that is restricted to < 50°F
- Average wall and roof U-factor < 0.200 in Climate Zones 1-5 and < 0.120 in Climate Zones 6-8
- Comply with the roof solar reflectance and thermal emittance provisions for Climate Zone 1



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**402.1.3 Insulation component R-value-based method.**

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE	
	All other	Group R	All other	Group R	All other	Group R	All other	
<b>Roofs</b>								
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci
Metal buildings <sup>b</sup>	R-19 +R-11 LS	R-19 +R-11 LS	R-19 +R-11 LS	R-19 +R-11 LS	R-19 +R-11 LS	R-19 +R-11 LS	R-19 +R-11 LS	R-19 +R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49
<b>Walls, above grade</b>								
Mass <sup>f</sup>	R-5.7ci <sup>f</sup>	R-5.7ci <sup>f</sup>	R-5.7ci <sup>f</sup>	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-9.5ci
Metal building	R-13 +R-6.5ci	R-13 +R-6.5ci	R-13 +R-6.5ci	R-13 +R-13ci	R-13 +R-6.5ci	R-13 +R-13ci	R-13 +R-13ci	R-13 +R-13ci
Metal framed	R-13 +R-5ci	R-13 +R-5ci	R-13 +R-5ci	R-13 +R-7.5ci	R-13 +R-7.5ci	R-13 +R-7.5ci	R-13 +R-7.5ci	R-13 +R-7.5ci
Wood framed and other	R-13 +R-3.8ci or R-20	R-13 +R-3.8ci or R-20	R-13 +R-3.8ci or R-20	R-13 +R-3.8ci or R-20	R-13 +R-3.8ci or R-20	R-13 +R-3.8ci or R-20	R-13 +R-3.8ci or R-20	R-13 +R-3.8ci or R-20
<b>Walls, below grade</b>								
Below-grade wall <sup>l</sup>	NR	NR	NR	NR	NR	NR	NR	R-7.5ci
<b>Floors</b>								
Mass <sup>g</sup>	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-14.6ci
Joist/framing	R-13	R-13	R-30	R-30	R-30	R-30	R-30	R-30
<b>Slab-on-grade floors</b>								
Unheated slabs	NR	NR	NR	NR	NR	R-10 for 24" below	R-10 for 24" below	R-15 for 24" below
Heated slabs <sup>9</sup>	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab

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**What about COMcheck?**



C402.1.5 Component performance alternative. (Must use Version 4.1.1.0 or later)

Building envelope values and fenestration areas determined in accordance with Equation 4-2 shall be an alternative to compliance with the U-, F- and C-factors in Tables C402.1.3, C402.1.4 and C402.4 and the maximum allowable fenestration areas in Section C402.4.1. Fenestration shall meet the applicable SHGC requirements of Section C402.4.3.

$A + B + C + D + E \leq \text{Zero}$  (Equation 4-2)

**THIS IS ONLY FOR THE THERMAL ENVELOPE! Trade offs are allowed in the envelope.**

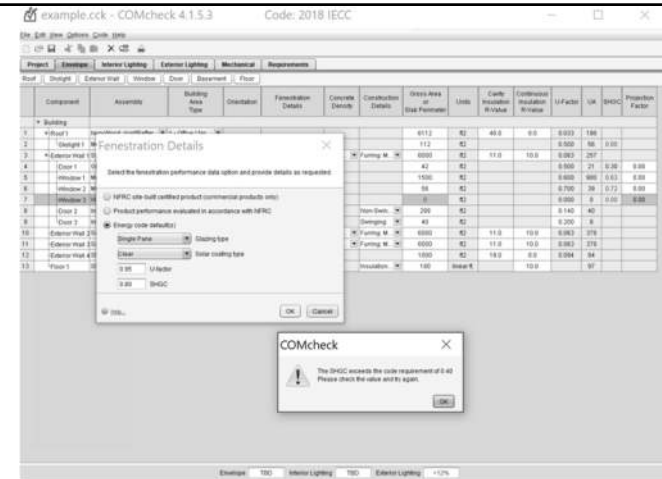
The mechanical and lighting portions of ComCheck are compliance reports only and do not allow any trade-offs within them. These reports are a convenient way to show compliance.



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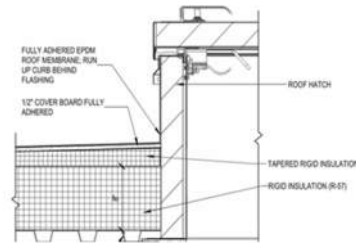
**C402.2 Specific building thermal envelope insulation requirements**

**C402.1.4.1Roof/ceiling assembly**

The maximum roof/ceiling assembly U-factor shall not exceed that specified in Table C402.1.4 based on construction materials used in the roof/ceiling assembly.

**C402.1.4.1.1 Tapered, above-deck insulation based on thickness**

Where used as a component of a maximum roof/ceiling assembly U-factor calculation, the sloped roof insulation R-value contribution to that calculation shall use the average thickness in inches along with the material R-value-per-inch solely for U-factor compliance as prescribed in Section C402.1.4.



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**C402.1.4 Assembly U-factor, C-factor or F-factor-based method.**

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R
<b>Roofs</b>								
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032
Metal buildings	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021
<b>Walls, above grade</b>								
Mass <sup>1</sup>	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.050
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064
Wood framed and other <sup>2</sup>	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064
<b>Walls, below grade</b>								
Below-grade wall <sup>3</sup>	C-1.140°	C-1.140°	C-1.140°	C-1.140°	C-1.140°	C-1.140°	C-0.119	C-0.092
<b>Floors</b>								
Mass <sup>4</sup>	U-0.322°	U-0.322°	U-0.107	U-0.087	U-0.074	U-0.074	U-0.057	U-0.051
Moist/framing	U-0.066°	U-0.066°	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
<b>Slab-on-grade floors</b>								
Unheated slabs	F-0.73°	F-0.73°	F-0.73°	F-0.73°	F-0.73°	F-0.54	F-0.52	F-0.52
Heated slabs	F-0.69	F-0.69	F-0.69	F-0.69	F-0.66	F-0.66	F-0.62	F-0.62
<b>Opaque doors</b>								
Nonswinging door	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31
Swinging door <sup>5</sup>	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% glazing <sup>6</sup>	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31

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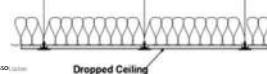
**C402.2 Specific building thermal envelope insulation requirements**

**C402.1.4.1Roof/ceiling assembly**

The maximum roof/ceiling assembly U-factor shall not exceed that specified in Table C402.1.4 based on construction materials used in the roof/ceiling assembly.

**C402.1.4.1.2 Suspended ceilings**

Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly U-factor of the roof/ceiling construction.



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**C402.2 Specific building thermal envelope insulation requirements**

**C402.1.4.1Roof/ceiling assembly**

The maximum roof/ceiling assembly U-factor shall not exceed that specified in Table C402.1.4 based on construction materials used in the roof/ceiling assembly.

**C402.1.4.1.3 Joints staggered**

Continuous insulation board shall be installed in not less than two layers, and the edge joints between each layer of insulation shall be staggered, except where insulation tapers to the roof deck at a gutter edge, roof drain or scupper



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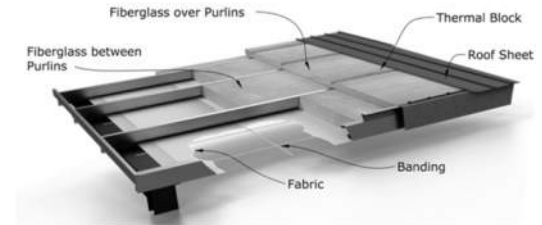
Footnote a: ASHRAE Descriptions

- A2.3.2.1: The first rated R-value of insulation is for insulation draped over purlins and then compressed when the metal roof panels are attached, or for insulation hung between the purlins. A minimum R3.5 thermal space block between the purlins and the metal roof panels is required when specified in Table A2.3
- A2.3.2.2: For double-layer installations, the second rated R-value of insulation is for insulation installed parallel to the purlins.
- A2.3.2.3: For continuous insulation (e.g., insulation boards or blankets), it is assumed that the insulation is installed below the purlins and is uninterrupted by framing members. Insulation exposed to the conditioned space or semi-heated space shall have a facing, an all insulation seams shall be continuously sealed to provide a continuous air barrier.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA 90.1 Appendix A.



Roof R-Value Metal Buildings



Liner System includes the following:

- Continuous vapor barrier liner membrane that is installed below the purlins and that is uninterrupted by framing members
- An uncompressed, unfaced insulation resting on top of the liner membrane and located between purlins
- Multilayer installations, the last rated R-value of insulation is for unfaced insulation draped over purlins and compressed when the metal roof panes are attached



C402.2 Specific building thermal envelope insulation requirements

TABLE C402.2  
SPECIFIC THERMAL ENVELOPE INSULATION REQUIREMENT MINIMUM R-VALUE METHOD<sup>1</sup>

CLIMATE ZONE	4-16,000 HOURS <sup>2</sup>				4-16,000 HOURS <sup>2</sup>				4-16,000 HOURS <sup>2</sup>			
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
Roof	15	15	15	15	15	15	15	15	15	15	15	15
Walls	15	15	15	15	15	15	15	15	15	15	15	15
Floors	15	15	15	15	15	15	15	15	15	15	15	15

What's the difference between metal building And metal frame?

C402.2.2 Above-grade walls



C402.2 Specific building thermal envelope insulation requirements

C402.2.2 Above-grade walls

Metal Building, Metal Frame, Wood and Other



- ✓ Cavity insulation or cavity plus continuous (ci)
- ✓ Continuous insulation not broken up by framing members e.g., rigid board insulation

Wall R-Value

Photo courtesy of Dow Building Solutions



### C402.2.2 Above-grade walls

#### Sectional View Of A Typical EIFS Application

Water that penetrates the primary moisture barrier separates the substrate and insulation board and causes ripples for long periods of time.

Finish coat, which forms the outer portion of the EIFS (EIFS exterior surface).

Metal studs, which form the inner portion of the wall (EIFS interior surface).

Figure 1

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### Metal Building Wall Insulation Assembly Description Per ASHRAE

A3.2.1: For the purpose of Section A1.2, the base assembly is a wall where the insulation is compressed between metal wall panels and the metal structure. Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing

- The first rated R-value of insulation is for insulation compressed between metal wall panels and the steel structure.
- For double layer installations, the second rated R-value of insulation is for insulation installed from the inside, covering the girts.
- For continuous insulation (e.g., insulation boards) it is assumed that the insulation boards are installed on the inside of the girts and uninterrupted by the framing members.
- Insulation exposed to the conditioned space or semi-heated space shall have a facing, and all insulation seams shall be continuously sealed to provide a continuous air barrier.

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### C402.2.2 Above-grade walls

#### Walls- Metal Buildings

Over-the-Purlin Installation

Roof panel

2" - 6" faced insulation

Over-the-Girt Installation

Wall panel

2" - 6" faced insulation

Taped Tab

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### C402.2 Specific building thermal envelope insulation requirements

#### C402.2.2 Above-grade walls

##### Mass Walls

- Walls weighing at least 35 lbs/ft<sup>2</sup> of wall surface area
- 25 lbs/ft<sup>2</sup> of wall surface area if material weight is ≤ 120 lb/ft<sup>3</sup>
- Heat capacity > 7 Btu/ft<sup>2</sup>
- Heat capacity > 5 Btu/ft<sup>2</sup> if the material weight is < 120 pcf

Heat capacity:  
The number of BTU's needed to raise 1 square foot of wall 1° F

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**C402.2 Specific building thermal envelope insulation requirements**

Floor framing *cavity insulation* or structural slab insulation should be installed to maintain permanent contact with underside of subfloor decking or structural slabs

**Exceptions:** Framing cavity insulation or structural slab insulation is permitted to be in contact with top side of sheathing or ci installed on the bottom side of floor where combined with insulation that meets or exceeds R-value in Table C402.1.3 for “Metal framed” or “Wood framed and other” values for “Walls, Above Grade” and extends from the bottom to the top of all perimeter floor framing or floor assembly members

Insulation applied to underside of concrete floor slabs is permitted an airspace of not more 1” where it turns up and is in contact with underside of floor under walls associated with the *building thermal envelope*

**Floors Section C402.2.3**

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**C402.2 Specific building thermal envelope insulation requirements**

<https://buildingscience.com/documents/insights/bsi-064-bobby-darin-thermal-performance>

Thermal Performance

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**C402.2 Specific building thermal envelope insulation requirements**

**C402.2.4 Slabs-on-grade**

**C402.2.4.1 Insulation installation**

Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend **downward from the top of the slab** for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches of soil. Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.

Exception: Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required

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**C402.2 Specific building thermal envelope insulation requirements**  
**C402.2.5 Below-grade walls**

What is a below grade wall?  
 A wall associated with the basement or first story of the building that is part of the building thermal envelope, is not less than 85 percent below grade and is on the exterior of the building.  
 Insulation must extend down 10 ft from the outside finished grade level or to the level of the lowest floor, whichever is less  
 R-value is for continuous insulation



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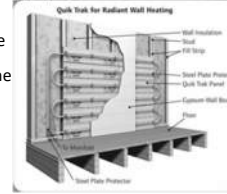
**C402.2 Specific building thermal envelope insulation requirements**

**Insulation of Radiant Heating Systems**  
 Section C402.2.6

Radiant heating system panels and their associated components:

- Installed in interior or exterior assemblies to be insulated with  $\geq R-3.5$  on all surfaces not facing the space being heated
- Installed in the building thermal envelope should be separated from the exterior of the building or unconditioned or exempt spaces by not less than the R-value installed in the opaque assembly in which they are installed or assembly comply with Section C402.1.4

**Exception:** heated slabs-on-grade insulated in accordance with Section C402.2.4



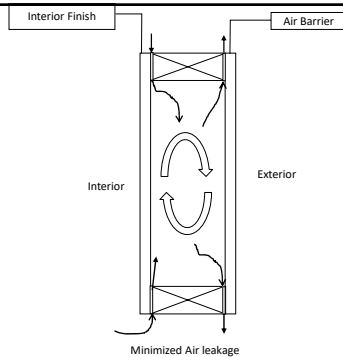
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**C402.2.7 Airspaces**

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



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



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**TABLE C402.4 BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS**

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
<b>Vertical fenestration</b>																
<b>U-factor</b>																
Fixed fenestration	0.50		0.45		0.42		0.36		0.36		0.34		0.29		0.26	
Operable fenestration	0.62		0.60		0.54		0.45		0.45		0.42		0.36		0.32	
Entrance doors	0.83		0.77		0.68		0.63		0.63		0.63		0.63		0.63	
<b>SHGC</b>																
	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable
PF < 0.2	0.23	0.21	0.25	0.23	0.25	0.23	0.36	0.33	0.38	0.33	0.38	0.34	0.40	0.36	0.40	0.36
0.2 ≤ PF < 0.5	0.28	0.25	0.30	0.28	0.30	0.28	0.43	0.40	0.46	0.40	0.46	0.41	0.48	0.43	0.48	0.43
PF ≥ 0.5	0.37	0.34	0.40	0.37	0.40	0.37	0.58	0.53	0.61	0.53	0.61	0.54	0.64	0.58	0.64	0.58
<b>Skylights</b>																
U-factor	0.70		0.65		0.55		0.50		0.50		0.50		0.44		0.41	
SHGC	0.30		0.30		0.30		0.40		0.40		0.40		NR		NR	

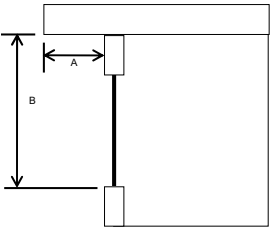


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C402.4.3 Projection Factor  
Equation 4-5



- $PF = A/B$
- where:
  - $PF$  = Projection factor (decimal).
  - $A$  = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.
  - $B$  = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.


$PF = A/B$   
 $PF = 30"/84"$   
 $PF = 0.36$

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**Vertical Fenestration Requirement**  
**C402.4.1 Maximum area**

Percentage of Vertical Fenestration Area to Gross Wall Area



- ✓ Allowed up to 30% maximum of above grade wall
- ✓ In Climate Zones 0-6, up to 40% maximum of above grade wall with daylighting controls

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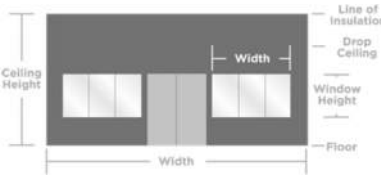
**Vertical Fenestration Requirement Section C402.4.1**

Based on above-grade wall area (*gross*)

- ✓ Includes walls between conditioned space and unconditioned space or the great outdoors
  - Includes walls that are > 15% above grade

Total fenestration area (*includes frame and glazing*)

- ✓ Does not include opaque door area



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Up to 40% vertical fenestration area allowed in Climate Zones 1-6, provided

- 40%**
  - No less than 50% of the conditioned floor area is within a daylight zone
  - in buildings 2 stories and less above grade
- 40%**
  - No less than 25% of the net floor area is within a daylight zone
  - in building  $\geq$  3 stories above grade
- 40%**
  - Daylight responsive controls are installed in daylight zones
  - VT of vertical fenestration is  $\geq$  1.1 times SHGC

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### Skylight maximum area Section C402.4.1 Prescriptive

- ✓ Limited to  $\leq 3\%$  of Roof Area
- ✓ Up to 6% allowed if automatic daylighting controls installed in daylight zones under skylights



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### C402.4.2 Minimum skylight fenestration area

Skylights shall be provided in enclosed spaces greater than 2,500 square feet 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

- Used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, space where manufacturing occurs, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation depot or workshop, the total toplit daylight zone shall be not less than half the floor area and shall provide one of the following:



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- The total daylight zone under skylights shall be not less than half the floor area and shall provide one of the following:

1. A minimum skylight area to toplit daylight zone of not less than 3 percent where all skylights have a VT of at least 0.40 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.
- Some exceptions apply such as for buildings in climate zones 6-8; buildings with low density lighting designs; where objects block direct beam of sunlight; and others.

#### C402.4.2.1 Lighting controls in toplit daylight zones.

Daylight responsive controls shall be provided within toplit daylight zones



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### IECC Commercial Envelopes

- Air Leakage
- Air barriers
- Fenestration air leakage
- Rooms Containing Fuel-burning Appliances
- Air intakes, exhaust openings, stairways and shafts
- Loading dock weatherseals
- Vestibules
- Recessed lighting



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### 2021 IECC – Air Leakage



**C402.5 Air leakage—thermal envelope**

- Comply with Sections C402.5.1 through C402.5.11.1

OR

- Test in accordance with Section C402.5.2 or C402.5.3
- Where testing then also comply with Sections C402.5.7, C402.5.8 and C402.5.9

**Testing Approach**

<https://www.buildings.com/resources/articles/2018/11/16/air-leakage-testing-a-hot-button-or-hot-air>

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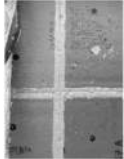
57

**C402.5** - Comply with Sections C402.5.1 through C402.5.11.1

**C402.5.1 Air barriers.**

A continuous air barrier shall be provided throughout the building thermal envelope. The continuous air barriers shall be located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1, and C402.5.1.2.

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

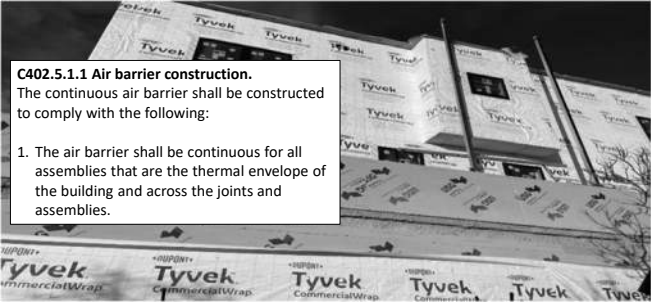
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**C402.5** - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

**C402.5.1.1 Air barrier construction.**  
The continuous air barrier shall be constructed to comply with the following:

- The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.



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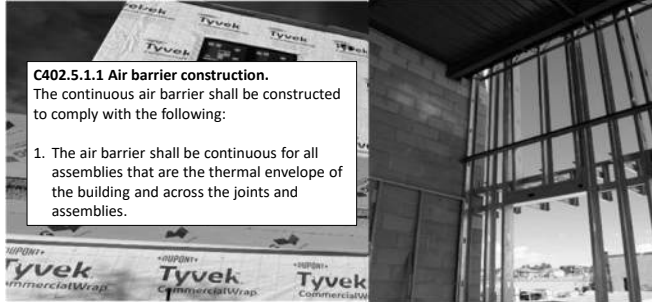
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**C402.5** - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

**Prescriptive Approach**

**C402.5.1.1 Air barrier construction.**  
The continuous air barrier shall be constructed to comply with the following:

- The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.

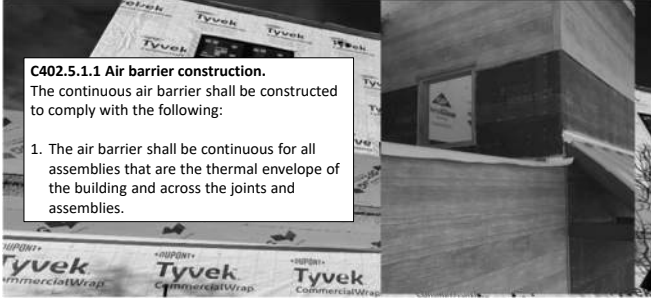


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C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021) 2021 Approach



**C402.5.1.1 Air barrier construction.**  
The continuous air barrier shall be constructed to comply with the following:

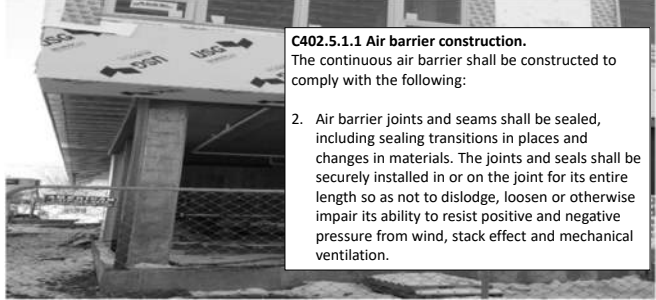
1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.

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C402.5 - Comply with C402.5.11.1



**C402.5.1.1 Air barrier construction.**  
The continuous air barrier shall be constructed to comply with the following:

2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

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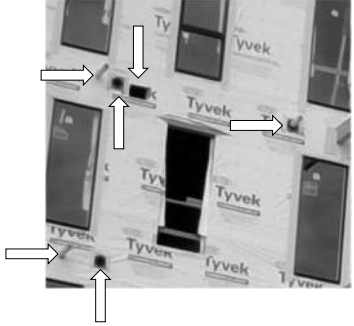
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**C402.5 - Comply with C402.5.11.1**

**C402.5.1.1 Air barrier construction.**  
The continuous air barrier shall be constructed to comply with the following

3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

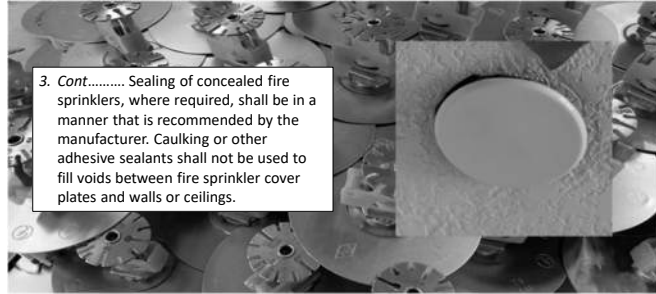


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**C402.5 - Comply with C402.5.11.1**



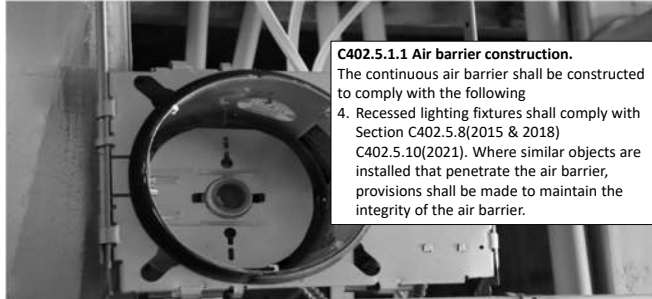
3. Cont..... Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.

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**C402.5 - Comply with C402.5.11.1**



**C402.5.1.1 Air barrier construction.**  
 The continuous air barrier shall be constructed to comply with the following  
 4. Recessed lighting fixtures shall comply with Section C402.5.8(2015 & 2018) C402.5.10(2021). Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

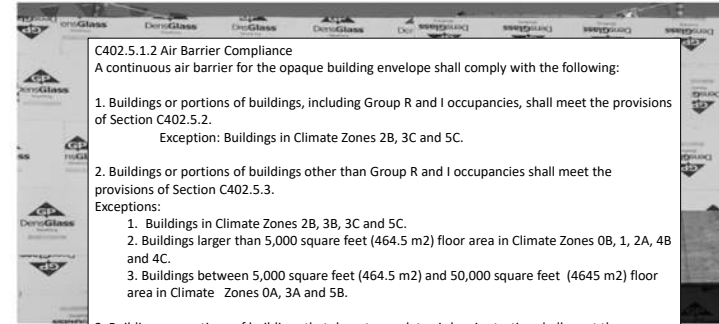


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**C402.5 - Comply with Sections C402.5.1 through C402.5.11.1**



**C402.5.1.2 Air Barrier Compliance**  
 A continuous air barrier for the opaque building envelope shall comply with the following:

- Buildings or portions of buildings, including Group R and I occupancies, shall meet the provisions of Section C402.5.2.  
 Exception: Buildings in Climate Zones 2B, 3C and 5C.
- Buildings or portions of buildings other than Group R and I occupancies shall meet the provisions of Section C402.5.3.  
 Exceptions:
  - Buildings in Climate Zones 2B, 3B, 3C and 5C.
  - Buildings larger than 5,000 square feet (464.5 m<sup>2</sup>) floor area in Climate Zones 0B, 1, 2A, 4B and 4C.
  - Buildings between 5,000 square feet (464.5 m<sup>2</sup>) and 50,000 square feet (4645 m<sup>2</sup>) floor area in Climate Zones 0A, 3A and 5B.
- Buildings or portions of buildings that do not complete air barrier testing shall meet the provisions of Section C402.5.1.3 or C402.5.1.4 in addition to Section C402.5.1.5.



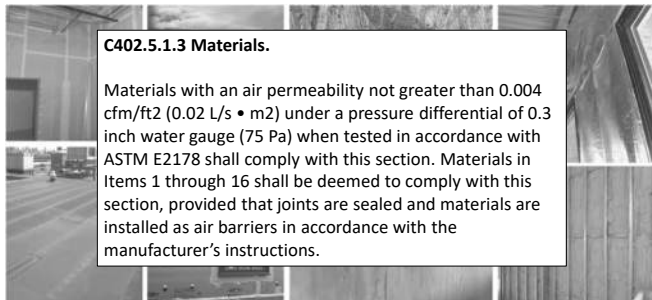
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**C402.5 - Comply with C402.5.11.1**

2021 Approach



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



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Material	Thickness (minimum)
Plywood	3/8 in.
Oriented strand board	3/8 in.
Extruded polystyrene insulation board	1/2 in.
Foil-faced urethane insulation board	1/2 in.
Closed cell spray foam minimum density of 1.5 pcf	1-1/2 in.
Open cell spray foam density between 0.4 and 1.5 pcf	4.5 in.
Exterior gypsum sheathing or interior gypsum board	1/2 in.
Cement board	1/2 in.
Built up roofing membrane	
Modified bituminous roof membrane	
Fully adhered single-ply roof membrane	
A Portland cement/sand parge, stucco, or gypsum plaster	5/8 in.
Cast-in-place and precast concrete	
Sheet metal or aluminum	
Solid or hollow masonry constructed of clay or shale masonry units	





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**C402.5.1.4 Assemblies.**  
 Assemblies of materials and components with an average air leakage not greater than 0.04 cfm/ under a pressure differential of 0.3 inch of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E2357, ASTM E1677, ASTM D8052 or ASTM E283 shall comply with this section. Assemblies listed in Items 1 through 3 shall be deemed to comply, provided that joints are sealed and the requirements of Section C402.5.1.1 are met.

1. Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.
2. Masonry walls constructed of clay or shale masonry units with a nominal width of 4 inches or more.
3. A Portland cement/sand parge, stucco or plaster not less than 1/2 inch in thickness.


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**C402.5 - Comply with Sections C402.5.1 through C402.5.11.1**



**C402.5.1.5 Building envelope performance verification.**  
 The installation of the continuous air barrier shall be verified by the *code official*, a *registered design professional* or *approved agency* in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in [Section C402.5.1](#).
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of [Sections C402.5.1.3](#) and [C402.5.1.4](#).
3. A final commissioning report shall be provided for inspections completed by the *registered design professional* or *approved agency*. The commissioning report shall be provided to the building owner or owner's authorized agent and the *code official*. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures taken.




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**C402.5 - Comply with Sections C402.5.1 through C402.5.11.1**

**C402.5.2 Dwelling and sleeping unit enclosure testing.**  
 The *building thermal envelope* shall be tested in accordance with [ASTM E779](#), [ANSI/RESNET/ICC 380](#), [ASTM E1827](#) or an equivalent method approved by the *code official*. The measured air leakage shall not exceed 0.30 cfm/ft<sup>2</sup> of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one *building thermal envelope*, each unit shall be considered an individual testing unit, and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units, the greater of seven units or 20 percent of the testing units in the building shall be tested, including a top floor unit, a ground floor unit and a unit with the largest testing unit enclosure area. For each tested unit that exceeds the maximum air leakage rate, an additional two units shall be tested, including a mixture of testing unit types and locations.




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**C402.5.3 Building thermal envelope testing.**  
 The *building thermal envelope* shall be tested in accordance with [ASTM E779](#), [ANSI/RESNET/ICC 380](#), [ASTM E3158](#) or [ASTM E1827](#) or an equivalent method approved by the *code official*. The measured air leakage shall not exceed 0.40 cfm/ft<sup>2</sup> of the *building thermal envelope* area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade.
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.

**Exception:** Where the measured air leakage rate exceeds 0.40 cfm/ft<sup>2</sup> (2.0 L/s × m<sup>2</sup>) but does not exceed 0.60 cfm/ft<sup>2</sup> (3.0 L/s × m<sup>2</sup>), a diagnostic evaluation using smoke tracer or infrared imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the *code official* and the building owner, and shall be deemed to comply with the requirements of this section.



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

- 1.The room or space containing the appliance shall be located outside of the *building thermal envelope*.
- 2.The room or space containing the appliance shall be enclosed and isolated from conditioned spaces inside the *building thermal envelope*. Such rooms shall comply with all of the following:
  - 2.1.The walls, floors and ceilings that separate the enclosed room or space from conditioned spaces shall be insulated to be not less than equivalent to the insulation requirement of below-grade walls as specified in [Table C402.1.3](#) or [Table C402.1.4](#).
  - 2.2.The walls, floors and ceilings that separate the enclosed room or space from conditioned spaces shall be sealed in accordance with [Section C402.5.1.1](#).
  - 2.3.The doors into the enclosed room or space shall be fully gasketed.
  - 2.4.Water lines and ducts in the enclosed room or space shall be insulated in accordance with [Section C403](#).
  - 2.5.Where an air duct supplying combustion air to the enclosed room or space passes through *conditioned space*, the duct shall be insulated to an *R-value* of not less than R-8.


**Exception:**

- 1.Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
- 2.Fireplaces and stoves complying with Section R402.4.2 and Section R1006 of the International Residential Code

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**C402.5.11 Operable openings interlocking (New)**

Where occupancies utilize operable openings to the outdoors that are larger than 40 square feet in area, such openings shall be interlocked with the heating and cooling system so as to raise the cooling setpoint to 90°F and lower the heating setpoint to 55°F whenever the operable opening is open. The change in heating and cooling setpoints shall occur within 10 minutes of opening the operable opening.



**Exceptions:**

- 1.Separately zoned areas associated with the preparation of food that contain appliances that contribute to the HVAC loads of a restaurant or similar type of occupancy.
- 2.Warehouses that utilize overhead doors for the function of the occupancy, where approved by the code official.
- 3.The first entrance doors where located in the exterior wall and are part of a vestibule system

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2021 IECC  
 Mechanical  
 Systems



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~~(Mandatory? Prescriptive?)~~.....Provisions IECC

Provisions Applicable to ALL Mechanical Systems	
✓ Calculation of heating and cooling loads	✓ Piping Insulation
✓ Data Centers	✓ Air System Design and Control
✓ Zone isolation required	✓ Heating Outside a Building
✓ Ventilation	✓ Refrigeration Equipment Performance
✓ Equipment sizing	✓ Walk-in Coolers and Freezers, Refrigerated Warehouse Coolers and Freezers
✓ HVAC equipment performance requirements	✓ Walk-in Coolers and Walk-in Freezers
✓ Heating and cooling system controls	✓ Duct and Plenum Insulation and Sealing
✓ Heated or Cooled Vestibules	
✓ Economizer fault detection	
✓ Demand Control Ventilation	
✓ Enclosed parking garage ventilation controls	
✓ Kitchen exhaust systems	
✓ Automatic control of HVAC systems in guestrooms	
✓ Shutoff dampers	


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TABLE C407.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE	
SECTION*	TITLE
	<b>Envelope</b>
<u>C402.5</u>	Air leakage—thermal envelope
	<b>Mechanical</b>
<u>C403.1.1</u>	Calculation of heating and cooling loads
<u>C403.1.2</u>	Data centers
<u>C403.2</u>	System design
<u>C403.3</u>	Heating and cooling equipment efficiencies
<u>C403.4</u>	Heating and cooling system controls
<u>Except C403.4.3, C403.4.4 and C403.4.5</u>	
<u>C403.5.5</u>	Economizer fault detection and diagnostics
<u>C403.7, except C403.7.4.1</u>	Ventilation and exhaust systems
<u>C403.8, except C403.8.6</u>	Fan and fan controls
<u>C403.9</u>	Large-diameter ceiling fans
<u>C403.11, except C403.11.3</u>	Refrigeration equipment performance
<u>C403.12</u>	Construction of HVAC system elements
<u>C403.13</u>	Mechanical systems located outside of the building thermal envelope
<u>C404</u>	Service water heating
<u>C405, except C405.3</u>	Electrical power and lighting systems
<u>C408</u>	Maintenance information and system commissioning

a. Reference to a code section includes all the relative subsections except as indicated in the table.

### HVAC Load Calculations IECC Section C403.1.1

Heating and cooling load sizing calculations required




- ✓ ASHRAE/ACCA Standard 183 OR
- ✓ Other approved computation procedures – defined in Chapter 3
  - Interior design conditions
  - Specified by Section C302 of the IECC
  - ≤ 72°F for heating load
  - ≥ 75°F for cooling load
- ✓ Loads reduced from energy recovery systems utilized in the HVAC system shall be accounted for in accordance with the ASHRAE HVAC Systems and Equipment Handbook

COOLING COIL PEAK				CLG SPACE PEAK				HEATING COIL PEAK				TEMPERATURES			
Peak at Time: Outside Air: CHANGES: 81.03/1.01				Multi: 7.1/15				Multi: Heating Design: 0				SABD: Cooling: Heating: 55.0 60.0			
Source: Net, + Lat, Total				Space: Percent, Surface, OF Total				Space Peak: Coil Peak, Percent, Space Sens, OF Total				RA Pmax: 75.0 75.0			
Envelope Loads				Envelope Loads				Envelope Loads				AIR FLOWS			
Supply Total: 0 0 0 0				Supply Total: 0 0 0 0				Supply Total: 0 0 0 0				Supply Total: 11,287 11,287			
Return Total: 0 0 0 0				Return Total: 0 0 0 0				Return Total: 0 0 0 0				Return Total: 11,287 11,287			
Fan Total: 0 0 0 0				Fan Total: 0 0 0 0				Fan Total: 0 0 0 0				Fan Total: 0 0 0 0			
Total: 0 0 0 0				Total: 0 0 0 0				Total: 0 0 0 0				Total: 11,287 11,287			
Internal Loads				Internal Loads				Internal Loads				Internal Loads			
Lights: 310.81 0 0 0				Lights: 172.073 0 0 0				Lights: 0 0 0 0				Lights: 11,287 11,287			
People: 0 0 0 0				People: 0 0 0 0				People: 0 0 0 0				People: 0 0 0 0			
Misc: 0 0 0 0				Misc: 0 0 0 0				Misc: 0 0 0 0				Misc: 0 0 0 0			
Sub Total: 310.81 0 0 0				Sub Total: 172.073 0 0 0				Sub Total: 0 0 0 0				Sub Total: 11,287 11,287			
Cooling Load: 311 -31 -0 0				Cooling Load: 33 0 0 0				Cooling Load: 40 0 0 0				Cooling Load: 0 0 0 0			
Ventilation Load: 0 0 27,620 0				Ventilation Load: 0 0 283,847 0				Ventilation Load: 0 0 283,847 0				Ventilation Load: 0 0 0 0			
ASHRAE Trans Heat: 0 0 0 0				ASHRAE Trans Heat: 0 0 0 0				ASHRAE Trans Heat: 0 0 0 0				ASHRAE Trans Heat: 0 0 0 0			
Solar Gain: 0 0 0 0				Solar Gain: 0 0 0 0				Solar Gain: 0 0 0 0				Solar Gain: 0 0 0 0			
Sensible Heat: 0 0 0 0				Sensible Heat: 0 0 0 0				Sensible Heat: 0 0 0 0				Sensible Heat: 0 0 0 0			
Latent Heat: 0 0 0 0				Latent Heat: 0 0 0 0				Latent Heat: 0 0 0 0				Latent Heat: 0 0 0 0			
Total: 310.81 0 0 0				Total: 172.073 0 0 0				Total: 40 0 0 0				Total: 11,287 11,287			
Grand Total: 304,732 28 362,676 100.00				Grand Total: 213,865 100.00				Grand Total: -213,865 -487,562 100.00				Grand Total: 11,287 11,287			

### C403.1.2 Data centers

**DATA CENTER A** room, or series of rooms that share data center systems, whose primary function is to house equipment for the processing and storage of electronic data and which has a design total ITE equipment power density exceeding 20 watts per square foot of conditioned area and a total design ITE equipment load greater than 10 kW.



**DATA CENTER SYSTEMS** HVAC systems and equipment, or portions thereof used to provide cooling or ventilation in a data center.

**INFORMATION TECHNOLOGY EQUIPMENT (ITE)** includes computers, data storage devices, servers, and network/communication equipment.

### C403.1.2 Data centers

Data center systems shall comply with Sections 6 and 8 of ASHRAE 90.4 with the following changes:

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

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



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### C403.1.2 Data centers

TABLE C403.1.2(1) MAXIMUM DESIGN MECHANICAL LOAD COMPONENT (DESIGN MLC)

CLIMATE ZONE	DESIGN MLC AT 100% AND AT 50% ITE LOAD
0A	0.24
0B	0.26
1A	0.23
2A	0.24
3A	0.23
4A	0.23
5A	0.22
6A	0.22
1B	0.28
2B	0.27
3B	0.26
4B	0.23
5B	0.23
6B	0.21
3C	0.19
4C	0.21
5C	0.19
7	0.20
8	0.19

INFORMATION TECHNOLOGY EQUIPMENT (ITE). Items including computers, data storage devices, servers and network and communication equipment.



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### C403.1.2 Data centers

TABLE C403.1.2(2) MAXIMUM ANNUALIZED MECHANICAL LOAD COMPONENT (ANNUALIZED MLC)

CLIMATE ZONE	HVAC MAXIMUM ANNUALIZED MLC AT 100% AND AT 50% ITE LOAD
0A	0.19
0B	0.20
1A	0.18
2A	0.19
3A	0.18
4A	0.17
5A	0.17
6A	0.17
1B	0.16
2B	0.18
3B	0.18
4B	0.18
5B	0.16
6B	0.17
3C	0.16
4C	0.16
5C	0.16
7	0.16
8	0.16



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### HVAC Performance IECC Section C403.3 Heating and cooling equipment efficiencies

Heating and cooling equipment installed in mechanical systems shall be sized in accordance with Section C403.3.1 and shall be not less efficient in the use of energy than as specified in Section C403.3.2

TABLE C403.3.2(1)  
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS—MINIMUM EFFICIENCY REQUIREMENTS\* \*

EQUIPMENT TYPE	SIZE CATEGORY	HEADING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE*
Air conditioners, air cooled	< 65,000 Btu/h <sup>b</sup>	All	Split system, three phase and applications outside US single phase <sup>c</sup>	13.0 SEER before 1/1/2023 13.4 SEER2 after 1/1/2023	AHRI 210/240—2017 before 1/1/2023 AHRI 210/240—2023 after 1/1/2023
			Single-package, three phase and applications outside US single phase <sup>c</sup>	14.0 SEER before 1/1/2023 13.4 SEER2 after 1/1/2023	

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



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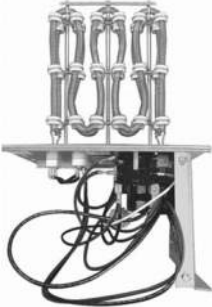

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### C403.4 Heating and cooling system controls

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

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

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### C403.4 Heating and cooling system controls

**C403.4.2.3 Automatic start and stop**  
Automatic start and stop controls shall be provided for each HVAC system. The automatic start controls shall be configured to automatically adjust the daily start time of the HVAC system in order to bring each space to the desired occupied temperature immediately prior to scheduled occupancy.

Automatic stop controls shall be provided for each HVAC system with direct digital control of individual zones. The automatic stop controls shall be configured to reduce the HVAC system's heating temperature setpoint and increase the cooling temperature setpoint by not less than 2°F before scheduled unoccupied periods based on the thermal lag and acceptable drift in space temperature that is within comfort limits.

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### Demand Controlled Ventilation IECC

**Section C403.7.1**

DCV shall be provided for all single-zone systems required to comply with Sections C403.5 through C403.5.3 and ~~each zone with~~ spaces > 500 ft<sup>2</sup> and the average occupant load ≥ 25 15 people/1000 ft<sup>2</sup> of floor area as established by Table 403.3.1.1 of the International Mechanical Code, where the HVAC system has:

- ✓ An air-side economizer, **or**
- ✓ Automatic modulating control of the outdoor air damper, **or**
- ✓ A design outdoor airflow > 3,000 cfm

*Demand control ventilation (DCV): a ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy.*

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### Demand Controlled Ventilation IECC


**Section C403.7.1**

**Exceptions:**

- Systems with energy recovery per C403.7.4
- Multiple zone systems without direct digital control of single zones communicating with central control panel
- Multi-Zone systems with design outdoor airflow 750 cfm
- ~~Spaces where supply airflow rate minus any makeup or outgoing transfer air requirement < 1,200 cfm~~
- ~~Ventilation provided for process loads only~~

Spaces where more than 75 percent of the space design outdoor airflow is required for makeup air that is exhausted from the space or transfer air that is required for makeup air that is exhausted from other spaces.

Spaces with one of the following occupancy classifications as defined in Table 403.3.1.1 of the International Mechanical Code: correctional cells, education laboratories, barber, beauty and nail salons, and bowling alley seating areas.



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### C403.7.2 Enclosed parking garage ventilation controls

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



**Exceptions:**

1. Garages with a total exhaust capacity less than ~~22,500~~ 8,000 cfm with ventilation systems that do not utilize heating or mechanical cooling.
2. Garages that have a garage area to ventilation system motor nameplate power ratio that exceeds 1,125 cfm/hp and do not utilize heating or mechanical cooling.



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### C403.7.4 Energy recovery systems

#### C403.7.4.1 Nontransient dwelling units

Nontransient dwelling units shall be provided with outdoor air energy recovery ventilation systems with an *enthalpy recovery ratio* of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.

**Exceptions:**

1. Nontransient dwelling units in Climate Zone 3C.
2. Nontransient dwelling units with not more than 500 square feet (46 m2) of conditioned floor area in Climate Zones 0, 1, 2, 3, 4C and 5C.
3. Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1 and 2.
4. Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 4, 5, 6, 7 and 8.

#### ENTHALPY RECOVERY RATIO

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

The enthalpy (H) of a thermodynamic system is defined as the sum of its internal energy and the product of its pressure and volume



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### C403.7.6 Automatic control of HVAC systems serving guestrooms

Automatic control of HVAC systems serving guest rooms in Group R-1 buildings containing over 50 guests rooms.



#### C403.7.6.1 Temperature setpoint controls.

Controls shall be provided on each HVAC system that are capable of and configured with three modes of temperature control:

1. When the guestroom is rented but unoccupied, the controls shall automatically raise the cooling setpoint and lower the heating setpoint by not less than 4°F from the occupant setpoint within 30 minutes after the occupants have left the guestroom.



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### C403.7.6 Automatic control of HVAC systems serving guestrooms

Automatic control of HVAC systems serving guest rooms in Group R-1 buildings containing over 50 guests rooms.



2. When the guestroom is unrented and unoccupied, the controls shall automatically raise the cooling setpoint not higher than 60°F to not lower than 80°F and lower the heating setpoint to. Unrented and unoccupied guestroom mode shall be initiated within 16 hours of the guestroom being continuously occupied or where a *networked guestroom control system* indicates that the guestroom is unrented and the guestroom is unoccupied for more than 20 minutes. A *networked guestroom control system* that is capable of returning the thermostat setpoints to default occupied setpoints 60 minutes prior to the time a guestroom 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



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**C403.7.6 Automatic control of HVAC systems serving guestrooms**

Automatic control of HVAC systems serving guest rooms in Group R-1 buildings containing over 50 guests rooms.



3. When the guestroom is occupied, HVAC setpoints shall return to their occupied setpoints once occupancy is sensed.



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**C403.8.5 Low-capacity ventilation fans (New)**

Mechanical ventilation system fans with motors less than 1/12 hp (0.062 kW) in capacity shall meet the efficacy requirements of Table C403.8.5 at one or more rating points.

Exceptions:

1. Where ventilation fans are a component of a listed heating or cooling appliance.
2. Dryer exhaust duct power ventilators, domestic range hoods and domestic range booster fans that operate intermittently.

FAN LOCATION	AIRFLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIRFLOW RATE MAXIMUM (CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
In-line fan	Any	3.8 cfm/watt	Any
Bathroom, utility room	10	2.8 cfm/watt	< 90
Bathroom, utility room	90	3.5 cfm/watt	Any

a. Airflow shall be tested in accordance with HVI 916 and listed. Efficacy shall be listed or shall be derived from listed power and airflow. Fan efficacy for fully ducted HRV, ERV, balanced and in-line fans shall be determined at a static pressure not less than 0.2 inch w.c. Fan efficacy for ducted range hoods, bathroom and utility room fans shall be determined at a static pressure not less than 0.1 inch w.c.



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**C403.9 Large-diameter ceiling fans (New)**

Where provided, large-diameter ceiling fans shall be tested and labeled in accordance with AMCA 230.

(Air Movement and Control Association)



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**C403.12.1 Duct and plenum insulation and sealing**

Supply and return air ducts and plenums shall be insulated with not less than R-6 insulation where located in unconditioned spaces and where located outside the building with not less than R-8 insulation in Climate Zones 0 through 4 and not less than R-12 insulation in Climate Zones 5 through 8. Ducts located underground beneath buildings shall be insulated as required in this section or have an equivalent thermal distribution efficiency. Underground ducts utilizing the *thermal distribution efficiency* method shall be listed and labeled to indicate the R-value equivalency. Where located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by not less than R-8 insulation in Climate Zones 0 through 4 and not less than R-12 insulation in Climate Zones 5 through 8

**THERMAL DISTRIBUTION EFFICIENCY (TDE).** The resistance to changes in air heat as air is conveyed through a distance of air duct. TDE is a heat loss calculation evaluating the difference in the heat of the air between the air duct inlet and outlet caused by differences in temperatures between the air in the duct and the duct material. TDE is expressed as a percent difference between the inlet and outlet heat in the duct



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### C403.12.3 Piping insulation

Piping serving as part of a heating or cooling system shall be thermally insulated in accordance with Table C403.12.3.



**Exceptions:**

1. Factory-installed piping within HVAC equipment tested and rated in accordance with a test procedure referenced by this code.
2. Factory-installed piping within room fan-coils and unit ventilators tested and rated according to AHRI 440 (except that the sampling and variation provisions of Section 6.5 shall not apply) and AHRI 840, respectively.
3. Piping that conveys fluids that have a design operating temperature range between 60°F (15°C) and 105°F (41°C).
4. Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
5. Strainers, control valves, and balancing valves associated with piping 1 inch (25 mm) or less in diameter.
6. Direct buried piping that conveys fluids at or below 60°F (15°C).
7. In radiant heating systems, sections of piping intended by design to radiate heat.



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### C403.14 Operable opening interlocking controls (New)

The heating and cooling systems shall have controls that will interlock these mechanical systems to the set temperatures of 90° F for cooling and 55° F for heating when the conditions of Section C402.5.8 exist. The controls shall configure to shut off the systems entirely when the outdoor temperatures are below 90°F or above 55° F

#### C402.5.8 Loading Dock Seals



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### Service Water Heating IECC Section C404

Table C404.2 Minimum Performance of Water-Heating Equipment

**Water Heater Types Covered**

- Electric Storage
- Gas and Oil Storage
- Instantaneous Water Heaters – Gas and Oil
- Hot water boilers – gas and oil
- Pool heaters
- Unfired storage tanks

**Heat Traps (C404.3)**

**Piping Insulation (C404.4)**

**Efficient Piping (C404.5)**

**Circulation & Temperature Maintenance (C404.6)**

**Demand Recirculation (C404.7)**

**Drain Heat Recovery (C404.8)**

**Pools and Spas (C404.9)**

**Portable Spas (C404.10)**

**SWH Commissioning (C404.11)**



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### C404.2 Service water-heating equipment performance efficiency

Water-heating equipment and hot water storage tanks shall meet the requirements of Table C404.2. The efficiency shall be verified through data furnished by the manufacturer of the equipment or through certification under an approved certification program. Water-heating equipment intended to be used to provide space heating shall meet the applicable provisions of Table C404.2.

TABLE C404.2 MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED <sup>a</sup>	TEST PROCEDURE	
Water heaters, electric	≤ 12 kW <sup>b</sup>	Tankless <sup>c</sup> ≤ 20 gallons and ≤ 100 gallons	0.90 – 0.0015V, EF	DGS 10.029.2, Int. 400	
		Resistance <sup>d</sup> ≤ 75 gallons and ≤ 100 gallons	0.90 – 0.0015V, EF		
	≥ 12 kW	Resistance	0.8 – 0.27V <sub>in</sub> , %		ANSI Z21.10.3
		Heat pump <sup>e</sup> ≤ 50 gallons and ≤ 100 gallons	2.0EF – 0.0015V, EF		DGS 10.029.2, Int. 400
Storage water heaters, gas	≤ 24 amps and ≤ 200 volts	≤ 20 gallons and ≥ 50 gallons	0.875 – 0.0015V, EF	DGS 10.029.2, Int. 400	
		≥ 50 gallons and ≤ 100 gallons	0.875 – 0.0015V, EF		
	≥ 75,000 Btu/h and ≤ 150,000 Btu/h	≤ 4,000 Btu/hgal	87% EF		ANSI Z21.10.3
		> 4,000 Btu/hgal	0.90V – 1.0V, %		
≥ 150,000 Btu/h	≤ 4,000 Btu/hgal	87% EF	ANSI Z21.10.3		
	> 4,000 Btu/hgal	0.90V – 1.0V, %			



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**TABLE C403.12.3 MINIMUM PIPE INSULATION THICKNESS (in inches)**

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (inches)				
	Conductivity Btu × in./h × ft² × °F <sup>b</sup>	Mean Rating Temperature, °F	< 1	1 to 1½	1½ to < 4	4 to < 8	> 8
> 350	0.32–0.34	250	4.5	5.0	5.0	5.0	5.0
251–350	0.29–0.32	200	3.0	4.0	4.5	4.5	4.5
201–250	0.27–0.30	150	2.5	2.5	2.5	3.0	3.0
141–200	0.25–0.29	125	1.5	1.5	2.0	2.0	2.0
105–140	0.21–0.28	100	1.0	1.0	1.5	1.5	1.5
40–60	0.21–0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20–0.26	50	0.5	1.0	1.0	1.0	1.5

k-value is the rate of heat flow through a homogeneous material

Simple conversion from K to R value  
Insulation thickness divided by your k-value at 75°F Mean Temperature


Mean Temperature °F	k*	Mean Temperature °C	k*
50	0.22	10	0.032
75	0.23	25	0.034
100	0.24	50	0.037
150	0.27	100	0.043
200	0.29	125	0.047
250	0.32	150	0.051
300	0.35	175	0.056
350	0.39	200	0.062
400	0.43	225	0.068
450	0.48	250	0.075
500	0.54	275	0.082

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<http://commercial.enr.com/cgi-bin/submit/012114012005767.c06-Ards-Ards-Rules-Rules06061344.pdf>

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**C404.5 Heated water supply piping**

Heated water supply piping shall be in accordance with Section C404.5.1 or C404.5.2. The flow rate through 1/4-inch piping shall be not greater than 0.5 gpm. The flow rate through 5/16-inch piping shall be not greater than 1 gpm. The flow rate through 3/8-inch piping shall be not greater than 1.5 gpm.



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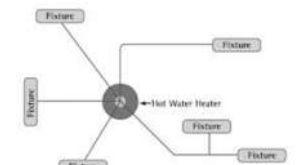
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**Maximum Allowed Pipe Length Method IECC**  
*Section C404.5.1*

Maximum allowed piping length from nearest source of heated water to termination of the fixture supply pipe:

Where piping contains more than one size, the largest size of pipe within the piping shall be used for determining the max. allowable length of piping in Table C404.5.1

- Public lavatory faucet, use “Public Lavatory faucets” column in Table C404.5.1
- All other plumbing fixtures and plumbing appliances use “Other fixtures and appliances” column in Table C404.5.1



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**TABLE C404.5.1 PIPING VOLUME AND MAXIMUM PIPING LENGTHS**

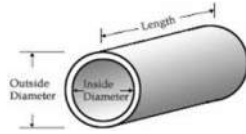
NOMINAL PIPE SIZE (inches)	VOLUME (liquid ounces per foot length)	MAXIMUM PIPING LENGTH (feet)	
		Public lavatory faucets	Other fixtures and appliances
1/4	0.33	6	50
5/16	0.5	4	50
3/8	0.75	3	50
1/2	1.5	2	43
5/8	2	1	32
3/4	3	0.5	21
7/8	4	0.5	16
1	5	0.5	13
1 1/4	8	0.5	8
1 1/2	11	0.5	6
2 or larger	18	0.5	4

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**Maximum Allowed Pipe Volume Method IECC**  
Section C404.5.2

- Water heaters, circulating water systems, and heat trace temp. maintenance systems to be considered sources of heated water
- The volume in the piping shall be determined from the “Volume” column in Table C404.5.1 or from Table C404.5.2.1.
- Volume from the nearest source of heated water to the termination of the fixture supply pipe as follows:
  - Public lavatory facet: ≤ 2 ounces
  - Other plumbing fixtures or plumbing appliances: ≤ 0.5 gallon



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TABLE C404.5.2.1 INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING									
OUNCES OF WATER PER FOOT OF TUBE									
Nominal Size (inches)	Copper Type M	Copper Type L	Copper Type K	CPVC CTS SDR 11	CPVC SCH 40	CPVC SCH 80	PE-RT SDR 9	Composite ASTM F1281	PEX CTS SDR 9
3/8	1.06	0.97	0.84	N/A	1.17	—	0.64	0.63	0.64
1/2	1.69	1.55	1.45	1.25	1.89	1.46	1.18	1.31	1.18
3/4	3.43	3.22	2.90	2.67	3.38	2.74	2.35	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	4.57	3.91	5.56	3.91
1 1/4	8.70	8.36	8.09	6.61	9.66	8.24	5.81	8.49	5.81
1 1/2	12.18	11.83	11.45	9.22	13.20	11.38	8.09	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	19.11	13.86	21.48	13.86



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**C404.6.1 Circulation systems**

Heated-water circulation systems shall be provided with a circulation pump.

The system return pipe shall be a dedicated return pipe or a cold water supply pipe.

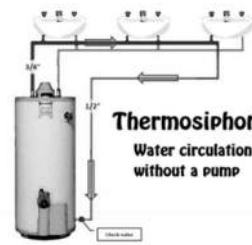
Gravity and thermo-siphon circulation systems shall be prohibited.

Controls for circulating hot water system pumps shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water.

The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F

~~Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy.~~

~~The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water.~~



<https://civildrain.com/blog/view/4513274/avoid-of-waiting-for-hot-water-hot-water-recirculation-loop>

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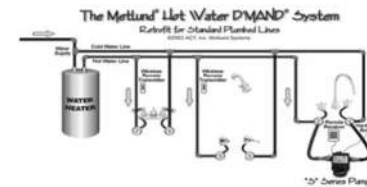
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**C404.6.1 Demand recirculation controls**

Demand recirculation water systems shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture, or sensing the flow of hot or tempered water to a fixture fitting or appliance

~~2. The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F.~~



<https://www.builditwater.com/Projects/Conservation/Recirc/RecircEnergy.html>



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**C404.9 Portable spas (New)**

The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP 14.

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**Power and Lighting Systems**

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**What's Covered Under Electrical Power and Lighting Systems Requirements? IECC**

- Interior Lighting requirements
  - Required Controls
  - Wattage/Efficiency Limits
- Interior Lighting Power Allowances (watts/ft<sup>2</sup>)
- Exterior Lighting Controls
  - Required Controls
  - Lamp Efficiency
- Exterior Lighting Power Allowances (watts/ft<sup>2</sup>)
- Electric Metering
- Electrical Transformers and Motors
- Vertical and Horizontal Transportation Systems and Equipment





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**C405.1.1 Lighting for dwelling units**

No less than 90 percent of the permanently installed lighting serving dwelling units, excluding kitchen appliance lighting, shall be provided by lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/W, or shall comply with Sections C405.2.5 and C405.3.



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**Occupant Sensor Controls** Sections C405.2.1, C405.2.1.1

Occupancy sensors are required in:

- ✓ Classrooms/lecture/training rooms
- ✓ Conference/meeting/multipurpose rooms
- ✓ Copt/print rooms
- ✓ Lounges/Breakrooms
- ✓ Enclosed offices
- ✓ Open plan office areas
- ✓ Restrooms
- ✓ Storage rooms
- ✓ Locker rooms
- ✓ Corridors
- ✓ Other spaces < 300 ft<sup>2</sup> enclosed by floor-to-ceiling height partitions
- ✓ Warehouse storage areas



Occupancy sensor function (other than for warehouses and open office plans):

- ✓ Automatically turn lights off within 20 minutes of occupants leaving space
- ✓ Either manual-on or controlled to automatically turn lighting on to not more than 50% power
- ✓ Incorporate a manual control to allow occupants to turn off the lights



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**Time-switch Controls**  
Section C405.2.2

Each area of the building that is NOT provided with occupant sensor control must have a time-switch control to turn lights off automatically.

**Exceptions**

1. Luminaires that are required to have specific application controls in accordance with Section C405.2.4.
2. Spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Lighting intended for continuous operation.
5. Shop and laboratory classrooms



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**Time-switch Control Functions**  
Section C405.2.2.1

Must include an override switching device with the following:

- Automatically turn off lights when the space is scheduled to be unoccupied
- Minimum 7-day clock
- Capable of being set for 7 different day types/week
- Incorporate holiday "shutoff" feature to turn all controlled lighting loads for 24 hours and resume to normally scheduled operations
- Program backup capabilities to prevent loss of program and time setting for 10 hours if power is interrupted
- Override switch should include:
  - Manual control
  - Control lighting to remain on for  $\leq 2$  hours
  - Control lighting for an area  $\leq 5,000$  ft<sup>2</sup>



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**C405.2.3 Light-reduction controls**

Where not provided with occupant sensor controls complying with Section C405.2.1.1, general lighting shall be provided with light-reduction controls complying with Section C405.2.3.1.

**Exceptions:**

1. Luminaires controlled by daylight responsive controls complying with Section C405.2.4.
2. Luminaires controlled by special application controls complying with Section C405.2.5.
3. Where provided with manual control, the following areas are not required to have light-reduction control:
  - 3.1. Spaces that have only one luminaire with a rated power of less than 60 watts.
  - 3.2. Spaces that use less than 0.45 watts per square foot (4.9 W/m<sup>2</sup>).
  - 3.3. Corridors, lobbies, electrical rooms and/or mechanical rooms.



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### C405.2.3.1 Light-reduction control function

Spaces required to have light-reduction controls shall have a *manual control* that allows the occupant to reduce the connected lighting load by not less than 50 percent in a reasonably uniform illumination pattern with an intermediate step in addition to full on or off, or with continuous dimming control, using one of the following or another *approved* method:

1. Continuous dimming of all luminaires from full output to less than 20 percent of full power.
2. Switching all luminaires to a reduced output of not less than 30 percent and not more than 70 percent of full power.
3. Switching alternate luminaires or alternate rows of luminaires to achieve a reduced output of not less than 30 percent and not more than 70 percent of full power



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### Daylight-responsive Controls

#### Section C405.2.4



Definition: A device or system that provides automatic control of electric light levels based on the amount of daylight in a space

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

1. Spaces with a total of more than 150 watts of general lighting within primary sidelit daylight zones complying with Section C405.2.4.2.
2. Spaces with a total of more than 300 watts of general lighting within primary and secondary sidelit daylight zones complying with Section C405.2.4.2.
3. Spaces with a total of more than 150 watts of general lighting within toplit daylight zones complying with Section C405.2.4.3.

Exceptions:

Daylight responsive controls are not required for the following:

1. Spaces in health care facilities where patient care is directly provided.
2. Sidelit daylight zones on the first floor above grade in Group A-2 and Group M occupancies



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Building Area Method IECC Table C405.3.2(1)

BUILDING AREA TYPE	LPD (w/ft <sup>2</sup> )
Automotive facility	0.75
Convention center	0.64
Courthouse	0.79
Dining: bar lounge/leisure	0.80
Dining: cafeteria/fast food	0.76
Dining: family	0.71
Dormitory <sup>a, b</sup>	0.53
Exercise center	0.72
Fire station <sup>a</sup>	0.56
Gymnasium	0.76
Health care clinic	0.81
Hospital <sup>a</sup>	0.96
Hotel/Motel <sup>a, b</sup>	0.56
Library	0.83
Manufacturing facility	0.82
Motion picture theater	0.44
Multiple-family <sup>c</sup>	0.45
Museum	0.55



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Space-By-Space Method IECC Table C405.4.2(2)

COMMON SPACE TYPES <sup>a</sup>	LPD (watts/ft <sup>2</sup> )
Atrium	
Less than 40 feet in height	0.48
Greater than 40 feet in height	0.60
Audience seating area	
In an auditorium	0.61
In a gymnasium	0.23
In a motion picture theater	0.27
In a penitentiary	0.67
In a performing arts theater	1.16
In a religious building	0.72
In a sports arena	0.33
Otherwise	0.33
Banking activity area	0.61




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**Exemptions to Proposed Lighting Power Calculation (cont'd.)**

- ✓ Theatrical, stage, film, and video production
- ✓ Used for photographic processes
- ✓ Integral to equipment or instrumentation installed by manufacturer
- ✓ Task lighting for plant growth or maintenance
- ✓ Advertising or directional signage
- ✓ Lighting for food warming
- ✓ Lighting equipment that is for sale
- ✓ Lighting demonstration equipment in lighting education facilities
- ✓ Approved because of safety considerations,
- ✓ In retail display windows when the display is enclosed by ceiling-height partitions
- ✓ Furniture-mounted supplemental task lighting controlled by automatic shutoff
- ✓ Exit signs
- ✓ Antimicrobial lighting used for the sole purpose of disinfecting a space





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**C405.11 Automatic receptacle control**

The following shall have automatic receptacle control complying with Section C405.11.1:

1. At least 50 percent of all 125V, 15- and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy or print functions, breakrooms, classrooms and individual workstations, including those installed in modular partitions and module office workstation systems.
2. At least 25 percent of branch circuit feeders installed for modular furniture not shown on the construction documents.



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**C405.11.1 Automatic receptacle control function**

Automatic receptacle controls shall comply with the following:

1. Either split controlled receptacles shall be provided with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.
2. One of the following methods shall be used to provide control:
  - 2.1. A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5,000 square feet and not more than one floor. The occupant shall be able to manually override an area for not more than 2 hours. Any individual shall control the receptacles of not more than 5,000 feet.
  - 2.2. An occupant sensor control that shall turn off receptacles within 20 minutes of all occupants leaving a space.
  - 2.3. An automated signal from another control or alarm system that shall turn off receptacles within 20 minutes after determining that the area is unoccupied.
3. All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space.
4. Plug-in devices shall not comply.

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**C405.11.1 Automatic receptacle control function**

Automatic receptacle controls shall comply with the following:

Exceptions: Automatic receptacle controls are not required for the following:

1. Receptacles specifically designated for equipment requiring continuous operation (24 hours per day, 365 days per year).
2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.
3. Within a single modular office workstation, noncontrolled receptacles are permitted to be located more than 12 inches, but not more than 72 inches (1828 mm) from the controlled receptacles serving that workstation

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### C405.12 Energy monitoring

New buildings with a gross conditioned floor area of 25,000 square feet or larger shall be equipped to measure, monitor, record and report energy consumption data in compliance with Sections C405.12.1 through C405.12.5.

Exception: R-2 occupancies and individual tenant spaces are not required to comply with this section provided that the space has its own utility services and meters and has less than 5,000 square feet of conditioned floor area



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### C405.12.1 Electrical energy metering

For all electrical energy supplied to the building and its associated site, including but not limited to site lighting, parking, recreational facilities and other areas that serve the building and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C405.12.2



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### C405.12.2 End-use metering categories

Meters or other approved measurement devices shall be provided to collect energy use data for each end-use category indicated in Table C405.12.2. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories indicated in Table C405.12.2 shall be permitted to be from a load that is not within that category.

**Exceptions:**

- 1.HVAC and water heating equipment serving only an individual dwelling unit shall not require end-use metering.
- 2.End-use metering shall not be required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.
- 3.End-use metering shall not be required for an individual tenant space having a floor area not greater than 2,500 square feet where a dedicated source meter complying with Section C405.12.3 is provided



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**TABLE C405.12.2 ENERGY USE CATEGORIES**

LOAD CATEGORY	DESCRIPTION OF ENERGY USE
Total HVAC system	Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120-volt equipment, or by 208/120-volt equipment that is located in a building where the main service is 480/277-volt power, is permitted to be excluded from total HVAC system energy use.
Interior lighting	Lighting systems located within the building.
Exterior lighting	Lighting systems located on the building site but not within the building.
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process load	Any single load that is not included in an HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment and commercial kitchens.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table, including but not limited to vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas and snow-melt systems.



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**IECC Additional Efficiency Package Options**  
Section C406

**C406.1 Additional energy efficiency credit requirements.**

New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of Section C406. Where a building contains multiple-use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following



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SECTION	CLIMATE ZONE																
	0A & 1A	0B & 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% heating efficiency improvement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1
C406.2.2: 5% cooling efficiency improvement	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	1	1	2	2	NA	1
C406.2.4: 10% cooling efficiency improvement	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3: Reduced lighting power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.4: Enhanced digital lighting controls	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406.5: On-site renewable energy	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406.6: Dedicated outdoor air	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.2: Recovered or renewable water heating	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.3: Efficient fossil fuel water heater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.4: Heat pump water heater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.8: Enhanced envelope performance	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Reduced air infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6
C406.10: Energy monitoring	4	4	4	4	3	3	3	3	3	3	2	3	2	2	2	2	2
C406.11: Fault detection and diagnostics system	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1

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**C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS**

**More efficient HVAC performance in accordance with Section C406.2**



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**C406.2 More efficient HVAC equipment performance**

Equipment shall exceed the minimum efficiency requirements listed in the tables in Section C403.3.2.

Variable refrigerant flow systems listed in the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 in accordance with Section C406.2.1, C406.2.2, C406.2.3 or C406.2.4 shall also meet applicable requirements of Section C403.

Energy efficiency credits for heating shall be selected from Section C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from Section C406.2.2, C406.2.4 or C406.2.5.

Selected credits shall include a heating or cooling energy efficiency credit or both.

Equipment not listed in Tables C403.3.2(1) through C403.3.2(9) and variable refrigerant flow systems not listed in the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 shall be limited to 10 percent of the total building system capacity for heating equipment where selecting Section C406.2.1 or C406.2.3 and cooling equipment where selecting Section C406.2.2, C406.2.4 or C406.2.5.

**C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS**

**Reduced lighting power in accordance with Section C406.3.**

Buildings shall comply with Section C406.3.1 or C406.3.2, and dwelling units and sleeping units within the building shall comply with Section C406.3.3.



**C406.3.1 Reduced lighting power by more than 10 percent**

The total connected interior lighting power calculated in accordance with Section C405.3.1 shall be less than 90 percent of the total lighting power allowance calculated in accordance with Section C405.3.2.

**C406.3.2 Reduced lighting power by more than 15 percent**

Where the total connected interior lighting power calculated in accordance with Section C405.3.1 is less than 85 percent of the total lighting power allowance calculated in accordance with Section C405.3.2, additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.





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**C406.3.3 Lamp efficacy**

Not less than 95 percent of the permanently installed lighting, excluding kitchen appliance light fixtures, serving dwelling units and sleeping units shall be provided by lamps with an efficacy of not less than 65 lumens per watt or luminaires with an efficacy of not less than 45 lumens per watt

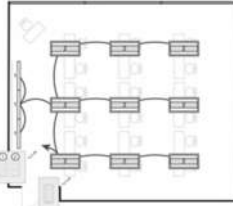
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C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

**Enhanced lighting controls in accordance with Section C406.4.**



- Enhanced digital lighting controls per C406.4, controls located and operated in accordance with Sections C405.2.1 through C405.2.3.
  - Luminaires configured for continuous dimming
  - Luminaires shall be addressed individually OR a controlled group of  $\leq 4$  luminaires (Where individual addressability is not available for the luminaire class type)
  - $\leq 8$  luminaires controlled together in a daylight zone
  - Fixtures controlled through digital control system that includes the following function:
    - Control reconfiguration based on digital addressability
    - Load shedding
    - Occupancy sensors capable of being reconfigured through the digital control system
- Construction documents including submittal of Sequence of Operations including specs outlining each function of the fixture requirements above
- Functional testing of controls comply with C408



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C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

**On-site supply of renewable energy in accordance with Section C406.5**

**C406.5.1 Basic renewable credit**

The total minimum ratings of on-site renewable energy systems, not including systems used for credits under Sections C406.7.2, shall be one of the following:

1. Not less than 0.86 Btu/h per square foot or 0.25 watts per square foot of conditioned floor area.
2. Not less than 2 percent of the annual energy used within the building for building mechanical and service water-heating equipment and lighting regulated in Section C405.

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C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

**Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.**

**C406.6 Dedicated outdoor air system**

- Be equipped with an independent ventilation system designed to provide  $\leq 100\%$  outdoor air to each occupied space
  - Ventilation system capable of total energy recovery
  - HVAC system include supply-air temperature controls that automatically reset the supply-air temp. in response to building loads or outdoor air temperatures
  - Controls reset the supply-air temperature at least 25% of the difference between design supply-air temp. and design room-air temp.


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What is a Dedicated Outdoor Air System?

- Consists of two parallel systems: A dedicated system for delivering outdoor air ventilation that handles both the latent and sensible loads of conditioning the ventilation air and a parallel system to handle mostly sensible loads generated by indoor sources and those that pass through the building enclosure
- Main purposes is to provide dedicated ventilation rather than ventilation as part of conditioned air.
- Improves indoor air quality and thermal comfort
- Provides a dedicated supply of 100% outdoor air rather than mixing it with the return air as is typical with VAV systems.
- Sized to meet ventilation requirements and does not require oversizing as with VAV systems
- Controls latent and sensible loads independently to avoid moisture related indoor air problems.



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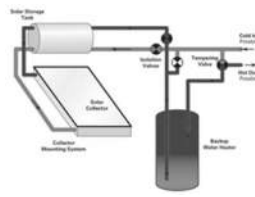

C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Reduced energy use in service water heating C406.7

Buildings with the following types allowed to use this compliance method:

- Group R-1: Boarding houses, hotels, or motels
- Group I-2: Hospitals, psychiatric hospitals, and nursing homes
- Group A-2: Restaurants and banquet halls or buildings containing food preparation areas
- Group F: Laundries
- Group R-2
- Group A-3: Health clubs and spas

Buildings showing a service hot water load of >10% of total building energy loads as shown with an energy analysis per C407

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Reduced energy use in service water heating C406.7

**C406.7.2 Recovered or renewable water heating**

The building service water-heating system shall have one or more of the following that are sized to provide not less than 30 percent of the building's annual hot water requirements, or sized to provide 70 percent of the building's annual hot water requirements if the building is required to comply with Section C403.10.5:

- Waste heat recovery from service hot water, heat-recovery chillers, building equipment or process equipment.
- On-site renewable energy water-heating systems.



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Reduced energy use in service water heating C406.7

**C406.7.3 Efficient fossil fuel water heater**

The combined input-capacity weighted-average equipment rating of all fossil fuel water-heating equipment in the building shall be not less than 95 percent Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with Section C404.2.1.

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Reduced energy use in service water heating C406.7

**C406.7.4 Heat pump water heater**

Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity weighted-average EF of 3.0.

Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

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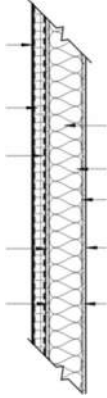

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C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Enhanced envelope performance in accordance with Section C406.8

**C406.8 Enhanced envelope performance**

The total UA of the building thermal envelope as designed shall be not less than 15 percent below the total UA of the building thermal envelope in accordance with Section C402.1.5

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C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Reduced air infiltration in accordance with Section C406.9

**C406.9 Reduced air infiltration.**

Air infiltration shall be verified by whole-building pressurization testing conducted in accordance with ASTM E779 or ASTM E1827 by an independent third party. The measured air-leakage rate of the building envelope shall not exceed 0.25 cfm/ft<sup>2</sup> under a pressure differential of 0.3 inches water column (75 Pa), with the calculated surface area being the sum of the above- and below-grade building envelope. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.

Exception: For buildings having over 250,000 square feet (25 000 m<sup>2</sup>) of conditioned floor area, air leakage testing need not be conducted on the whole building where testing is conducted on representative above-grade sections of the building. Tested areas shall total not less than 25 percent of the conditioned floor area and shall be tested in accordance with this section.



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C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

**C406.10 Energy monitoring**

Buildings shall be equipped to measure, monitor, record and report energy consumption data in compliance with Sections C406.10.1 through C406.10.5.

**C406.11 Fault detection and diagnostics system**

**C406.12 Efficient kitchen equipment**



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### C408 MAINTENANCE INFORMATION AND SYSTEM COMMISSIONING



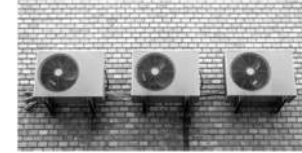
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### C408.1 General

This section covers the provision of maintenance information and the commissioning of, and the functional testing requirements for, building systems



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### C408.1.1 Building operations and maintenance information

The building operations and maintenance documents shall be provided to the owner and shall consist of:

- manufacturers' 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 visible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product

**Building  
Operation and  
Maintenance  
Manual**

**Read this prior to  
any maintenance!**



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

- Prior to the final mechanical and plumbing inspections
- Registered design professional or approved agency shall provide evidence of mechanical systems commissioning and completion in accordance with the provisions of this section



- Construction document notes shall clearly indicate:
- Provisions for commissioning and completion requirements in accordance with this section
- Copies of all documentation shall be given to the owner or owner's authorized agent and made available to the code official upon request



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

- Exceptions:
- Mechanical systems and service water heater systems in buildings where the total mechanical equipment capacity is less than:
- 480,000 Btu/h cooling capacity and 600,000 Btu/h combined service water-heating and space-heating capacity.
- Systems included in Section C403.5 (Economizers) that serve individual dwelling units and sleeping units



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#### C408.2.1 Commissioning plan

- A commissioning plan shall be developed by a registered design professional and include the following items:
  - A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities
  - A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed
  - Functions to be tested including, but not limited to, calibrations and economizer controls
  - Conditions under which the test will be performed. Testing shall affirm winter and summer design conditions and full outside air conditions
  - Measurable criteria for performance



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#### C408.2.2 Systems adjusting and balancing

- HVAC systems shall be balanced
- Accordance with generally accepted engineering standards
- Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the product specifications
- Test and balance activities shall include air system and hydronic system balancing



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#### C408.2.3 Functional performance testing

##### C408.2.3.1 Equipment

- Equipment functional performance testing
- Operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications
- Operation, function, and maintenance serviceability for each of the commissioned systems is confirmed
- Testing shall include all modes and sequence of operation, including under full-load, part-load and emergency conditions

##### C408.2.3.2 Controls

- HVAC and service water-heating control systems shall be tested and adjusted and operate in accordance with approved plans and specifications

##### C408.2.3.3 Economizers

- Air economizers shall undergo a functional test to determine that they operate in accordance with manufacturer's specifications



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### C408.2.4 Preliminary commissioning report

- The report shall be identified as “Preliminary Commissioning Report” shall include the completed Commissioning Compliance Checklist, Figure C408.2.4, and shall identify
  - Itemization of deficiencies found during testing that have not been corrected at the time of reporting
  - Deferred tests that cannot be performed at the time of report preparation because of climatic conditions (This would include any climatic conditions required for testing)
  - Report sent to Owner
  - Results of functional performance tests
  - Functional performance test procedures used during the commissioning process, including measurable criteria for test acceptance
  - Building Official can require a copy for their review



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Project Information: \_\_\_\_\_ Project Name: \_\_\_\_\_

Project Address: \_\_\_\_\_

Commissioning Authority: \_\_\_\_\_

Commissioning Plan (Section C408.2.1)

Commissioning Plan was used during construction and includes all items required by Section C408.2.1

Systems Adjusting and Balancing has been completed.

HVAC Equipment Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on: \_\_\_\_\_

HVAC Controls Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on: \_\_\_\_\_

Economizer Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on: \_\_\_\_\_

Lighting Controls Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on: \_\_\_\_\_

Service Water Heating System Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on: \_\_\_\_\_

Manual, record documents and training have been completed or scheduled

Preliminary Commissioning Report submitted to owner and includes all items required by Section C408.2.4

I hereby certify that the commissioning provider has provided me with evidence of mechanical, service water heating and lighting systems commissioning in accordance with the 2018 IECC.

Signature of Building Owner or Owner's Representative \_\_\_\_\_ Date \_\_\_\_\_



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### C408.3 Lighting system functional testing

- Automatic lighting controls required by this code shall comply with this section



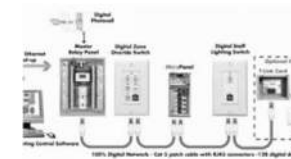
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### C408.3.1 Functional testing

- 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 through C408.3.1.3 for the applicable control type.



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### C408.3.1.1 Occupant sensor controls

- Where occupant sensor controls are provided, the following procedures shall be performed:
- Certify that the occupant sensor has been located and aimed in accordance with manufacturer recommendations
- For projects with seven or fewer occupant sensors, each sensor shall be tested



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### C408.3.1.3 Daylight responsive controls

- Where daylight responsive controls are provided, the following shall be verified
  - Control devices have been properly located, field calibrated and set for accurate setpoints and threshold light levels
  - Daylight controlled lighting loads adjust to light level set points in response to available daylight
  - The locations of calibration adjustment equipment are readily accessible only to authorized personnel



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### 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.



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## Existing Buildings Chapter 5

### Section C501 - General

- ✓ Buildings Designated as Historic
- ✓ Existing buildings
  - ✓ Additions
  - ✓ Alterations
  - ✓ Repairs and Maintenance
- ✓ Change in Occupancy





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**Historic Buildings**

- **IECC Definition of Historic Building**
- Any building or structure that is one or more of the following:
  - ❖ Listed, or certified as eligible for listing by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places.
  - ❖ Designated as historic under an applicable state or local law.
  - ❖ Certified as a contributing resource within a National Register-listed, state-designated or locally designated historic district.



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**C501.5 Historic Buildings**

Provisions of this code relating to the construction, repair, alteration, restoration and movement of structures, and change of occupancy shall not be mandatory for historic buildings provided that a report has been submitted to the code official and signed by a registered design professional, or a representative of the State Historic Preservation Office or the historic preservation authority having jurisdiction, demonstrating that compliance with that provision would threaten, degrade or destroy the historic form, fabric or function of the building.

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**Existing Buildings**  
**Section C502 - Additions**

- Addition to:
  - Existing Building
  - Building System
  - Or portion thereof

Must conform to the code as it relates to new construction without requiring the unaltered portion of the existing building or system to comply.

- Shall not create unsafe or hazardous condition
- Shall not overload existing building systems
- Can comply as the addition alone or as a single building with existing building

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**Existing Buildings**  
**Section C502.2 – ADDITIONS - Change in space conditioning**

Any nonconditioned space that is altered to become conditioned space shall be required to be brought into full compliance with this code

**Examples:**

- ✓ Converting part of an unconditioned warehouse to office space
- ✓ Shell building tenant build-out ???



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**Existing Buildings  
Section C502 - Additions**



**C502.3.1 Vertical fenestration area**  
 Additions shall comply with the following:

1. Where an addition has a new vertical fenestration area that results in a total building fenestration area less than or equal to that permitted by Section C402.4.1, the addition shall comply with Section C402.1.5, C402.4.3 or C407.
2. Where an addition with vertical fenestration that results in a total building fenestration area greater than Section C402.4.1 or an addition that exceeds the fenestration area greater than that permitted by Section C402.4.1, the fenestration shall comply with Section C402.4.1.1 for the addition only.
3. Where an addition has vertical fenestration that results in a total building vertical fenestration area exceeding that permitted by Section C402.4.1.1, the addition shall comply with Section C402.1.5 or C407.



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**Existing Buildings  
Section C502 - Additions**



**C502.3.2 Skylight area**  
 Skylights shall comply with the following:

1. Where an addition has new skylight area that results in a total building fenestration area less than or equal to that permitted by Section C402.4.1, the addition shall comply with Section C402.1.5 or C407.
2. Where an addition has new skylight area that results in a total building skylight area greater than permitted by Section C402.4.1 or where additions have skylight area greater than that permitted by Section C402.4.1, the skylight area shall comply with Section C402.4.1.2 for the addition only.
3. Where an addition has skylight area that results in a total building skylight area exceeding that permitted by Section C402.4.1.2, the addition shall comply with Section C402.1.5 or C407.



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**Existing Buildings  
Section C502 - Additions**

- Mechanical Systems comply with C403
- SWH – C404
- Pools and inground permanently installed spas – C404.9
- Lighting power and systems comply with Sections C405 and C408
  - Interior comply with addition alone or addition plus existing building
  - Exterior comply with addition alone or addition plus existing



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**Existing Buildings  
Section C503.1 - Alterations General**



- Alteration must comply with code as for new construction
- Unaltered portion(s) do not need to comply
- Alteration cannot make existing building less conforming than it may have already been
- Alteration shall not create an unsafe or hazardous condition or overload existing systems.
- Alterations comply with ASHRAE 90.1-2013 do not need to comply with C402 through C405
- Vertical Fenestration and Skylight Area similar to requirements for additions

**Exceptions.....**




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### Existing Buildings Section C503 - Alterations Exceptions



1. Storm windows installed over existing fenestration
2. Surface-applied window film installed on existing single-pane fenestration assemblies reducing solar heat gain, provided that the code does not require the glazing or fenestration to be replaced
3. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation



4. Construction where the existing roof, wall or floor cavity is not exposed
5. Roof recover
6. Air barriers shall not be required for roof recover and roof replacement where the alterations or renovations to the building do not include alterations, renovations or repairs to the remainder of the building envelope



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### Existing Buildings Section C503.2 – Alterations Building Envelope

- New building envelope assemblies that are part of the alteration shall comply with Sections C402.1 through C402.5.

Exception: Where the existing building exceeds the fenestration area limitations of Section C402.4.1 prior to alteration, the building is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.



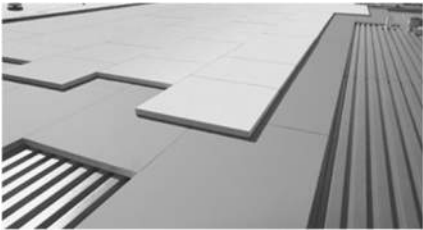

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### C503.3.1 Roof replacement.

Roof replacements shall comply with Section C402.1.3, C402.1.4, C402.1.5 or C407 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck. In no case shall the R-value of the roof insulation be reduced or the U-factor of the roof assembly be increased as part of the roof replacement.





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### C503.3.2 Vertical fenestration



- The addition of vertical fenestration that results in a total building fenestration area less than or equal to that specified in Section C402.4.1 shall comply with Section C402.1.5, C402.4.3 or C407.
- The addition of vertical fenestration that results in a total building fenestration area greater than Section C402.4.1 shall comply with Section C402.4.1.1 for the space adjacent to the new fenestration only.
- Alterations that result in a total building vertical fenestration area exceeding that specified in Section C402.4.1.1 shall comply with Section C402.1.5 or C407.
- Provided that the vertical fenestration area is not changed, using the same vertical fenestration area in the standard reference design as the building prior to alteration shall be an alternative to using the vertical fenestration area specified in Table C407.5.1(1).





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**C503.3.3 Skylight area**

- New skylight area that results in a total building skylight area less than or equal to that specified in Section C402.4.1 shall comply with Section C402.1.5, C402.4 or C407.
- The addition of skylight area that results in a total building skylight area greater than Section C402.4.1 shall comply with Section C402.4.1.2 for the space adjacent to the new skylights.
- Alterations that result in a total building skylight area exceeding that specified in Section C402.4.1.2 shall comply with Section C402.1.5 or C407.
- Provided that the skylight area is not changed, using the same skylight area in the standard reference design as the building prior to alteration shall be an alternative to using the skylight area specified in Table C407.5.1(1).





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**Existing Buildings  
Section C503 - Alterations**

- Heating and Cooling
  - New HVAC systems and duct systems that are part of the alteration to comply with Section C403
  - Economizers new cooling systems that are part of alteration shall comply with Section C403.5.
- Service hot water systems
  - New SWH systems that are part of the alteration to comply with C404
- Lighting Systems
  - New Lighting systems that are part of the alteration to comply with C405





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**Existing Buildings Section C504 - Repairs**

**REPAIR.** The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage

- Work on nondamaged components necessary for the required repair or damaged components shall be considered part of the repair and not subject to the alterations requirements
- Repairs considered part of the code
  - Glass-only replacements in an existing sash and frame
  - Roof repairs
  - Replacement of existing doors that separate conditioned space from the exterior do not require the installation of a vestibule or revolving door, provided that an existing vestibule that separate a conditioned space from the exterior shall not be removed
  - Air barriers shall not be required for roof repair where the repairs to the building do not include alterations, renovations or repairs to the remainder of the building envelop
  - Repairs where only the bulb and/or ballast within the






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**Existing Buildings  
Section C504 - Repairs**

- Where a building was constructed to comply with ANSI/ASHRAE/IESNA 90.1, repairs shall comply with the standard and need not comply with Sections C402, C403, C404 and C405.

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**Section C505 – Change in Occupancy**



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 C405.3.2(1) or C405.3.2(2) to another use in Table C405.3.2(1) or C405.3.2(2), the installed lighting wattage shall comply with Section C405.3

Where the space undergoing a change in occupancy or use is in a building with a fenestration area that exceeds the limitations of Section C402.4.1, the space is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.

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.

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**CODE DATA**

Plan Review

CODE ANALYSIS IS BASED ON:  
 2021 INTERNATIONAL BUILDING CODE  
 2021 INTERNATIONAL FIRE CODE  
 2021 INTERNATIONAL ENERGY CONSERVATION CODE  
 2021 INTERNATIONAL MECHANICAL CODE  
 2021 INTERNATIONAL FUEL GAS CODE  
 2020 NATIONAL ELECTRICAL CODE  
 2018 INTERNATIONAL PLUMBING CODE

**B. USE AND OCCUPANCY CLASSIFICATION (CHAPTER 3)**  
 BUSINESS GROUP B


**C. GENERAL BUILDING HEIGHTS AND AREAS (CHAPTER 5)**  
 CONSTRUCTION TYPE: TYPE II B, FULLY SPRINKLERED  
 ALLOWABLE AREA: 69,000 SF  
 ACTUAL AREA: 25,817 SF  
 AREA MODIFICATION: NONE REQUESTED  
 ALLOWABLE HEIGHT: 75'-0", 4 STORIES  
 ACTUAL HEIGHT: 29'-7", 2 STORIES





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# CODE DATA

CODE ANALYSIS IS BASED ON:  
2021 INTERNATIONAL BUILDING CODE  
2021 INTERNATIONAL FIRE CODE  
2021 INTERNATIONAL ENERGY CONSERVATION CODE  
2021 INTERNATIONAL MECHANICAL CODE  
2021 INTERNATIONAL FUEL GAS CODE  
2020 NATIONAL ELECTRICAL CODE  
2018 INTERNATIONAL PLUMBING CODE

## B. USE AND OCCUPANCY CLASSIFICATION (CHAPTER 3)

BUSINESS GROUP B

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ALLOWABLE HEIGHT: 75'-0", 4 STORIES  
ACTUAL HEIGHT: 29'-7", 2 STORIES

## D. TYPES OF CONSTRUCTION, (CHAPTER 6)

TYPE II-B CONSTRUCTION

NO RATING IS REQUIRED FOR STRUCTURAL FRAME, BEARING WALLS (int or ext), NONBEARING WALLS AND PARTITIONS, FLOOR CONSTRUCTION, OR ROOF CONSTRUCTION FOR TYPE IIB PER TABLE 601.

## E. FIRE PROTECTION SYSTEMS (CHAPTER 9)

THE BUILDING WILL BE FULLY SPRINKLERED PER APPLICABLE CODES. REFER TO SPECS.

## F. MEANS OF EGRESS (CHAPTER 10)

OCCUPANT LOAD: PER TABLE 1004.1.2

BUSINESS OCCUPANCY - 285 OCCUPANTS TOTAL (REFER TO OCCUPANT LOAD TABLE ON CODE PLAN SHEETS)

EGRESS WIDTH WITH SPRINKLER SYSTEM

STAIRWAYS: .3 INCHES PER OCCUPANT \* 115 OCCUPANTS (2ND FLOOR ONLY) = 35 INCHES MINIMUM

OTHER EGRESS COMPONENTS: .2 INCHES PER OCCUPANT \* 285 OCCUPANTS = 57 INCHES MINIMUM

## G. PLUMBING SYSTEMS (CHAPTER 29)

PER TABLE 2902.1

285 OCCUPANTS / 2 = 143 OCCUPANTS PER GENDER

	WATER CLOSETS	LAVATORIES	DRINKING FOUNTAINS	SERVICE SINKS
	1 / 25 FIRST 50	1 / 40 FIRST 80	1 / 100	
	1 / 50 AFTER	1 / 80 AFTER		
MALE	4 REQD, 4 PROV	4 REQD, 4 PROV		
FEMALE	4 REQD, 4 PROV	4 REQD, 4 PROV		
UNISEX			3 REQD, 4 PROV	1 REQD, 2 PROV

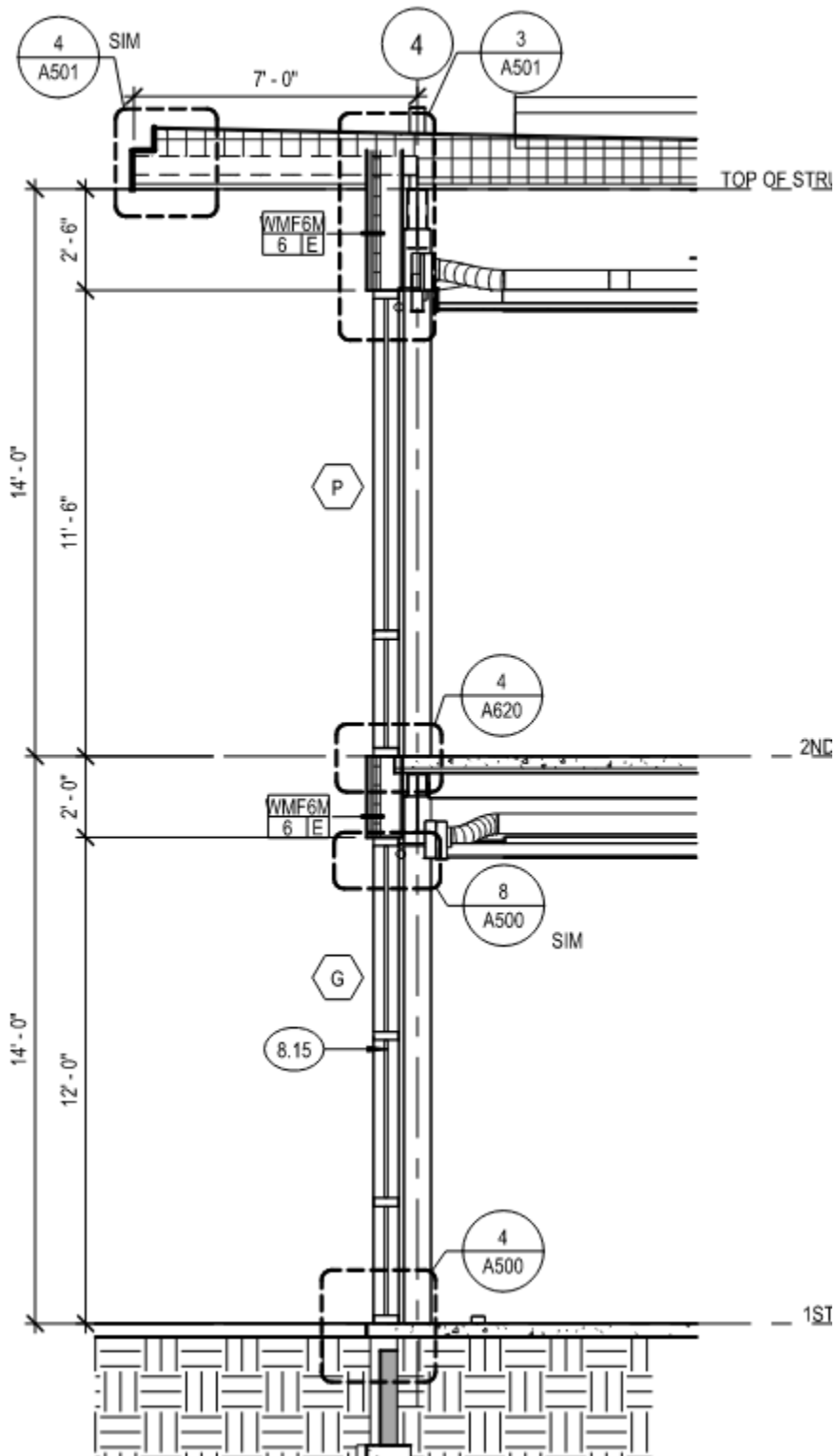
## 2021 IECC - ENERGY CONSERVATION CODE SUMMARY

CLIMATE ZONE: 5B

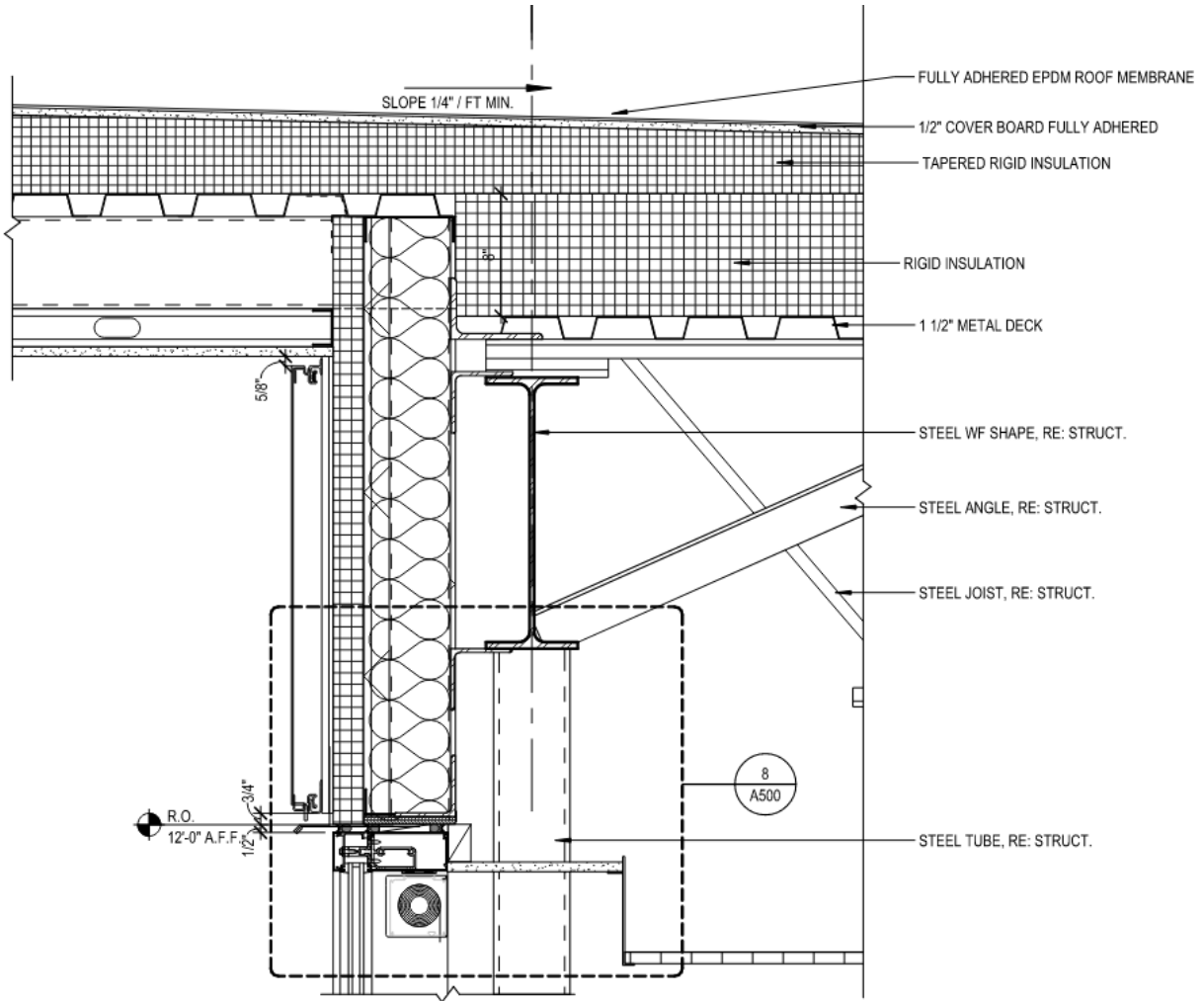
C401.2: APPLICATION

THE PROJECT WILL COMPLY WITH THE REQUIREMENTS OF IECC C407.

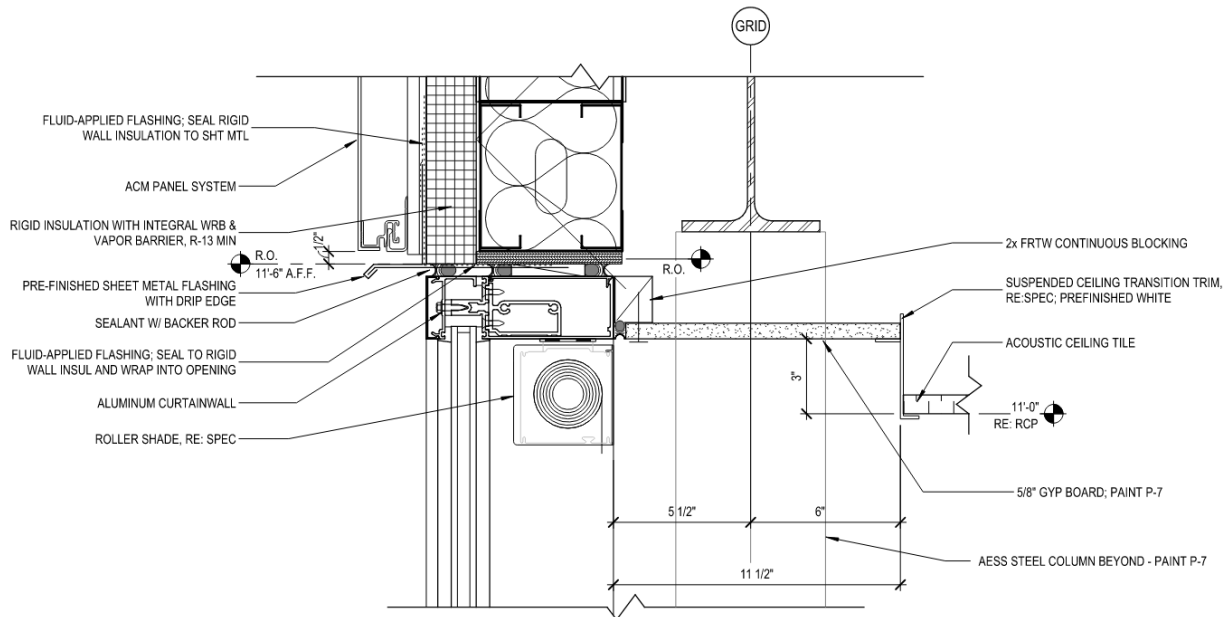
1. THE PROJECT COMPLIES WITH ALL REQUIREMENTS IN TABLE C407.2.
2. THE PROJECT IS TARGETING ZERO ENERGY DESIGN THROUGH AN ENERGY MODEL AND VERIFICATION FOLLOWING SUBSTANTIAL COMPLETION.



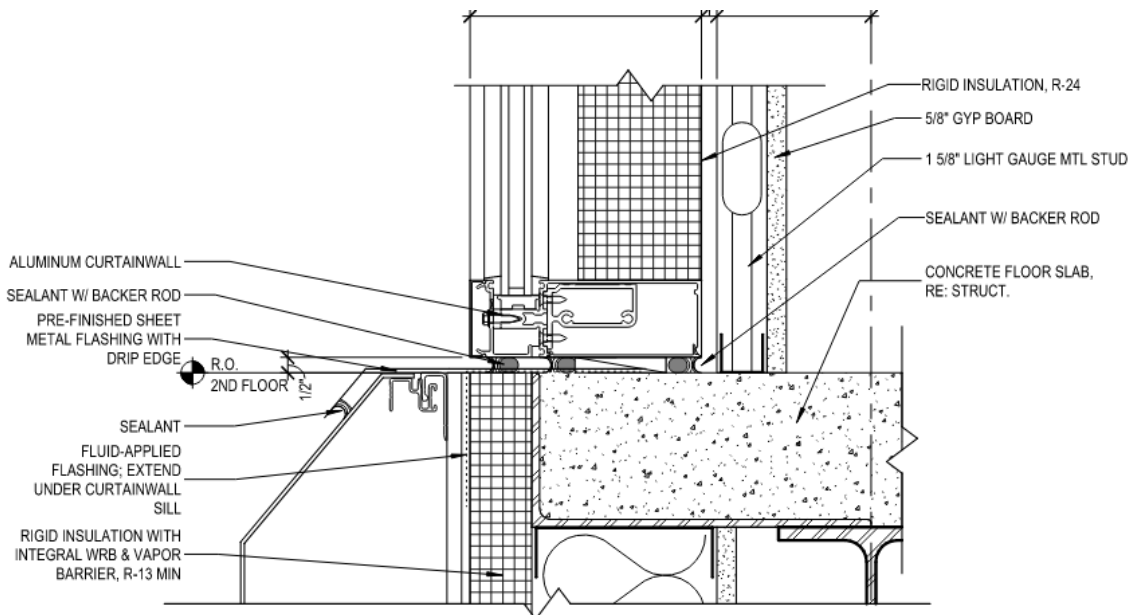




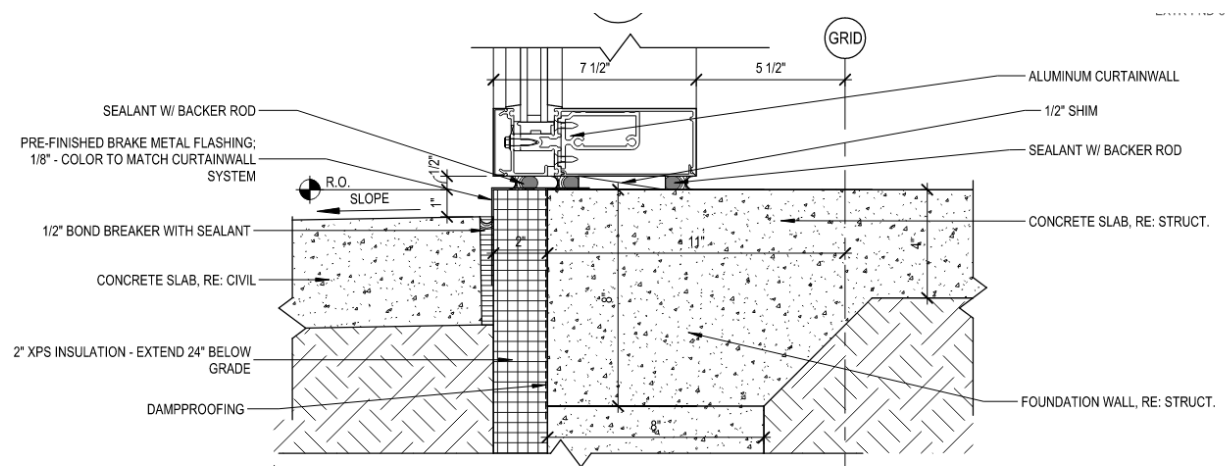
3 TYPICAL SOFFIT @ WMF6M6 ASSEMBLY  
 A501 1 1/2" = 1'-0"



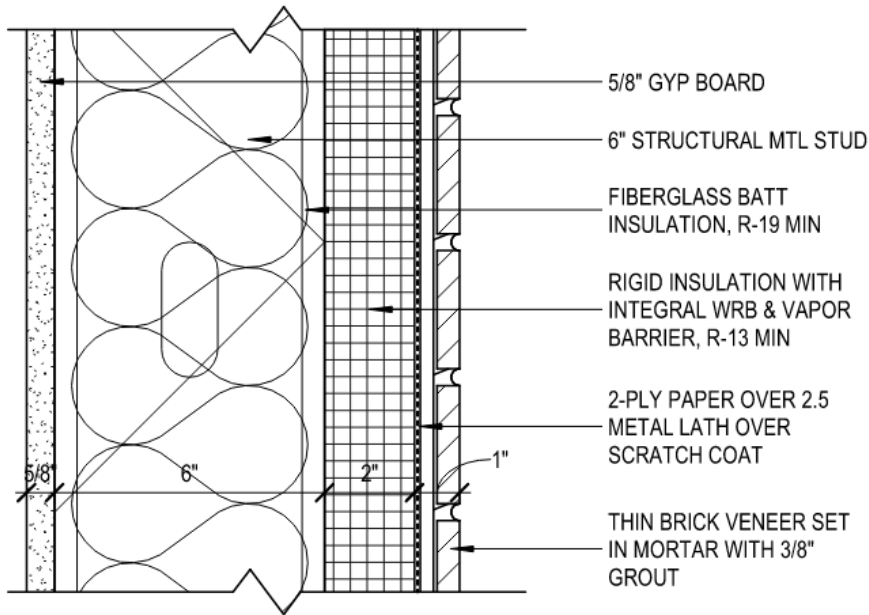
8 CURTAIN WALL HEAD DETAIL AT 2ND FLOOR  
 A500 3" = 1'-0"



4 CURTAINWALL SILL @ 2ND FLOOR SLAB  
 A620 3" = 1'-0"



4 FOUNDATION-SILL @ CURTAIN WALL  
 A500 3" = 1'-0" EXTR-FND-52

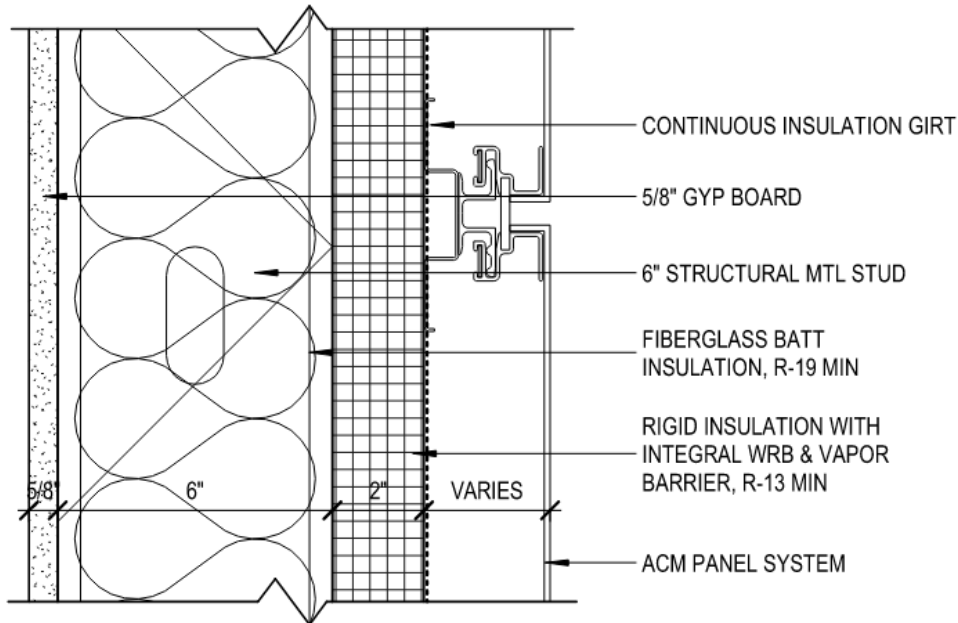


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G002

**TYPICAL WMF6G6E ASSEMBLY**

3" = 1'-0"

E)

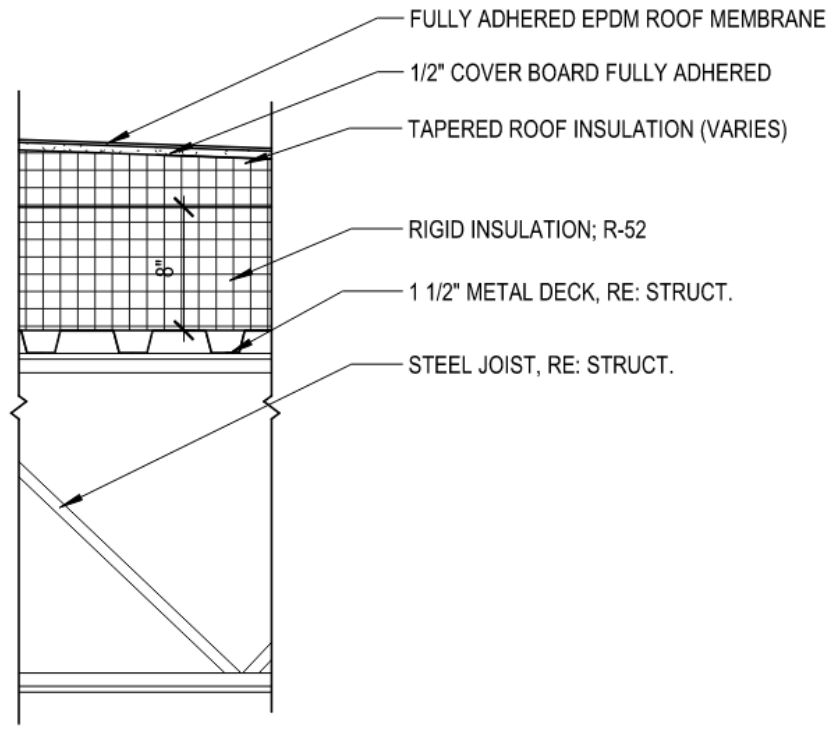


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G002

**TYPICAL WMF6M6E WALL ASSEMBLY**

3" = 1'-0"

EXT)



# TYPICAL ROOF TYPE

1" = 1'-0"



Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U- Factor <sup>(a)</sup>
Door: Glass (over 50% glazing): Metal Frame, Entrance Door, Perf. Specs.: Product ID , SHGC 0.21, [Bldg. Use 1 - Office] (b)	48	---	---	0.390	0.630
Ext. Wall: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Office]	1222	19.0	13.0	0.045	0.055
Door: Glass (over 50% glazing): Metal Frame, Entrance Door, Perf. Specs.: Product ID , SHGC 0.21, [Bldg. Use 1 - Office] (b)	24	---	---	0.390	0.630
Window: Metal Frame: Fixed, Perf. Specs.: Product ID A6414,05-116-45, SHGC 0.25, PF 0.53, [Bldg. Use 1 - Office] (b)	634	---	---	0.330	0.360
Spandrel: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Office]	210	0.0	24.0	0.037	0.055
<b>SOUTH</b>					
Courtyard South: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Office]	1061	19.0	13.0	0.045	0.055
Window: Metal Frame: Fixed, Perf. Specs.: Product ID A6414,05-116-45, SHGC 0.25, PF 0.53, [Bldg. Use 1 - Office] (b)	554	---	---	0.330	0.360
Spandrel: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Office]	112	0.0	24.0	0.037	0.055
Ext. Wall: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Office]	2012	19.0	13.0	0.045	0.055
Window: Metal Frame: Fixed, Perf. Specs.: Product ID A6414,05-116-45, SHGC 0.25, PF 0.53, [Bldg. Use 1 - Office] (b)	1189	---	---	0.330	0.360
Spandrel: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Office]	401	0.0	24.0	0.037	0.055
<b>WEST</b>					
Ext. Wall: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Office]	3328	19.0	13.0	0.045	0.055
Door: Insulated Metal, Swinging, [Bldg. Use 1 - Office]	24	---	---	0.360	0.370
Door: Glass (over 50% glazing): Metal Frame, Entrance Door, Perf. Specs.: Product ID , SHGC 0.21, [Bldg. Use 1 - Office] (b)	48	---	---	0.390	0.630
Door: Glass (over 50% glazing): Metal Frame, Entrance Door, Perf. Specs.: Product ID , SHGC 0.21, [Bldg. Use 1 - Office] (b)	24	---	---	0.390	0.630
Window: Metal Frame: Fixed, Perf. Specs.: Product ID A6414,05-116-45, SHGC 0.25, PF 0.53, [Bldg. Use 1 - Office] (b)	2094	---	---	0.330	0.360
Spandrel: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Office]	535	0.0	24.0	0.037	0.055
Ext. Wall: Steel-Framed, 16in. o.c., [Bldg. Use 1 - Office]	491	0.0	18.6	0.047	0.055

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

(b) Fenestration product performance must be certified in accordance with NFRC and requires supporting documentation.

(c) Slab-On-Grade proposed and budget U-factors shown in table are F-factors.

## Envelope PASSES: Design 1% better than code

### Envelope Compliance Statement

*Compliance Statement:* The proposed envelope design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed envelope systems have been designed to meet the 2021 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Check

Name - Title	Signature	Date
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# Inspection Checklist

Energy Code: 2021 IECC

Requirements: 0.0% were addressed directly in the COMcheck software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 [PR1] <sup>1</sup>	Plans and/or specifications provide all information with which compliance can be determined for the building envelope and document where exceptions to the standard are claimed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.4.1 [PR11] <sup>1</sup>	The skylight area <= 3 percent of the gross roof area.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.4.1.1 [PR12] <sup>1</sup>	Vertical Fenestration Area Allowance: A maximum of 40 percent of gross above-grade wall area is permitted to be vertical fenestration area provided >= 50 percent of the conditioned floor area is within a daylight zone, daylight responsive controls are installed, and glazing assemblies within the scope of NFRC 200 have visible transmittance >= 1.1 times SHGC.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.4.2 [PR14] <sup>1</sup>	In enclosed spaces > 2,500 ft <sup>2</sup> directly under a roof with ceiling heights >15 ft. and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the following requirements apply: (a) the daylight zone under skylights is >= half the floor area; (b) the skylight area to daylight zone is >= 3 percent with a skylight VT >= 0.40; or a minimum skylight effective aperture >= 1 percent.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406 [PR9] <sup>1</sup>	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C303.2 [FO4] <sup>2</sup>	Slab edge insulation installed per manufacturer's instructions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.2.1 [FO6] <sup>1</sup>	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C105 [FO3] <sup>2</sup>	Installed slab-on-grade insulation type and R-value consistent with insulation specifications reported in plans and COMcheck reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.2.4 [FO7] <sup>2</sup>	Slab edge insulation depth/length. Slab insulation extending away from building is covered by pavement or >= 10 inches of soil.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Framing / Rough-In Inspection	Complies?	Comments/Assumptions
C303.1.3 [FR12] <sup>2</sup>	Fenestration products rated in accordance with NFRC certified and as to performance labels or certificates provided.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.4.3 [FR10] <sup>1</sup>	Vertical fenestration SHGC value.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.4.3, C402.4.3.4 [FR8] <sup>1</sup>	Installed vertical fenestration U-factor and SHGC consistent with label specifications and as reported in plans and COMcheck reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.4.5 [FR14] <sup>2</sup>	U-factor of opaque swinging and nonswinging doors associated with the building thermal envelope meets requirements.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.5.1.4 [FR20] <sup>1</sup>	The building envelope contains a continuous air barrier that is sealed in an approved manner and average assembly air leakage $\leq 0.04$ cfm/ft <sup>2</sup> . Air barrier penetrations are sealed in an approved manner.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.4 [FR18] <sup>3</sup>	Factory-built fenestration and doors are labeled as meeting air leakage requirements.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.7.7 [ME58] <sup>3</sup>	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed. Reference section language for operational details.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

**Additional Comments/Assumptions:**

1 High Impact (Tier 1)	2 Medium Impact (Tier 2)	3 Low Impact (Tier 3)
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Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.7 [EL26] <sup>2</sup>	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.8 [EL27] <sup>2</sup>	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.9.1, C405.9.2 [EL28] <sup>2</sup>	Escalators and moving walks comply with ASME A17.1/CSA B44 and 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.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.10 [EL29] <sup>2</sup>	Total voltage drop across the combination of feeders and branch circuits <= 5%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.1.1 [EL30] <sup>2</sup>	At least 90% of dwelling unit permanently installed lighting shall have lamp efficacy >= 65 lm/W or luminaires with efficacy >= 45 lm/W or comply with C405.2.4 or C405.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.11, C405.11.1 [EL31] <sup>2</sup>	50% of 15/20 amp receptacles installed in enclosed offices, conference rooms, copy rooms, break rooms, classrooms and workstations and > 25% of branch circuit feeders for modular furniture will have automatic receptacle control in accordance with C405.11.1.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Insulation Inspection	Complies?	Comments/Assumptions
C303.1 [IN3] <sup>1</sup>	Roof insulation installed per manufacturer's instructions and is labeled with R-value or insulation certificate providing R-value and other relevant data. Blown or poured loose-fill insulation is installed only where the roof slope is $\leq 3$ in 12.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.2.1 [IN20] <sup>1</sup>	Roof assembly meets minimal thermal resistance installed between roof framing or in a continuous fashion on the roof assembly as stipulated in Table C402.1.3. Requirements for above deck insulation, minimum thickness, suspended ceilings, staggered joints and skylight curbs will be met.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C303.2 [IN7] <sup>1</sup>	Above-grade wall insulation installed per manufacturer's instructions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C105 [IN6] <sup>1</sup>	Installed above-grade wall insulation type and R-value consistent with insulation specifications reported in plans and COMcheck reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.2.3 [IN8] <sup>2</sup>	Installed floor insulation type and R-value consistent with insulation specifications reported in plans and COMcheck reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.2.6 [IN18] <sup>3</sup>	Radiant panels and associated components, designed for heat transfer from the panel surfaces to the occupants or indoor space are insulated with a minimum of R-3.5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C105 [IN2] <sup>1</sup>	Installed roof insulation type and R-value consistent with insulation specifications reported in plans and COMcheck reports. For some ceiling systems, verification may need to occur during Framing Inspection.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Envelope Assemblies table for values.
C402.5.1.1 [IN1] <sup>1</sup>	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed, weather stripped or wrapped with moisture vapor-permeable wrapping material to minimize air leakage.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C401.3 [FI58] <sup>1</sup>	A thermal envelope certificate will be supplied and completed by an approved third party.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.10 [FI26] <sup>3</sup>	Recessed luminaires in thermal envelope to limit infiltration and be IC rated and labeled. Seal between interior finish and luminaire housing.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.11 [FI59] <sup>1</sup>	Operable openings > 40 ft <sup>2</sup> will be interlocked with heating and cooling systems to setback setpoint temperatures within 10 minutes of opening.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C402.5.8 [FI37] <sup>1</sup>	Weatherseals installed on all loading dock cargo door openings and provide direct contact along the top and sides of vehicles parked in the doorway.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406.3 [FI67] <sup>1</sup>	Reduced lighting power - this credit specifies that the connected lighting power is $\geq$ 10% more efficient than 2021 IECC requirements.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406.4 [FI54] <sup>1</sup>	Enhanced Digital Lighting Controls - Interior lighting has the following enhanced lighting controls in accordance with Sections C405.2.1 through C405.2.3, Luminaires capable of continuous dimming and being addressed individually, at least 8 luminaires controlled in combination in a daylight zone, digital control system for fixtures with load shedding or occupancy sensors, Sequence of Operations documentation, and functional testing per Section C408.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406.5 [FI49] <sup>1</sup>	On-site renewable energy credits - on-site renewable energy system supplies at least 0.86 Btuh or 0.25 watts per square foot of conditioned floor area OR provides at least 2 percent of the energy used within the building for mechanical and service water heating equipment and lighting regulated in C405.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406.7.4 [FI53] <sup>1</sup>	Reduced energy use in service water heating - the hot water system is served by heat pump water heaters with a minimum Energy Factor of 3.0. The heat pump does not draw conditioned air from within the building.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C406.8 [FI68] <sup>1</sup>	Enhanced envelope performance - the building thermal envelope UA value is $\geq$ 15% better than the total UA of the envelope specified by Section C402.1.5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

1 High Impact (Tier 1)    2 Medium Impact (Tier 2)    3 Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C406.10 [FI63] <sup>1</sup>	Energy Monitoring - the building is equipped with an energy management system to monitor, record, and report energy consumption for electrical energy, by end-use category, contain meters, a data acquisition system and employ graphical reports.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.1.1 [FI57] <sup>1</sup>	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building, equipment and systems are intended to be installed, maintained, and operated.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

**Additional Comments/Assumptions:**

1 High Impact (Tier 1)	2 Medium Impact (Tier 2)	3 Low Impact (Tier 3)
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# COMcheck Software Version COMcheckWeb Mechanical Compliance Certificate

## Project Information

Energy Code: 2021 IECC  
Project Title:  
Location:  
Climate Zone: 5b  
Project Type: New Construction

Construction Site: Owner/Agent: Designer/Contractor:

## Additional Efficiency Package(s)

Credits: 10.0 Required 0.0 Proposed

## Mechanical Systems List

### Quantity System Type & Description

- 1 GSHP-1 (Single Zone):  
Ground Source, Brine-To-Water Heat Pump  
Heating Mode: Capacity = 28 kBtu/h,  
Proposed Efficiency = 4.20 COP, Required Efficiency = 2.50 COP  
Cooling Mode: Capacity = 38 kBtu/h,  
Proposed Efficiency = 19.70 EER, Required Efficiency = 12.10 EER  
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00  
Fan System: GSHP 1 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes  
  
Fans:  
FAN 1 Supply, Constant Volume, 1300 CFM, 0.5 motor nameplate hp, 1.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW
- 1 GSHP-2 (Single Zone):  
Ground Source, Brine-To-Water Heat Pump  
Heating Mode: Capacity = 38 kBtu/h,  
Proposed Efficiency = 4.00 COP, Required Efficiency = 2.50 COP  
Cooling Mode: Capacity = 51 kBtu/h,  
Proposed Efficiency = 19.30 EER, Required Efficiency = 12.10 EER  
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00  
Fan System: GSHP 2 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes  
  
Fans:  
FAN 2 Supply, Constant Volume, 1725 CFM, 1.0 motor nameplate hp, 1.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW
- 1 GSHP-3 (Single Zone):  
Ground Source, Brine-To-Water Heat Pump  
Heating Mode: Capacity = 20 kBtu/h,  
Proposed Efficiency = 4.00 COP, Required Efficiency = 2.50 COP  
Cooling Mode: Capacity = 26 kBtu/h,  
Proposed Efficiency = 19.60 EER, Required Efficiency = 12.10 EER  
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00  
Fan System: GSHP 3 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes  
  
Fans:  
FAN 21 Exhaust, Constant Volume, 200 CFM, 1.0 motor nameplate hp, 1.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW  
FAN 3 Supply, Constant Volume, 900 CFM, 0.5 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW
- 1 GSHP-4 (Single Zone):

## Quantity System Type & Description

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 47 kBtu/h,

Proposed Efficiency = 3.80 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 66 kBtu/h,

Proposed Efficiency = 19.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 4 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 4 Supply, Constant Volume, 1950 CFM, 1.0 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

### 1 GSHP-5 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 38 kBtu/h,

Proposed Efficiency = 4.00 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 51 kBtu/h,

Proposed Efficiency = 19.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 5 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 5 Supply, Constant Volume, 1800 CFM, 1.0 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

### 1 GSHP-6 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 38 kBtu/h,

Proposed Efficiency = 4.00 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 51 kBtu/h,

Proposed Efficiency = 19.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 6 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 6 Supply, Constant Volume, 1350 CFM, 0.5 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

### 1 GSHP-7 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 55 kBtu/h,

Proposed Efficiency = 3.70 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 74 kBtu/h,

Proposed Efficiency = 18.20 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 7 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 7 Supply, Constant Volume, 2100 CFM, 1.0 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

### 1 GSHP-8 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 38 kBtu/h,

Proposed Efficiency = 4.00 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 51 kBtu/h,

Proposed Efficiency = 19.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 8 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 8 Supply, Constant Volume, 1750 CFM, 1.0 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

### 1 GSHP-9 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 38 kBtu/h,

Proposed Efficiency = 4.00 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 51 kBtu/h,

Proposed Efficiency = 19.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00



## Quantity System Type & Description

Fan System: GSHP 9 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 9 Supply, Constant Volume, 1750 CFM, 1.0 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

### 1 GSHP-10 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 38 kBtu/h,

Proposed Efficiency = 4.00 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 51 kBtu/h,

Proposed Efficiency = 19.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 10 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 10 Supply, Constant Volume, 1700 CFM, 1.0 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

### 1 GSHP-11 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 47 kBtu/h,

Proposed Efficiency = 3.80 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 66 kBtu/h,

Proposed Efficiency = 19.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 11 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 11 Supply, Constant Volume, 2000 CFM, 1.0 motor nameplate hp, 0.00 fan energy index , fan exception: Fan array <= 5 total HP or <= 4.1 kW

### 1 GSHP-12 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 38 kBtu/h,

Proposed Efficiency = 4.00 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 51 kBtu/h,

Proposed Efficiency = 19.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 12 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 12 Supply, Constant Volume, 1750 CFM, 1.0 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

### 1 GSHP-13 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 10 kBtu/h,

Proposed Efficiency = 4.43 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 12 kBtu/h,

Proposed Efficiency = 15.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 13 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 13 Supply, Constant Volume, 600 CFM, 0.2 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

### 1 GSHP-14 (Single Zone):

Ground Source, Brine-To-Water Heat Pump

Heating Mode: Capacity = 10 kBtu/h,

Proposed Efficiency = 4.43 COP, Required Efficiency = 2.50 COP

Cooling Mode: Capacity = 12 kBtu/h,

Proposed Efficiency = 15.30 EER, Required Efficiency = 12.10 EER

Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00

Fan System: GSHP 14 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:

FAN 14 Supply, Constant Volume, 600 CFM, 0.2 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW

## Quantity System Type & Description

- 1 GSHP-15 (Single Zone):  
Ground Source, Brine-To-Water Heat Pump  
Heating Mode: Capacity = 10 kBtu/h,  
Proposed Efficiency = 4.43 COP, Required Efficiency = 2.50 COP  
Cooling Mode: Capacity = 12 kBtu/h,  
Proposed Efficiency = 15.30 EER, Required Efficiency = 12.10 EER  
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00  
Fan System: GSHP 15 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes  
  
Fans:  
FAN 15 Supply, Constant Volume, 600 CFM, 0.2 motor nameplate hp, 0.00 fan energy index , fan exception: Single fan < 1 HP or < 0.89 kW
- 1 ERV-1 (Single Zone):  
Heating: 1 each - Other, Electric, Capacity = 0 kBtu/h  
No minimum efficiency requirement applies  
Fan System: ERV-1 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes  
  
Fans:  
FAN 17 Supply, Constant Volume, 2136 CFM, 2.0 motor nameplate hp, 1.00 fan energy index  
FAN 16 Exhaust, Constant Volume, 2000 CFM, 2.0 motor nameplate hp, 1.00 fan energy index
- 1 ERV-2 (Single Zone):  
Heating: 1 each - Other, Electric, Capacity = 0 kBtu/h  
No minimum efficiency requirement applies  
Fan System: ERV-1 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes  
  
Fans:  
FAN 17 Supply, Constant Volume, 2136 CFM, 2.0 motor nameplate hp, 1.00 fan energy index  
FAN 16 Exhaust, Constant Volume, 2000 CFM, 2.0 motor nameplate hp, 1.00 fan energy index
- 1 EWH-1:  
Electric Storage Water Heater, Capacity: 66 gallons w/ Circulation Pump  
No minimum efficiency requirement applies

## Mechanical Compliance Statement

*Compliance Statement:* The proposed mechanical design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2021 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

_____	_____	01/12/2024
Name - Title	Signature	Date



# Inspection Checklist

Energy Code: 2021 IECC

Requirements: 88.0% were addressed directly in the COMcheck software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 [PR2] <sup>1</sup>	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical and service water heating systems and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks. Hot water system sized per manufacturer's sizing guide.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C406 [PR9] <sup>1</sup>	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C403.13.2 , C403.13.3 [FO9] <sup>3</sup>	Snow/ice melting system and freeze protection systems have sensors and controls configured to limit service for pavement temperature above 50F and outdoor temperature above 40F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.

**Additional Comments/Assumptions:**

1 High Impact (Tier 1)	2 Medium Impact (Tier 2)	3 Low Impact (Tier 3)
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Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5, C404.5.1, C404.5.2 [PL6] <sup>3</sup>	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C404.6.1, C404.6.2 [PL3] <sup>1</sup>	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.3 [PL7] <sup>3</sup>	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.1, C404.6.1.1 [PL8] <sup>3</sup>	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

**Additional Comments/Assumptions:**

1 High Impact (Tier 1)	2 Medium Impact (Tier 2)	3 Low Impact (Tier 3)
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Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 [ME41] <sup>3</sup>	Thermally ineffective panel surfaces of sensible heating panels have insulation $\geq$ R-3.5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.8.4 [ME142] <sup>2</sup>	Motors for fans that are not less than 1/12 hp and less than 1 hp are electronically commutated motors or have a minimum motor efficiency of 70 percent. These motors have the means to adjust motor speed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.8.6 [ME143] <sup>2</sup>	Each DX cooling system $>$ 65 kBtu and chiller water/evaporative cooling system with fans $>$ 1/4 hp are designed to vary the indoor fan airflow as a function of load and comply with detailed requirements of this section.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
C403.9 [ME144] <sup>2</sup>	Large diameter fans where installed shall be tested and labeled in accordance with AMCA 230.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.3 [ME55] <sup>2</sup>	HVAC equipment efficiency verified.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<i>See the Mechanical Systems list for values.</i>
C403.2.2 [ME59] <sup>1</sup>	Natural or mechanical ventilation is provided in accordance with International Mechanical Code Chapter 4. Mechanical ventilation has capability to reduce outdoor air supply to minimum per IMC Chapter 4.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.7.1 [ME59] <sup>1</sup>	Demand control ventilation provided for spaces $>$ 500 ft <sup>2</sup> and $>$ 15 people/1000 ft <sup>2</sup> occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow $>$ 3,000 cfm.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Systems with energy recovery.
C403.7.2 [ME115] <sup>3</sup>	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
C403.7.6 [ME141] <sup>3</sup>	HVAC systems serving guestrooms in Group R-1 buildings with $>$ 50 guestrooms: Each guestroom is provided with controls that automatically manage temperature setpoint and ventilation (see sections C403.7.6.1 and C403.7.6.2).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
C403.7.4 [ME57] <sup>1</sup>	Exhaust air energy recovery on systems meeting Table C403.7.4(1) and C403.7.4(2).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.7.5 [ME116] <sup>3</sup>	Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and satisfy hood rating requirements and maximum exhaust rate criteria.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.

1 High Impact (Tier 1)    2 Medium Impact (Tier 2)    3 Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.4.3.3.2 [ME121] <sup>3</sup>	Closed-circuit cooling tower within heat pump loop have either automatic bypass valve or lower leakage positive closure dampers. Open-circuit tower within heat pump loop have automatic valve to bypass all heat pump water flow around the tower. Open- or closed-circuit cooling towers used in conjunction with a separate heat exchanger have heat loss by shutting down the circulation pump on the cooling tower loop. Open- or closed circuit cooling towers have a separate heat exchanger to isolate the cooling tower from the heat pump loop, and heat loss is controlled by shutting down the circulation pump on the cooling tower loop.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
C403.4.1.4 [ME63] <sup>2</sup>	Heating for vestibules and air curtains with integral heating include automatic controls that shut off the heating system when outdoor air temperatures > 45F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 60F and cooling setpoint >= 80F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.2.1 [ME53] <sup>3</sup>	Air outlets and zone terminal devices have means for air balancing.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.11.3, C403.11.3.1, C403.11.3.2 [ME123] <sup>3</sup>	Refrigerated display cases, walk-in coolers or walk-in freezers served by remote compressors and remote condensers not located in a condensing unit, have fan-powered condensers that comply with Sections C403.11.3.1 and refrigeration compressor systems that comply with C403.11.3.2..	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.7 [EL26] <sup>2</sup>	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.8 [EL27] <sup>2</sup>	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.9.1, C405.9.2 [EL28] <sup>2</sup>	Escalators and moving walks comply with ASME A17.1/CSA B44 and 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.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.10 [EL29] <sup>2</sup>	Total voltage drop across the combination of feeders and branch circuits <= 5%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.1.1 [EL30] <sup>2</sup>	At least 90% of dwelling unit permanently installed lighting shall have lamp efficacy >= 65 lm/W or luminaires with efficacy >= 45 lm/W or comply with C405.2.4 or C405.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.11, C405.11.1 [EL31] <sup>2</sup>	50% of 15/20 amp receptacles installed in enclosed offices, conference rooms, copy rooms, break rooms, classrooms and workstations and > 25% of branch circuit feeders for modular furniture will have automatic receptacle control in accordance with C405.11.1.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C303.3, C408.2.5.3 [F18] <sup>3</sup>	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.3.1 [FI27] <sup>3</sup>	HVAC systems and equipment capacity does not exceed calculated loads.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.4.1 [FI47] <sup>3</sup>	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.4.1.1 [FI42] <sup>3</sup>	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
C403.4.1.2 [FI38] <sup>3</sup>	Thermostatic controls have a 5 °F deadband.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.4.1.3 [FI20] <sup>3</sup>	Temperature controls have setpoint overlap restrictions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.4.2 [FI39] <sup>3</sup>	Each zone equipped with setback controls using automatic time clock or programmable control system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.4.2.1, C403.4.2.2 [FI40] <sup>3</sup>	Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.4.2.3 [FI41] <sup>3</sup>	Systems include optimum start controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C404.3 [FI11] <sup>3</sup>	Heat traps installed on supply and discharge piping of non-circulating systems.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.4 [FI25] <sup>2</sup>	All piping insulated in accordance with section details and Table C403.12.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.1 [FI12] <sup>3</sup>	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank. System return pipe is a dedicated return pipe or a cold water supply pipe.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

1 High Impact (Tier 1)    2 Medium Impact (Tier 2)    3 Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C408.1.1 [FI57] <sup>1</sup>	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building, equipment and systems are intended to be installed, maintained, and operated.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.1 [FI28] <sup>1</sup>	Commissioning plan developed by registered design professional or approved agency.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.3.1 [FI31] <sup>1</sup>	HVAC equipment, systems and system-to-system relationships have been tested to ensure proper operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.3.2 [FI10] <sup>1</sup>	HVAC and service water heating control systems have been tested to ensure proper operation, calibration and adjustment of controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.4 [FI29] <sup>1</sup>	Preliminary commissioning report completed and certified by registered design professional or approved agency.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.5 [FI7] <sup>3</sup>	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.5.1 [FI43] <sup>1</sup>	An air and/or hydronic system balancing report is provided for HVAC systems.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.5.2 [FI30] <sup>1</sup>	Final commissioning report due to building owner within 90 days of receipt of certificate of occupancy.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

**Additional Comments/Assumptions:**

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
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A	B	C	D	E
Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	Lamps/ Fixture	# of Fixture	Fixture Watt.	(C X D)
LED: L6.1: Other:	1	1	20	20
LED: L6.1E: Other:	1	1	20	20
LED: L6.2: Other:	1	4	38	152
LED: L6PS: Other:	1	18	38	684
LED: L6S: Other:	1	3	38	114
LED: L8: Other:	1	18	26	468
LED: L8E: Other:	1	10	26	260
LED: L8PSE: Other:	1	1	26	26
LED: L10: Other:	1	9	49	441
LED: L10PSE: Other:	1	7	49	343
LED: L10SE: Other:	1	1	33	33
LED: L14: Other:	1	3	46	138
LED: L14PSE: Other:	1	3	46	138
LED: L16: Other:	1	1	52	52
LED: L16PS: Other:	1	1	53	53
LED: P1: Other:	1	11	40	440
LED: ST1: Other:	1	12	26	312
LED: ST1E: Other:	1	9	26	234
LED: T1: Other:	1	4	88	352
LED: TP: Other:	1	2	6	12
LED: W1: Other:	1	5	6	30
LED: W2: Other:	1	18	6	108
LED: W3: Other:	1	4	27	108
LED: X1: Other:	1	22	3	66
LED: X2: Other:	1	4	3	12
Total Proposed Watts =			8477	

**Interior Lighting PASSES: Design 45% better than code**

**Interior Lighting Compliance Statement**

*Compliance Statement:* The proposed interior lighting design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed interior lighting systems have been designed to meet the 2021 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable

2024.01.12

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Name - Title \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_



