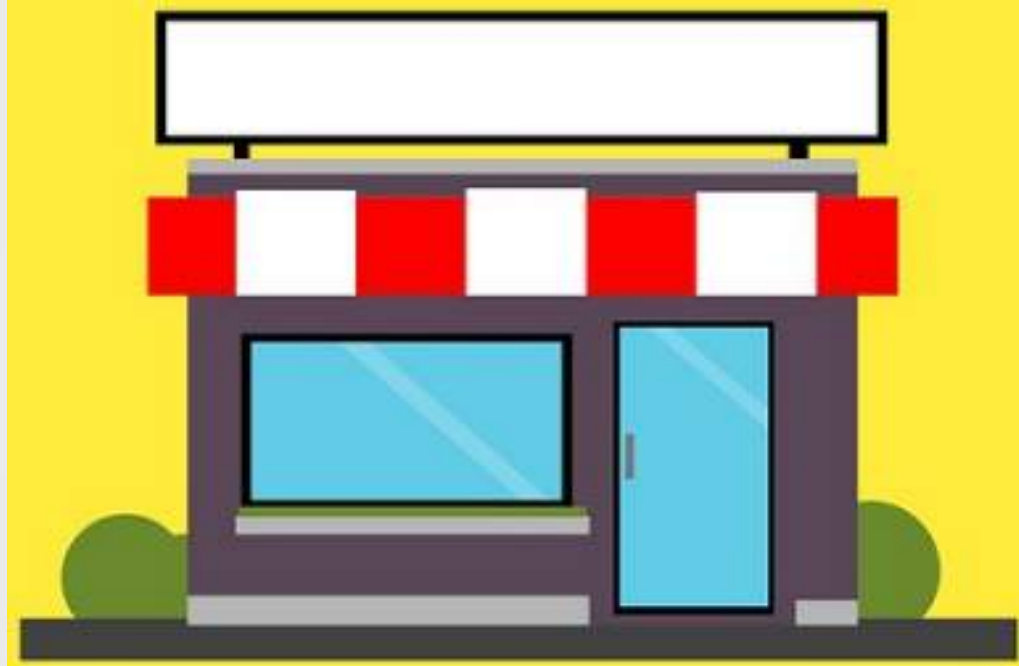


2021 IECC Commercial Inspections



2021 IECC Commercial Inspections



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1

1

Instructor



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Gil Rossmiller

In the construction industry for over 40 years
ICC – IRC Plumbing & Mechanical Code Development Committee
ICC – Commercial Energy Code Development Committee
ICC – Residential Energy Code Development Committee
2003-2016 Building Official
Parker, Colorado

2

2

Professionalism



- Professional manner
- Courteous
- Prompt
- Good frame of mind
- Refrain from criticism
- Work to limit complaints



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3

3

Develop a Reputation

- Thorough
- Knowledgeable
- Fair
- Reasonable
- Understands construction



- A jerk
- Hard to work with
- Unreasonable
- Arrogant
- Doesn't know the code
- #&*@\$@&#%





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Field Relations

- Unskilled people
 - Be patient
 - Expect to spend more time doing inspection
 - Use opportunity to educate person about codes




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5

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 m²) 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 m²) 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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C402.2 Specific building thermal envelope insulation requirements

C402.1.4.1 Roof/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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C402.2 Specific building thermal envelope insulation requirements

C402.1.4.1 Roof/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.



Dropped Ceiling



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C402.2 Specific building thermal envelope insulation requirements

C402.1.4.1 Roof/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

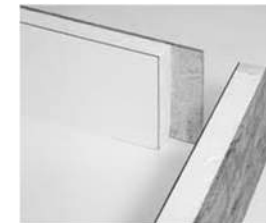
Continuous insulation board shall be installed in not less than two layers, and the edge joints between each layer of insulation shall be staggered, except where insulation tapers to the roof deck at a gutter edge, roof drain or scupper



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Skylight Curbs 402.2.1.5

- Skylight curbs: Insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.



Exception: Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.



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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, and all insulation seams shall be continuously sealed to provide a continuous air barrier.

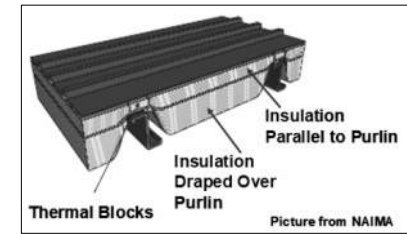
a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA 90.1 Appendix A.



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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



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Metal Building Roofs



Photos courtesy of MBMA



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C402.2 Specific building thermal envelope insulation requirements

C402.2.2 Above-grade walls

Metal Building, Metal Frame, Wood and Other



Photo courtesy of Dow Building Solutions

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

Wall R-Value



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C402.2.2 Above-grade walls

Sectional View Of A Typical EIFS Application

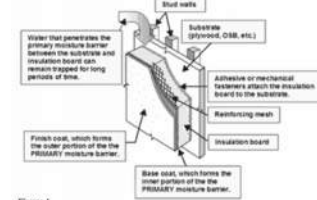
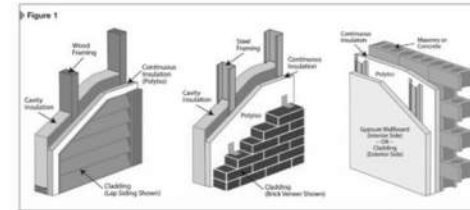


Figure 1



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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.



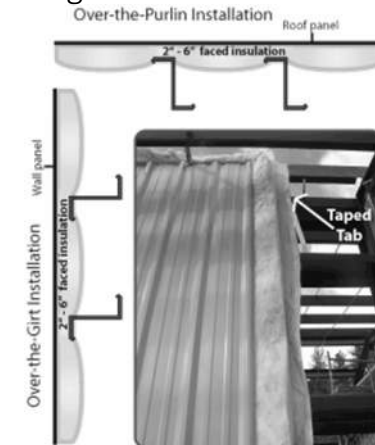
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C402.2.2 Above-grade walls

Walls- Metal Buildings



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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/ft² of wall surface area
- 25 lbs/ft² of wall surface area if material weight is \leq 120 lb/ft³
- Heat capacity $>$ 7 Btu/ft²
- Heat capacity $>$ 5 Btu/ft² 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

Floors Over Outdoor Air or Unconditioned Space
Section C402.2.3



Joist/Framing (Steel/Wood)
Insulation installed between framing

Mass Floors
Materials weighing (of floor surface area)
35 lbs/ft², **or**
25 lbs/ft² if material weight is \leq 120 lbs/ft³
Insulation installed continuously



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C402.2 Specific building thermal envelope insulation requirements

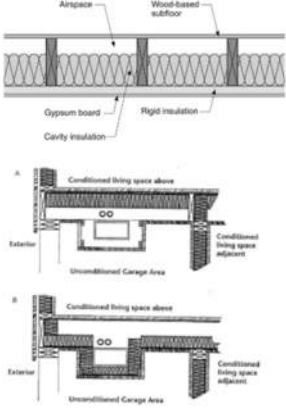
Floor framing *cavity insulation* or structural slab insulation should be installed to maintain permanent contact with underside of subfloor decking or structural slabs


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



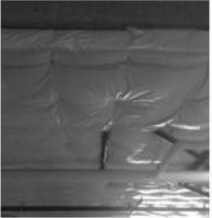




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C402.2 Specific building thermal envelope insulation requirements

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

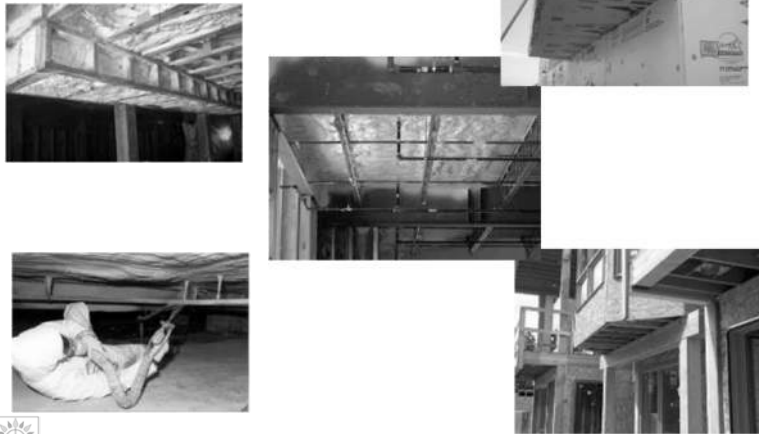
Thermal Performance



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Floors over Unconditioned Space



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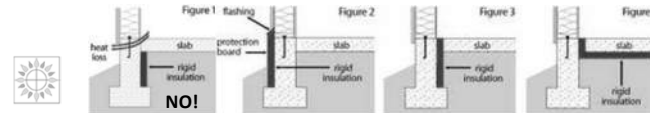
C402.2 Specific building thermal envelope insulation requirements

C402.2.4 Slabs-on-grade

C402.2.4.1 Insulation installation

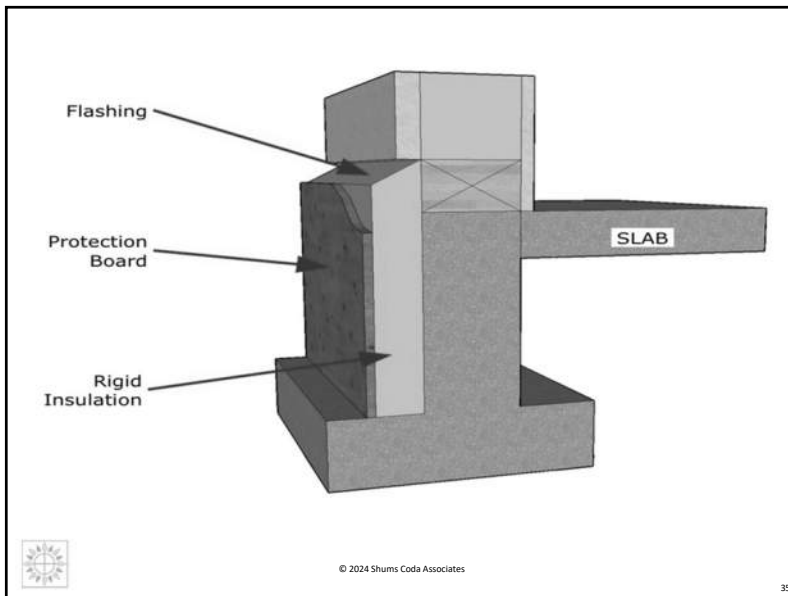
Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend **downward from the top of the slab** for the minimum distance shown in the table or to the top of the footing, whichever is less, 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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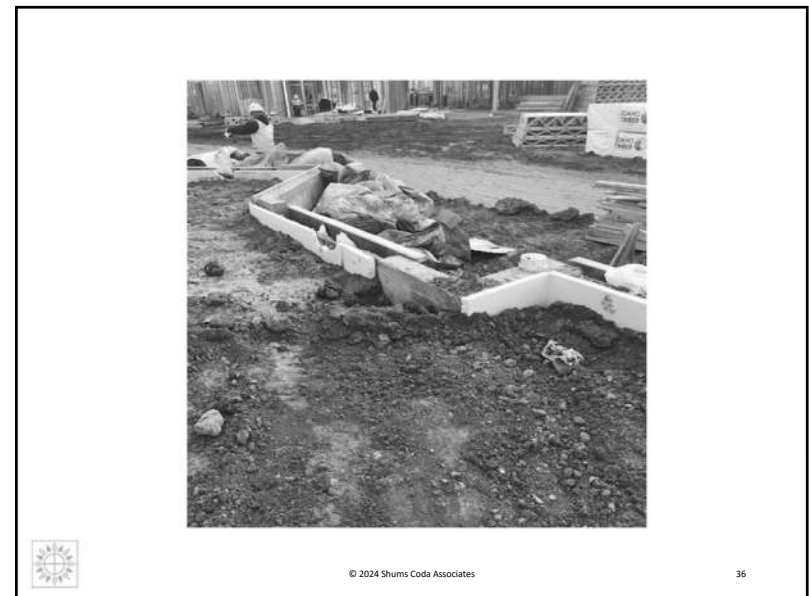
34



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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

38

C402.2 Specific building thermal envelope insulation requirements

Insulation of Radiant Heating Systems

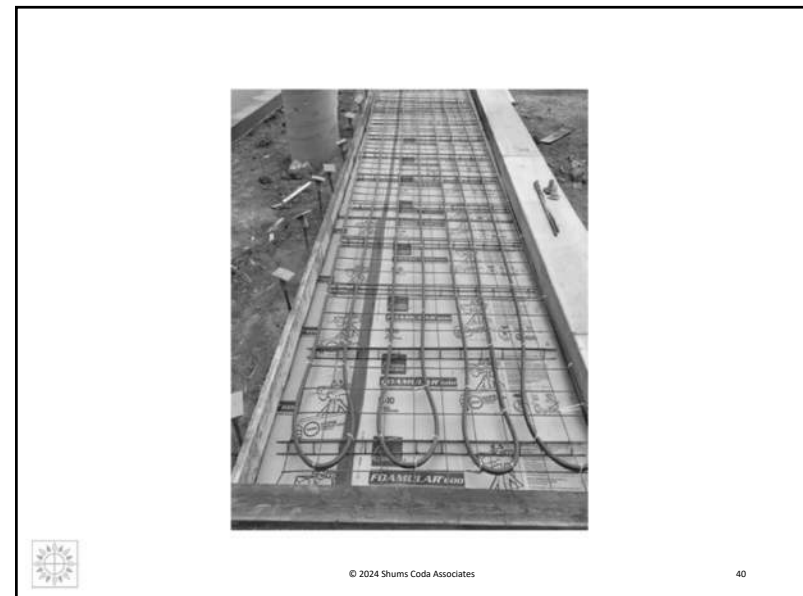
Section C402.2.6

Radiant heating system panels and their associated components:

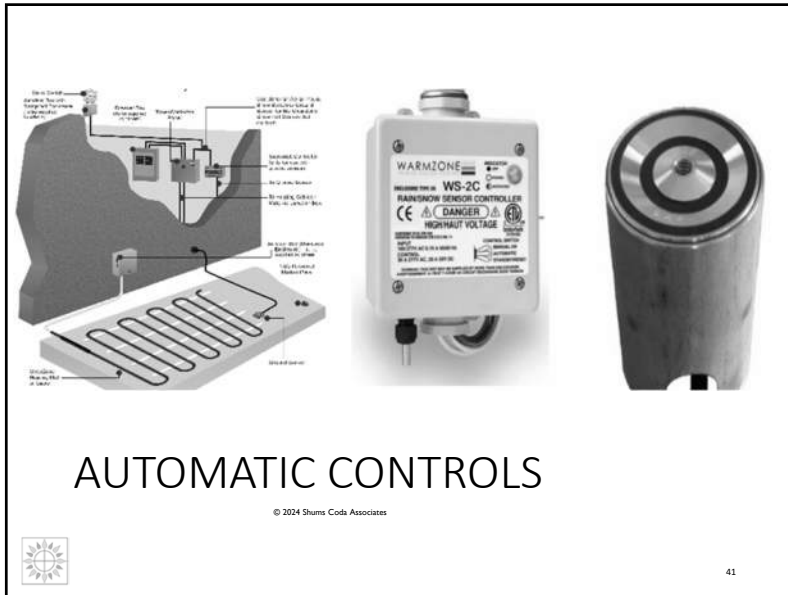
- Installed in interior or exterior assemblies to be insulated with $\geq R-3.5$ on all surfaces not facing the space being heated
- Installed in the building thermal envelope should be separated from the exterior of the building or unconditioned or exempt spaces by not less than the R-value installed 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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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 ≥ 3 stories above grade
- 40%
 - Daylight responsive controls are installed in daylight zones
 - VT of vertical fenestration is ≥ 1.1 times SHGC

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**NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE**

**PRODUCT LISTING
FOR CODE COMPLIANCE**

LABEL CERTIFICATE ID: PJ-WTI-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:

CPD ID	Product Name	Framing Ref	Glazing Ref	Spacer Ref	Total Area	U-factor**	SHGC**	VT**
					ft ²	Btu/ hr-ft ² -F	-	-
	Metal - Curtain wall/Storefront/Window Wall				344.44			
P-OBE-51487	3000 (2" X 4-1/2") CS, 1" IG (1/4" SNX 62/27 #2 X 1/2" AIR X 1/4" CLEAR) P1 G1	FA-OBE-64398	GA-GIN-12488	SA-NFC-4732	344.44	0.39	0.25	0.52
	Metal - Entrance Door				43.06			
P-OBE-51489	AD 375 DOOR SERIES, 1" IG (1/4" SNX 62/27 #2 X 1/2" AIR X 1/4" CLEAR) P1 G1	FA-OBE-64401	GA-GIN-12488	SA-NFC-4732	43.06	0.46	0.17	0.34

FRAME, GLAZING and SPACER ASSEMBLIES

FRAMING LISTING:

Framing Ref	Section ID	Product Type	Frame Material	Description
FA-OBE-64398	OBE	Storefront System	Al	3000 (2" X 4-1/2") CS
FA-OBE-64401	OBE	Entrance Door	Al	AD 375 DOOR SERIES

GLAZING LISTING:

Glazing Ref	Section ID	# Layers	Layer	Gas Fill	Description
GA-GIN-12488	GIN	2	IG	Ar	1" IG (1/4" SNX 62/27 #2 X 1/2" AIR X 1/4" CLEAR)

SPACER LISTING:

Spacer Ref	Section ID	Spacer Config	Spacer Material	Description
SA-NFC-4732	NFC	NCA	Not Required	P1 G1 Group 1

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FOR CODE COMPLIANCE

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

NFRC CERTIFIED PRODUCT RATING INFORMATION: *
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PRODUCT LISTING:

CPD ID	Product Name	Framing Ref	Glazing Ref	Spacer Ref	Total Area	U-factor**	SHGC**	VT**
					ft ²	Btu/ hr-ft ² -F	-	-
	Metal - Curtain wall/Storefront/Window Wall				344.44			
P-OBE-51487	3000 (2" X 4-1/2") CS, 1" IG (1/4" SNX 62/27 #2 X 1/2" AIR X 1/4" CLEAR) P1 G1	FA-OBE-64398	GA-GIN-12488	SA-NFC-4732	344.44	0.39	0.25	0.52
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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/feature/article/10188184/air-leakage-testing-a-hot-button-or-hot-air>

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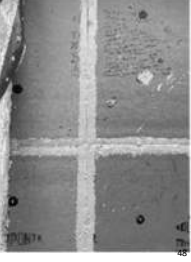
47

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.

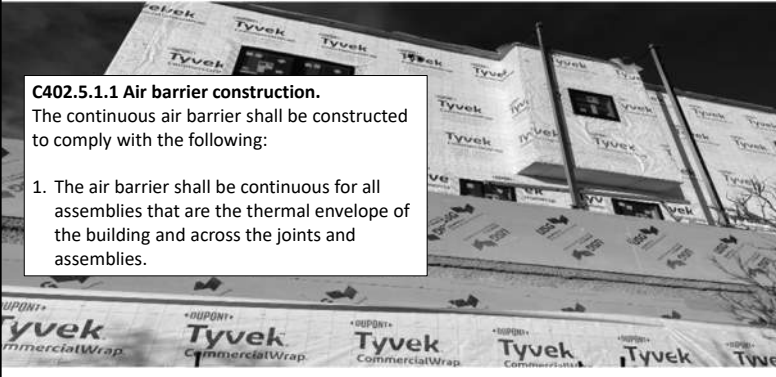
Exception: Air barriers are not required in buildings located in Climate Zone 2B.

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



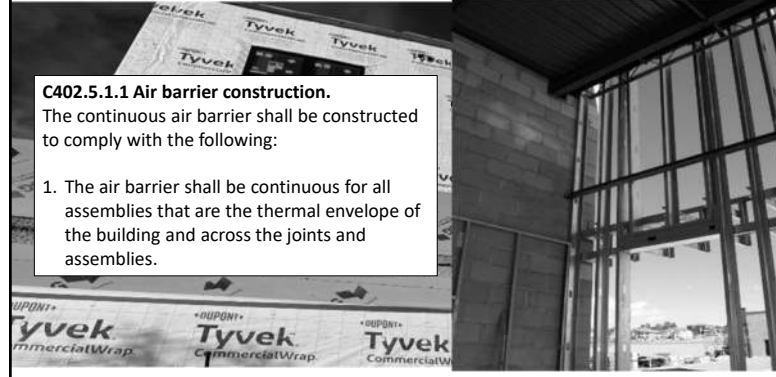
C402.5.1.1 Air barrier construction.
The continuous air barrier shall be constructed to comply with the following:

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 C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021) **Prescriptive Approach**



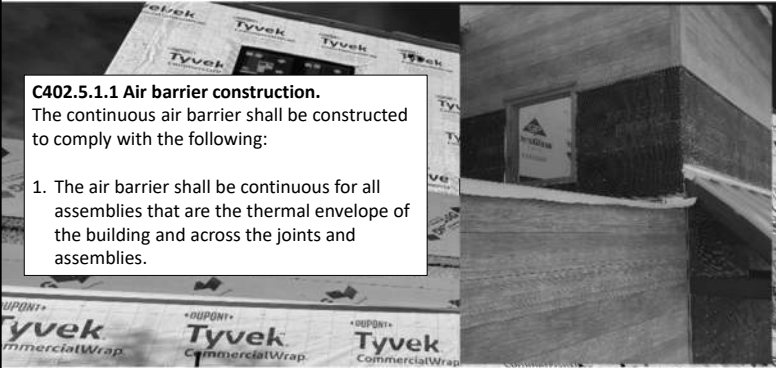
C402.5.1.1 Air barrier construction.
The continuous air barrier shall be constructed to comply with the following:

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 C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021) **2021 Approach**



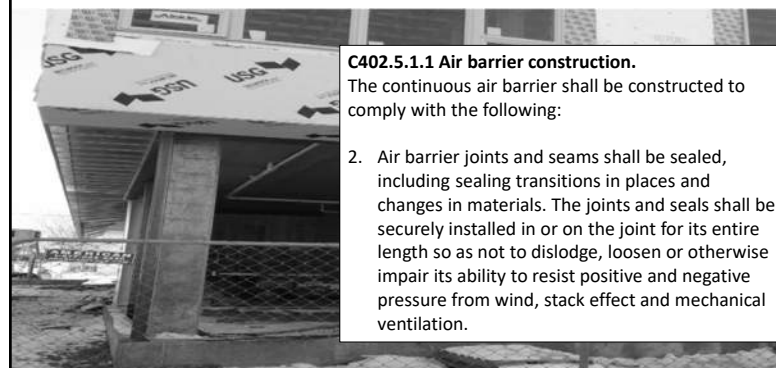
C402.5.1.1 Air barrier construction.
The continuous air barrier shall be constructed to comply with the following:

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 C402.5.1 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:

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.

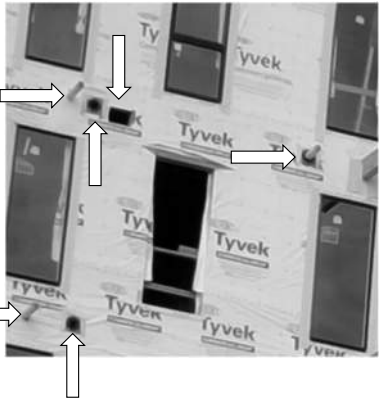
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C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021) **2021 Approach**

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

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.

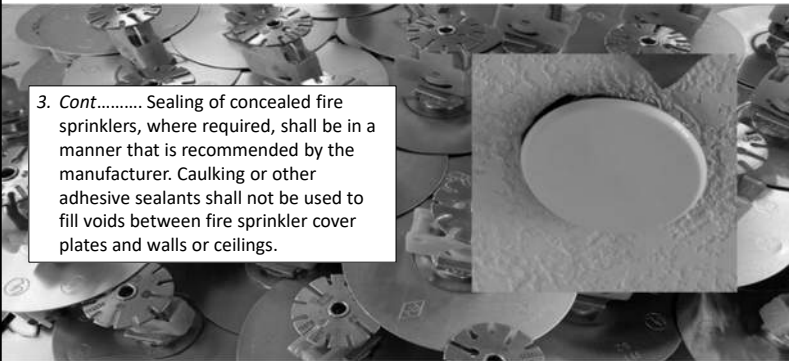


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C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021) **2021 Approach**

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.



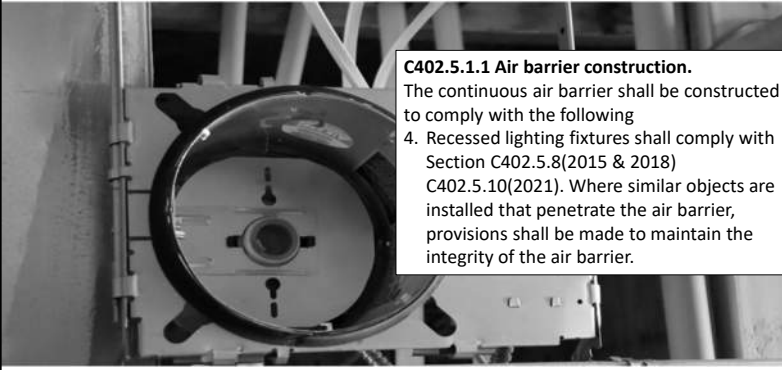
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C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021) **2021 Approach**

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

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.



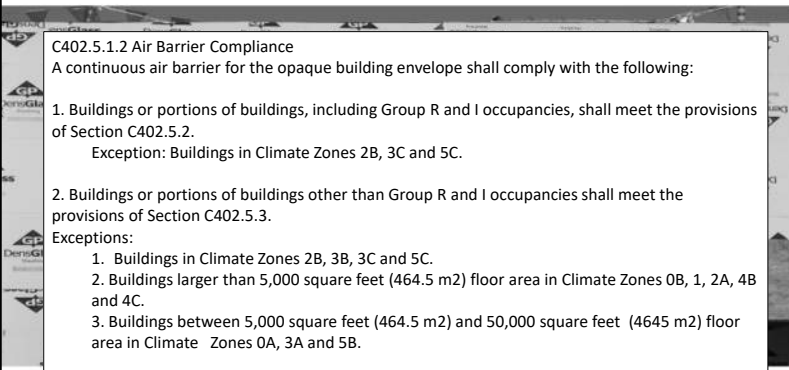
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C402.5 - Comply with Sections C402.5.1 through C402.5.11.1 **2021 Approach**

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

1. Buildings or portions of buildings, including Group R and I occupancies, shall meet the provisions of Section C402.5.2.
Exception: Buildings in Climate Zones 2B, 3C and 5C.
2. Buildings or portions of buildings other than Group R and I occupancies shall meet the provisions of Section C402.5.3.
Exceptions:
 1. Buildings in Climate Zones 2B, 3B, 3C and 5C.
 2. Buildings larger than 5,000 square feet (464.5 m2) floor area in Climate Zones 0B, 1, 2A, 4B and 4C.
 3. Buildings between 5,000 square feet (464.5 m2) and 50,000 square feet (4645 m2) floor area in Climate Zones 0A, 3A and 5B.
3. Buildings or portions of buildings that do not complete air barrier testing shall meet the provisions of Section C402.5.1.3 or C402.5.1.4 in addition to Section C402.5.1.5.



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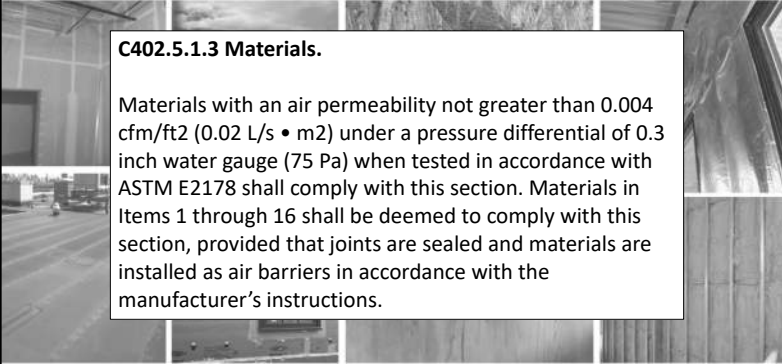

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C402.5 - Comply with C402.5.1 through C402.5.8(2015 & 2018) or C402.5.11.1(2021)

2021 Approach

C402.5.1.3 Materials.


Materials with an air permeability not greater than 0.004 cfm/ft² (0.02 L/s • m²) 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	



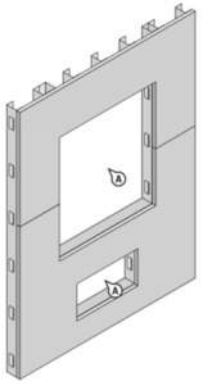
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Installation Methods for DuPont Flashing Products
Packaged Terminal Air Conditioner (PTAC) Unit

This method is for flashing/protecting the rough opening of a Packaged Terminal Air Conditioner (PTAC) Unit.
Method 1: Using DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound™ and DuPont™ StraightFlash™



C:\Users\GilRossmiller.AzureAD\OneDrive - Colorado Code Consulting\Documents\Documents\CCC\Classes\2021 I Codes\2021 IECC\Commercial\tyvek-fluid-applied-wb--and-dupont-flashing-products-installation-guidelines-43-d101091-enus.pdf



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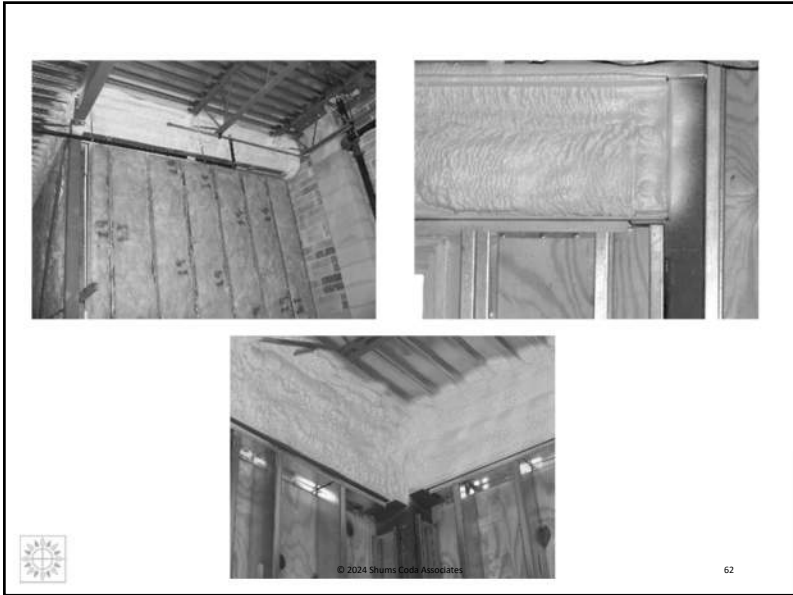
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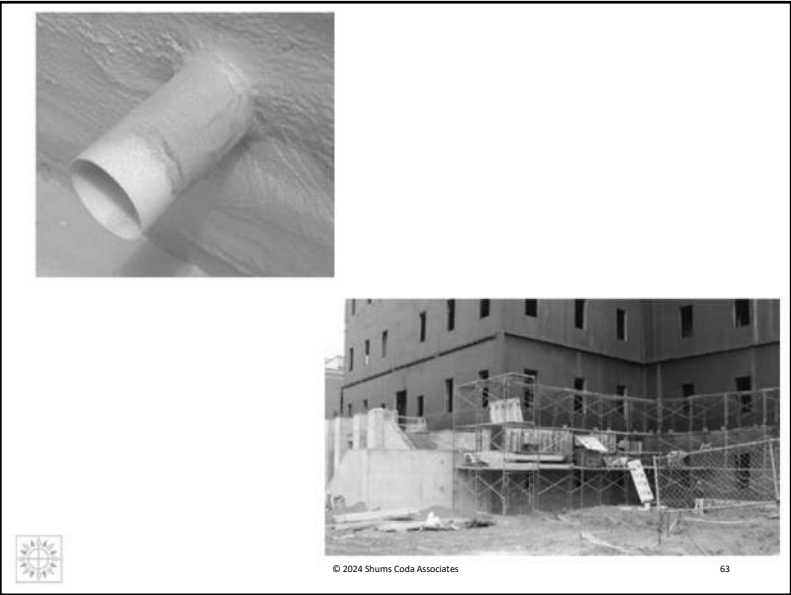
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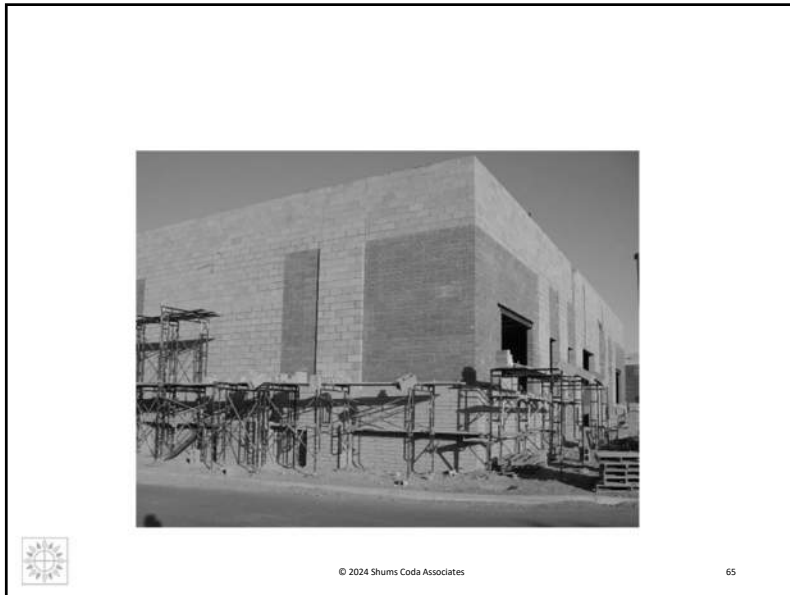
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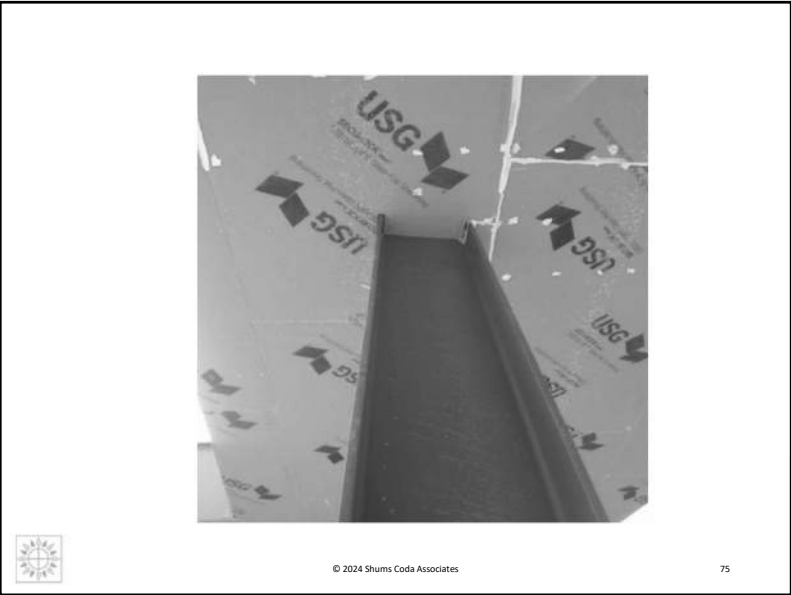
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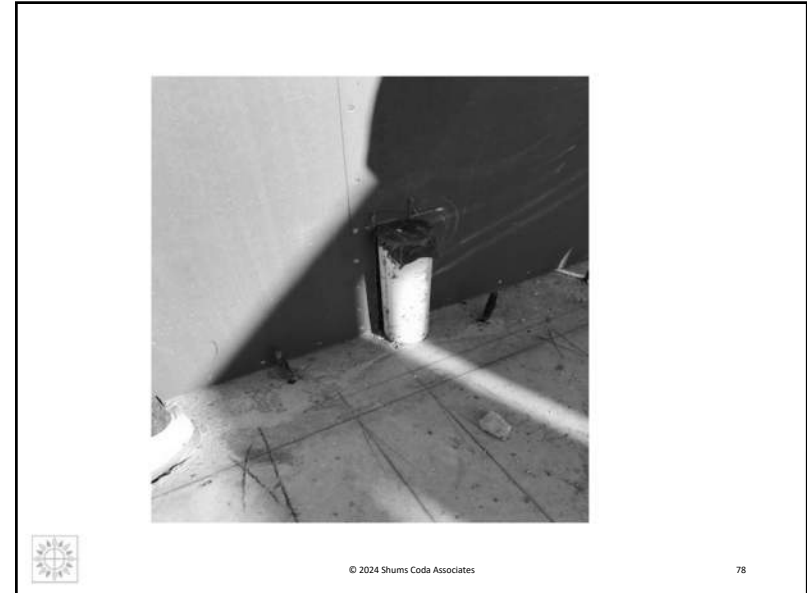
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HVAC Performance IECC
Section C403.3 Heating and cooling equipment efficiencies

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^{a, c}

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

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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C403.3.1 Equipment sizing



The output capacity of heating and cooling equipment shall be not greater than that of the smallest available equipment size that exceeds the loads calculated in accordance with Section C403.1.1.

A single piece of equipment providing both heating and cooling shall satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

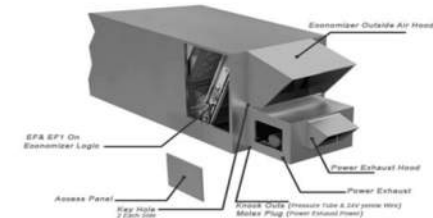


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C403.5: Economizers
Reorganized the mechanical section of the code to put all economizer requirements in one location, making clarifications. Also making more consistent with ASHRAE 90.1.



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C403.4 Heating and cooling system controls

C403.4.1 Thermostatic controls

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

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

1. The perimeter system includes not fewer than one thermostatic control zone for each building exposure having exterior walls facing only one orientation (within ± 45 degrees) for more than 50 contiguous feet.
2. The perimeter system heating and cooling supply is controlled by thermostats located within the zones served by the system



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MARK	MANUFACTURER	MODEL	LOCATION
GSHP-1	WATER FURNACE	NDV 500-038	SOUTH LEVEL 1 MECH
GSHP-2	WATER FURNACE	NDV 500-049	SOUTH LEVEL 1 MECH
GSHP-3	WATER FURNACE	NDV 500-026	SOUTH LEVEL 1 MECH
GSHP-4	WATER FURNACE	NDV 500-064	NORTH LEVEL 1 MECH
GSHP-5	WATER FURNACE	NDV 500-049	NORTH LEVEL 1 MECH
GSHP-6	WATER FURNACE	NDV 500-038	NORTH LEVEL 1 MECH
GSHP-7	WATER FURNACE	NDV 500-072	SOUTH LEVEL 2 MECH
GSHP-8	WATER FURNACE	NDV 500-049	SOUTH LEVEL 2 MECH
GSHP-9	WATER FURNACE	NDV 500-049	SOUTH LEVEL 2 MECH
GSHP-10	WATER FURNACE	NDV 500-049	NORTH LEVEL 2 MECH
GSHP-11	WATER FURNACE	NDV 500-064	NORTH LEVEL 2 MECH
GSHP-12	WATER FURNACE	NDV 500-049	NORTH LEVEL 2 MECH
GSHP-13	WATER FURNACE	NCE-018	SOUTH LEVEL 1 IDF 107
GSHP-14	WATER FURNACE	NCE-018	SOUTH LEVEL 2 MDF 223
GSHP-15	WATER FURNACE	NCE-018	SOUTH LEVEL 1 ELECT



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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




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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



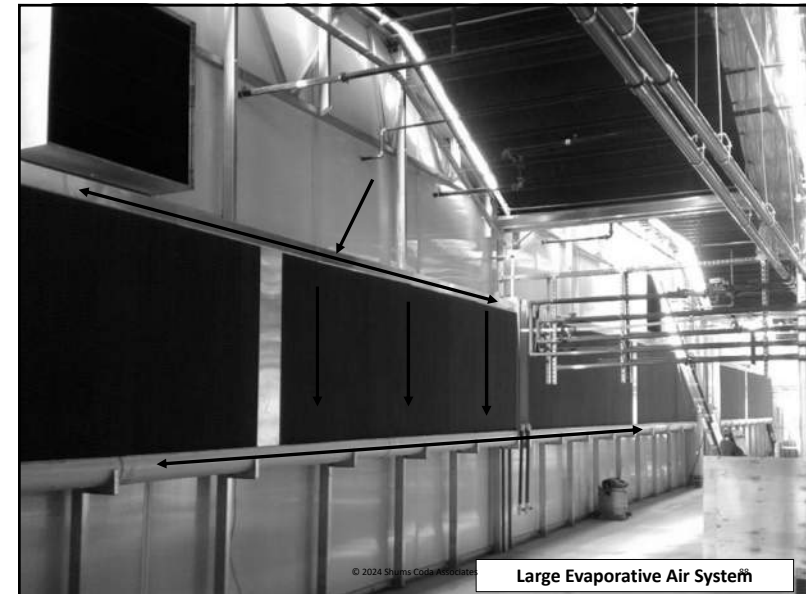
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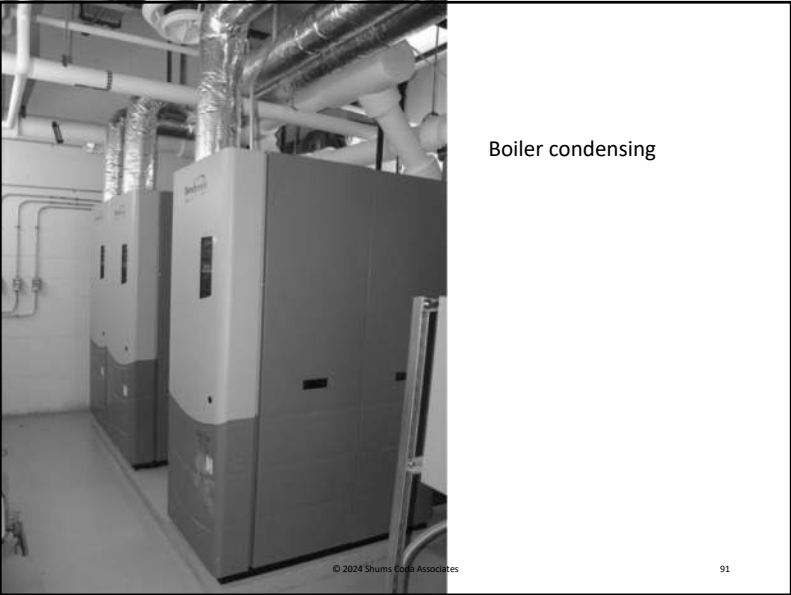
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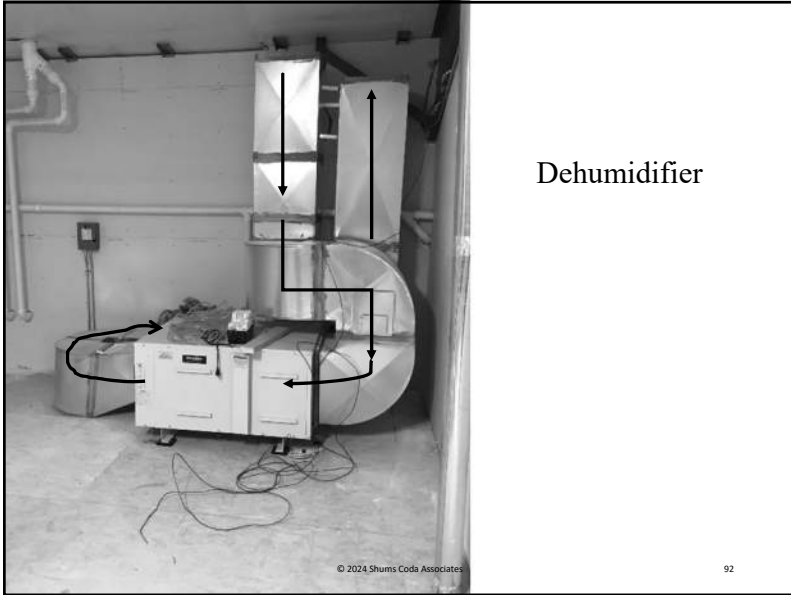


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Boiler condensing

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Dehumidifier

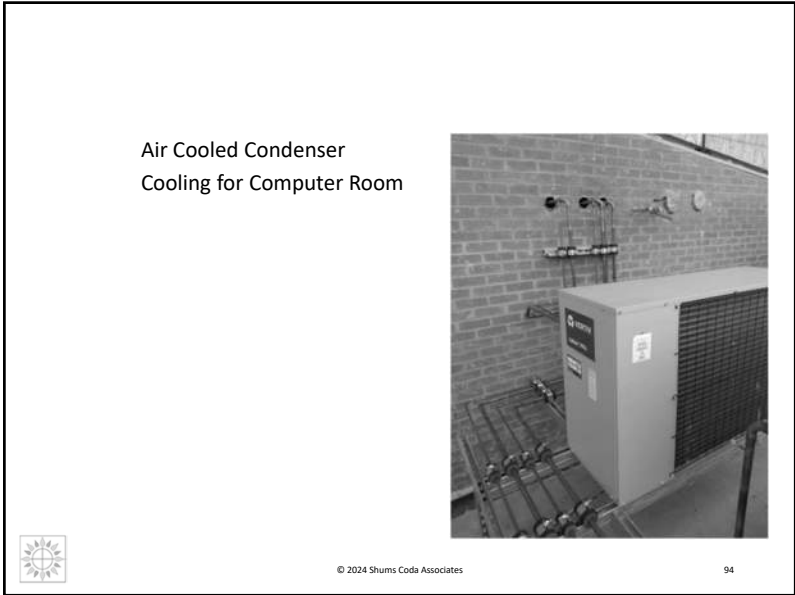
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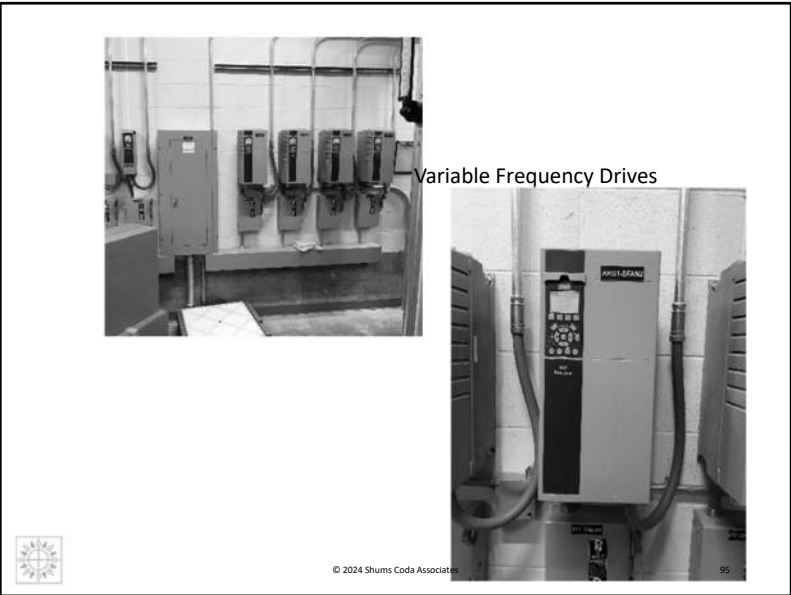
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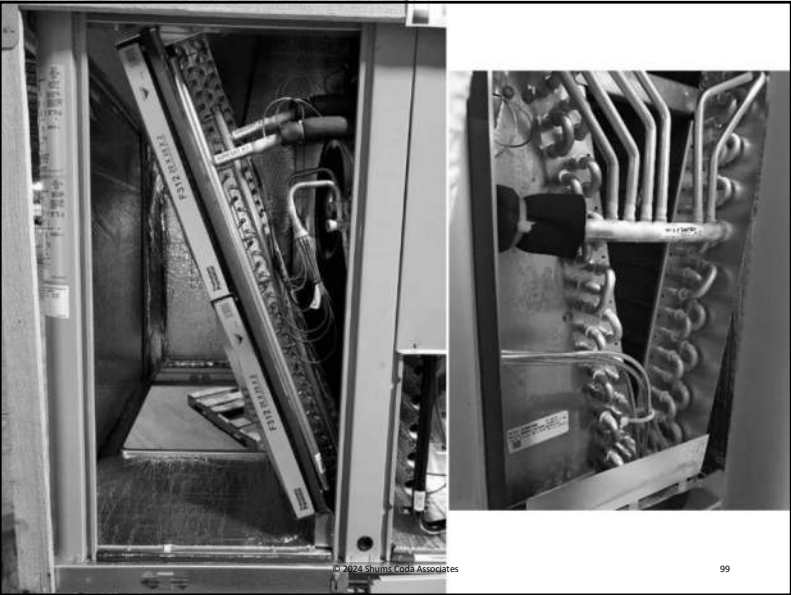
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Economizer



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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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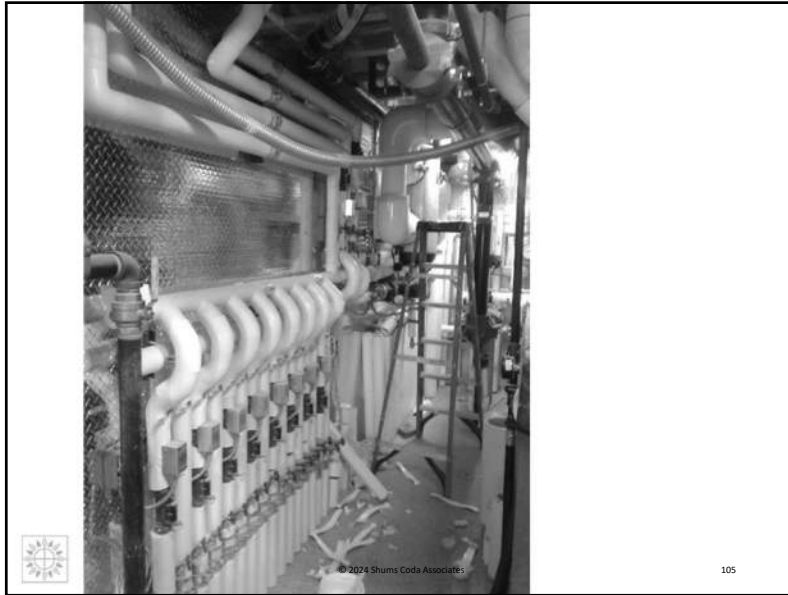
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C404.5 Heated water supply piping

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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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

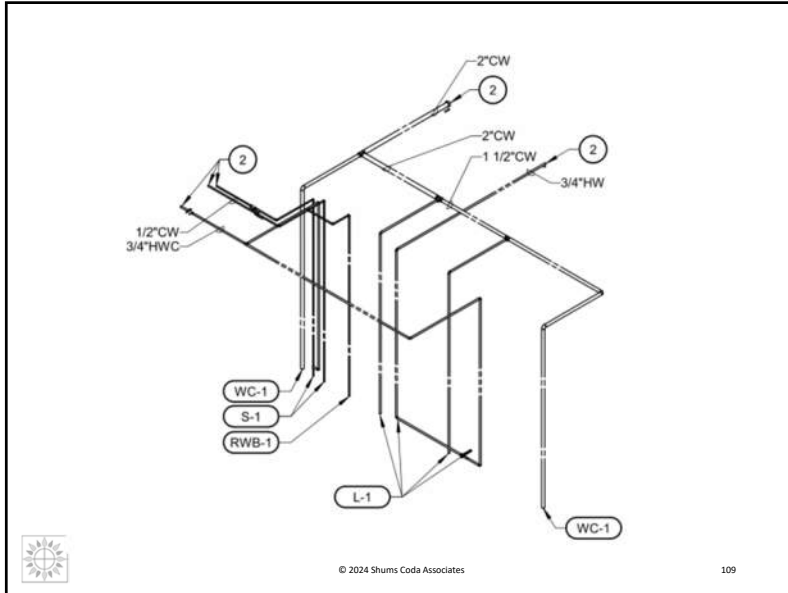
- Public lavatory faucet, use "Public Lavatory faucets" column in Table C404.5.1
- All other plumbing fixtures and plumbing appliances use "Other fixtures and appliances" column in Table C404.5.1

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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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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° For above 55° F

C402.5.8 Loading Dock Seals

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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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<p>Interior Lighting requirements</p> <ul style="list-style-type: none"> Required Controls Wattage/Efficiency Limits <p>Interior Lighting Power Allowances (watts/ft²)</p> <p>Exterior Lighting Controls</p> <ul style="list-style-type: none"> Required Controls Lamp Efficiency <p>Exterior Lighting Power Allowances (watts/ft²)</p> <p>Dwelling Unit Meters</p> <p>Electric Metering</p> <p>Electrical Transformers and Motors</p> <p>Vertical and Horizontal Transportation Systems and Equipment</p> <p>Voltage Drop</p> <p>Automatic receptacle control</p> <p>Energy monitoring</p>	<p>What's Covered Under Electrical Power and Lighting Systems Requirements? IECC</p>   <p style="text-align: right; font-size: small;">113</p>
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Lighting system controls, the maximum lighting power for interior and exterior applications, and electrical energy consumption shall comply with this section.

Sleeping units shall comply with Section C405.2.5 and with either Section C405.1.1 or C405.3.


General lighting shall consist of all lighting included when calculating the total connected interior lighting power in accordance with Section C405.3.1 and which does not require specific application controls in accordance with Section C405.2.5.


Transformers, uninterruptable power supplies, motors and electrical power processing equipment in data center systems shall comply with Section 8 of ASHRAE 90.4 in addition to this code.

C405.1 General




Energy Standard for Data Centers






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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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C405.2 Lighting controls


Lighting systems shall be provided with controls as specified for:

1. Lighting controls as specified in Sections C405.2.1 through C405.2.8.
2. Luminaire level lighting controls (LLLC) and lighting controls as specified in Sections C405.2.1, C405.2.5 and C405.2.6. The LLLC luminaire shall be independently capable of:
 - 2.1. Monitoring occupant activity to brighten or dim lighting when occupied or unoccupied, respectively.
 - 2.2. Monitoring ambient light, both electric light and daylight, and brighten or dim artificial light to maintain desired light level.
 - 2.3. For each control strategy, configuration and reconfiguration of performance parameters including; bright and dim setpoints, timeouts, dimming fade rates, sensor sensitivity adjustments, and wireless zoning configurations


Exemptions:

- Security or emergency areas that must be continuously lighted
- Interior exit stairways, interior exit ramps and exit passageways
- Emergency egress lighting normally off





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Occupant Sensor Controls C405.2.1

Occupancy sensors are required in:

- ✓ Classrooms/lecture/training rooms
- ✓ Conference/meeting/multipurpose rooms
- ✓ Copy/print rooms
- ✓ Lounges/Breakrooms
- ✓ Enclosed offices
- ✓ Open plan office areas
- ✓ Restrooms
- ✓ Storage rooms
- ✓ Locker rooms
- ✓ Corridors
- ✓ Other spaces < 300 ft² enclosed by floor-to-ceiling height partitions
- ✓ Warehouse storage areas



Exception: Luminaires that are required to have specific application controls in accordance with Section C405.2.5.



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C405.2.1.1 Occupant sensor control function

Occupant sensor controls in warehouses shall comply with Section C405.2.1.2



Occupant sensor controls in open plan office areas shall comply with Section C405.2.1.3.

Occupant sensor controls in corridors shall comply with Section C405.2.1.4.

Occupant sensor controls for all other spaces specified in Section C405.2.1 shall comply with the following:

- 1.They shall automatically turn off lights within 20 minutes after all occupants have left the space.
- 2.They shall be manual on or controlled to automatically turn on the lighting to not more than 50-percent power.
- 3.They shall incorporate a manual control to allow occupants to turn off lights.

Exception: Full automatic-on controls with no manual control shall be permitted in corridors, interior parking areas, stairways, restrooms, locker rooms, lobbies, library stacks and areas where manual operation would endanger occupant safety or security



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C405.2.1.2 Occupant sensor control function in warehouse storage areas.

Lighting in warehouse storage areas shall be controlled as follows:

1. Lighting in each aisleway shall be controlled independently of lighting in all other aisleways and open areas.
2. Occupant sensors shall automatically reduce lighting power within each controlled area to an unoccupied setpoint of not more than 50 percent of full power within 20 minutes after all occupants have left the controlled area.
3. Lights that are not turned off by occupant sensors shall be turned off by time-switch control complying with Section C405.2.2.1.
4. A manual control shall be provided to allow occupants to turn off lights in the space

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

Occupant sensor controls in open plan office spaces less than 300 square feet in area shall comply with Section C405.2.1.1.

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

- 1.The controls shall be configured so that general lighting can be controlled separately in control zones with floor areas not greater than 600 square feet within the open plan office space.
- 2.General lighting in each control zone shall be permitted to automatically turn on upon occupancy within the control zone. General lighting in other unoccupied zones within the open plan office space shall be permitted to turn on to not more than 20 percent of full power or remain unaffected.

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

Occupant sensor controls in open plan office spaces less than 300 square feet in area shall comply with Section C405.2.1.1.

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

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

Exception: Where general lighting is turned off by time-switch control complying with Section C405.2.2.1.

4.General lighting in each control zone shall turn off or uniformly reduce lighting power to an unoccupied setpoint of not more than 20 percent of full power within 20 minutes after all occupants have left the control zone



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C405.2.1.4 Occupant sensor control function in corridors

Occupant sensor controls in corridors shall uniformly reduce lighting power to an occupied setpoint not more than 50 percent of full power within 20 minutes after all occupants have left the space.



Exception: Corridors provided with less than two footcandles of illumination on the floor at the darkest point with all lights on.



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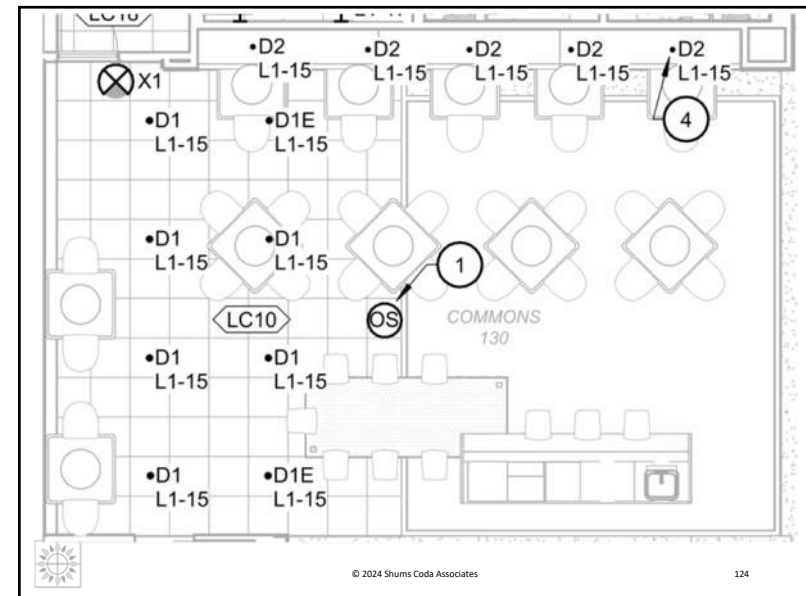
LUMINAIRE SCHEDULE									
TYPE	MANUFACTURER	LUMINAIRE SERIES	SOURCE (TYPE/COLOR TEMPERATURE)	VOLTAGE	LOAD (VA)	FINISH	MOUNTING	DESCRIPTION	
A	ACIFY	OPAL SERIES	20W LED A80K BICO	120 V	23	WHITE	RECESSED	30" LED FLAT PANEL WITH FROSTED ACRYLIC LENS, METAL FRAME, WHITE FINISH	
B	ACIFY	OPAL SERIES	20W LED A80K BICO	120 V	23	WHITE	RECESSED	24" LED FLAT PANEL WITH FROSTED ACRYLIC LENS, METAL FRAME, WHITE FINISH, 0-10V DIMMABLE BALLAST (DIM TO BLACK)	
D1	LITHONIA LIGHTING	LONA SERIES	2000 LUMEN LED A80K BICO	120 V	19		RECESSED	4" OPEN LED DOWNLIGHT WITH CLEAR ALZAK, SEMI-SPECULAR REFLECTOR, 0-10V DIMMABLE DRIVER	
D1E	LITHONIA LIGHTING	LONA SERIES	2000 LUMEN LED A80K BICO	120 V	19		RECESSED	4" OPEN LED DOWNLIGHT WITH CLEAR ALZAK, SEMI-SPECULAR REFLECTOR, 0-10V DIMMABLE DRIVER, 90-MINUTE BATTERY BACK-UP	
D2	LITHONIA LIGHTING	LONA SERIES	160 LUMEN LED A80K BICO	120 V	8		RECESSED	2" OPEN LED DOWNLIGHT WITH CLEAR ALZAK, SEMI-SPECULAR REFLECTOR, NARROW DISTRIBUTION, 0-10V DIMMABLE DRIVER, REMOVE DIFFUSING LENS	
D3	LITHONIA LIGHTING	LONA SERIES	2000 LUMEN LED A80K BICO	120 V	19		RECESSED	4" OPEN LED DOWNLIGHT WITH CLEAR ALZAK, SEMI-SPECULAR REFLECTOR, 0-10V DIMMABLE DRIVER	
L1	NALITE	RG2 SERIES	36W LAMPY LED A80K BICO	120 V	7	WHITE	RECESSED	2" LINEAR WITH 2" APERTURE, FROSTED WHITE LENS, 0-10V DIMMABLE DRIVER	
L2	NALITE	RG2 SERIES	36W LAMPY LED A80K BICO	120 V	7	WHITE	RECESSED	2" LINEAR WITH 2" APERTURE, FROSTED WHITE LENS, 0-10V DIMMABLE DRIVER, 90-MINUTE BATTERY BACKUP	
L3	NALITE	RG2 SERIES	36W LAMPY LED A80K BICO	120 V	10	WHITE	RECESSED	3" LINEAR WITH 2" APERTURE, FROSTED WHITE LENS, 0-10V DIMMABLE DRIVER	
L3E	NALITE	RG2 SERIES	36W LAMPY LED A80K BICO	120 V	10	WHITE	RECESSED	3" LINEAR WITH 2" APERTURE, FROSTED WHITE LENS, 0-10V DIMMABLE DRIVER, 90-MINUTE BATTERY BACKUP	
L3A	MAVAK	BLUFF 2 LED	36W LAMPY LED A80K BICO	120 V	10	SATIN SILVER	RECESSED	3" LINEAR WITH 2" APERTURE, FLUSH LENS, THIN LENS, 0-10V DIMMABLE DRIVER, WET LOCATION LISTED	
L4	NALITE	RG2 SERIES	72W LAMPY LED A80K BICO	120 V	20	WHITE	RECESSED	4" LINEAR WITH 2" APERTURE, FROSTED WHITE LENS, 0-10V DIMMABLE DRIVER	
L4.1	NALITE	RG2 SERIES	36W LAMPY LED A80K BICO	120 V	13	WHITE	RECESSED	4" LINEAR WITH 2" APERTURE, FROSTED WHITE LENS, 0-10V DIMMABLE DRIVER	
L4.1E	NALITE	RG2 SERIES	36W LAMPY LED A80K BICO	120 V	13	WHITE	RECESSED	4" LINEAR WITH 2" APERTURE, FROSTED WHITE LENS, 0-10V DIMMABLE DRIVER, 90-MINUTE BATTERY BACKUP	



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LIGHTING CONTROL MATRIX															
KEY	SPACE TYPE	MANUAL ON / OFF SWITCH	TIME ON	RECEPTACLE CONTROL	TIME OFF	OCCUPANCY SENSOR CEILING	OCCUPANCY SENSOR WALL	VACANCY SENSOR CEILING	VACANCY SENSOR WALL	DIMMING 1%	DAY/DAK PHOTOCELL SENSOR ON/OFF CONTROL	INTEGRATED NETWORKED	DM TO 30% DURING OFF HOURS	STARWELL LIGHTING CONTROL, DM TO 50% WHEN NOT OCCUPIED	REMARKS
LC1	CORRIDOR		X		X										
LC2	PERIMETER OFFICES	X		X				X		X	X	X			
LC3	INTERIOR OFFICES	X		X				X		X	X	X			
LC4	EXECUTIVE OFFICES	X		X					X	X	X	X			
LC5	STORAGE	X						X	X						
LC6	OPEN OFFICES		X	X	X					X	X	X			
LC7	STAR WELL		X		X										
LC8	CONFERENCE/ MEETING	X		X		X				X	X	X			
LC9	JANITOR	X							X						
LC10	BREAK ROOM/ SUITE		X		X	X				X		X	X		
LC11	EXTERIOR		X		X						X			X	
LC12	ELECMECH ROOM	X													
LC13	ELEVATOR PIT	X									X				
LC14	WELLNESS/QUIET	X		X					X	X					
LC15	CONTROL/AV STUDIO	X						X							
LC16	EXTERIOR FAÇADE		X		X						X		X		
LC17	EXTERIOR SITE		X		X						X		X		
LC18	VESTIBULE					X					X	X	X		
LC19	LANDSCAPE/BOLLARD		X		X						X		X		
LC20	RESTROOM	X							X						
LC21	RECEPTION		X	X	X					X					
LC22	MAIN ENTRY CANOPY		X		X						X				

REMARKS:
1. REFER TO SYMBOLS AND SWITCH LABELS ON LIGHTING PLAN FOR VARYING LIGHTING CONTROLS IN TAGGED SPACE

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C405.9.2 Escalators and moving walks

Escalators and moving walks shall comply with ASME A17.1/CSA B44 and shall have automatic controls that reduce speed as permitted in accordance with ASME A17.1/CSA B44 and applicable local code.

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

C405.9.2.1 Energy recovery.
Escalators shall be designed to recover electrical energy when resisting overspeed in the down direction

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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.

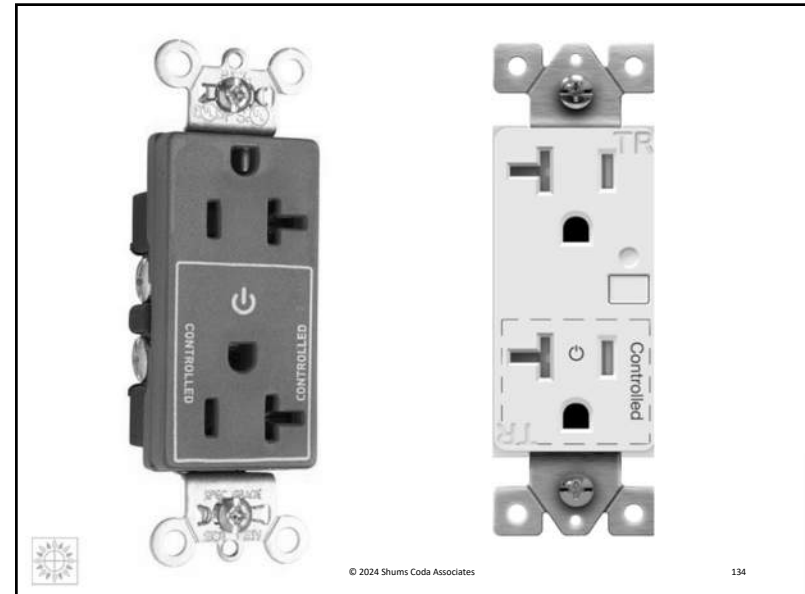
2. At least 25 percent of branch circuit feeders installed for modular furniture not shown on the construction documents.



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SHUMS CODA
ASSOCIATES

- 4610 S Ulster, Suite 150
- Denver, CO 80237

- Ph. 303-400-6564
- Fax 303-693-0630

- www.shumscoda.com
- gil.rossmiller@shumscoda.com



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