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2022 CT State Building Code (CSBC)

- 2021 IBC
- 2017/ANSI A117.1 Accessible and Usable Buildings and Facilities
- 2021 IEBC
- 2021 IPC
- **2021 IMC**
- **2021 IECC**
- 2020 NFPA 70
- 2021 International Swimming Pool & Spa
- 2021 IRC
- 2022 Connecticut State Fire Safety Code (CSFSC)
 - 2021 NFPA 101
- 2022 Connecticut State Fire Prevention Code (CSFPC)
 - 2021 NFPA 1
 - 2019 NFPA 13,14,20, 211
 - 2020 NFPA 25, 58, 31, 70, 91
 - 2021 NFPA 54, 90A, 90B



2021 IMC International Mechanical Code

Chapter 3: General Regulations

303 Equipment and Appliance Location

303.7 Pit Location

2015 – Appliances installed in Pits shall not come in direct contact with soil.

2021 – Appliances installed in Pits shall not come in direct contact with soil and shall be installed less than 3" above the pit floor.

2021 – Excavation on the control side of the appliance shall exceed not less than 30" horizontally

303 Equipment and Appliance Location

303.9 Fireplaces in Group I-2

2015 –

2021 – Fuel-burning appliances and fireplaces in Group I-2, condition 2 shall be in accordance with section 901.4

Chapter 3: General Regulations

304 Installation

304.11 Guards

2015 – The guard shall extend not less than 30" beyond each end of the components that require service.

2021 – The guard shall extend not less than 30" beyond each end of the components that require service and each end of the roof hatch parallel to the roof edge.

305 Piping Support

305.4 Piping Support Table

2021 – Removed brass piping from table

Chapter 3: General Regulations

306 Access and Service Space

306.1.1 Central Furnaces

2015 – Central furnaces within compartments or alcoves shall have a minimum working space clearance ...

2021 – **Removed**

307 Condensate Disposal

307.1.1 Identification

2021 – The termination of concealed condensate piping shall be marked to indicate whether the piping is connected to the primary or secondary drain.

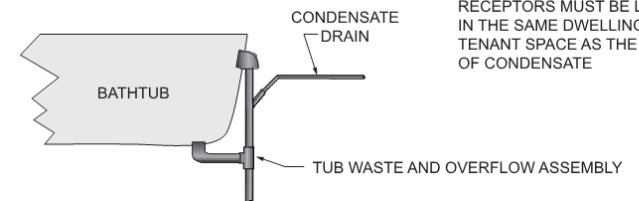
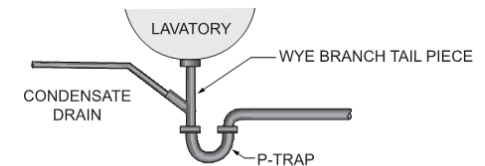
Chapter 3: General Regulations

307 Condensate Disposal

307.2.1.1 Condensate Discharge

2021 – Clarified the ability to connect condensate directly to lavatory wye.

Condensate drains shall not directly connect to any plumbing drain, waste or vent pipe. Condensate drains shall not discharge into a plumbing fixture other than a floor sink, floor drain, mop sink, hub drain, standpipe, utility sink or laundry sink. **Condensate drain connections to a lavatory wye branch tailpiece or to a bathtub overflow pipe shall not be considered as discharging to a plumbing fixture.** Except where discharging to grade outdoors, the point of discharge of condensate drains shall be located within the same occupancy, tenant space or dwelling unit as the source of the condensate.



NOTE: ALL CONDENSATE RECEPTORS MUST BE LOCATED IN THE SAME DWELLING UNIT OR TENANT SPACE AS THE SOURCE OF CONDENSATE

Chapter 3: General Regulations

307 Condensate Disposal

307.2.2 Drain Pipe Material

2021 – Added: PE-RT and PVDF

307.2.3.3 Identification

2021 – Added: The termination of concealed condensate piping shall be marked to indicate whether the piping is connected to the primary or secondary drain.

Chapter 4: Ventilation

401 General

401.2 Ventilation Requirements

2015 – Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 PA) in accordance with section R402.4.1.2 of IECC shall be ventilated by mechanical means in accordance with section 403

2021 – Dwelling units complying with the air leakage requirements of the IECC or 90.1 shall be ventilated by mechanical means in accordance with section 403

Chapter 4: Ventilation

401 General

401.4 Intake Opening Locations

2015 –

2021 – Separation is not required between intake air openings and living space exhaust air openings of an individual dwelling unit or sleeping unit where an approved factory-built intake/exhaust combination termination fitting is used to separate the air streams in accordance with the manufacture's Instructions

403 Mechanical Ventilation

403.2.1 Recirculation of Air

2015 –

2021 – The design and installation of dehumidification systems shall comply with ANSI/ACCA 10 Manual SPS.

Chapter 4: Ventilation

403 Mechanical Ventilation

403.3.1.3 System Operations

2015 –

2021 – Where demand control ventilation is employed to adjust the outdoor airflow rate based on the actual number of occupants present, the minimum quantity of outdoor air shall not flow below that determined from the area outdoor flow rate column of table 403.3.1.1 during periods when the building is expected to be occupied

403 Mechanical Ventilation

403.3.1.5 Balancing

2015 – The ventilation air distribution system shall be provided with means to adjust the system to achieve not less than the minimum ventilation airflow rate as required by section 403.3 and 403.3.1.2.

2021 – **REMOVED**

Chapter 4: Ventilation

403 Mechanical Ventilation

403.3.2.1 Outdoor Air for Dwelling Units

2021 – Exception 2 added:

2. The minimum mechanical ventilation rate determined in accordance with equation 4-9 shall be reduced by 30% provided that both of the following conditions apply:

2.1 a ducted system supplies ventilation air directly to each bedroom and to one or more of the following rooms: Living room, Dining room, Kitchen

2.2 the whole house ventilation system is a balanced ventilation system

Chapter 4: Ventilation

403 Mechanical Ventilation

403.3.2.4 System Controls

2015 –

2021 – Where provided within a dwelling unit, controls for outdoor air ventilation system shall include text or a symbol indicating the system's function

403 Mechanical Ventilation

403.3.2.5 Ventilating Equipment

2015 –

2021 – Fans providing exhaust or outdoor air shall be listed and labeled to provide the minimum required air flow in accordance with ANSI/AMCA 210-ANSI/ASHRAE 51

Chapter 4: Ventilation

403 Mechanical Ventilation

403.3.3.1 Ventilation Table

2021 – Updated Ventilation Table

Coin operated laundries changed outdoor airflow rate in breathing zone from .06 to 0.12.

Commercial laundry changed people outdoor airflow in breathing zone from 25 CFM per person to 5 CFM per person.

Food and Beverage: Kitchen added numbers in the first three columns.

Private dwelling kitchens double exhaust airflow rate from 25/100 CFM/Sq FT to 50/100.

Retail Stores, sales floors and showroom floors updated shipping and receiving and added warehouses.

Sports and amusement added options to Gym, stadium, arena (play area)

Storage added refrigerated warehouses/freezers.

Theaters added options to lobbies & stages, studios.

Note G added **Wheel Type** ERV requirement for energy recovery of exhaust air.

Chapter 4: Ventilation

404 Enclosed Parking Garages

404.1 Enclosed Parking Garages

2021 – Added Carbon Monoxide & nitrogen dioxide detectors shall be listed in accordance with UL 2075

407 Ambulatory Care Facilities and Group i-2 Occupancies

407.1 General

2015 – Refers to ASHRAE 170 for ventilation.

2021 – Refers to ASHRAE 170 and NFPA99 for ventilation.

Chapter 5: Exhaust Systems

Section 501 – General

501.2 Independent System Required

501.3.1 Added

“Separation is not required between intake air openings and living space exhaust air openings of an individual dwelling unit or sleeping unit where an approved factory-built intake/exhaust combination termination fitting is used to separate the air streams in accordance with the manufacturer's instructions.”

502.4 Stationary Battery Systems & 502.5 Valve Regulated Lead-Acid Batteries in Cabinets

Now references IFC Section 1207.6.1 (Deleted 502.4.1 through 502.4.3)

502.9.5 Flammable and Combustible Liquids

added exception for “The storage of beer, distilled spirits and wine in barrels and casks conforming to the requirements of International Fire Code.”



Chapter 5: Exhaust Systems

502.16 Repair garages for vehicles fueled by lighter than air fuels

Added exception for garages where no open flame or welding

Added 502.16.1 Hydrogen fueled vehicles (Chapter 6 of NFPA2)

502.16.2 Eliminated monitoring and control to keep concentration below 25% of LFL

502.20.1 Exhaust systems for manicure and pedicure stations shall operate continuously when the space is occupied.

504 Clothes Dryer Exhaust

Deleted need for dryer exhaust system to be independent of all other systems.

504.4.1 Termination location. Exhaust duct terminations shall be in accordance with the dryer manufacturer's installation instructions. Where the manufacturer's instructions do not specify a termination location, the exhaust duct shall terminate not less than 3 feet (914 mm) in any direction from openings into buildings, including openings in ventilated soffits.

505.4.2 Ducts shall be undiminished and not less than 12.5 square inches

504.6 Domestic Booster fans prohibited



Chapter 5: Exhaust Systems

505 Domestic Cooking Exhaust Equipment

Hoods and equipment must be listed and labelled with

Overhead and downdraft not integral to equipment - UL 507

Downdraft hoods - UL 858/ANSI Z21.1

Microwave ovens over cooking surface – UL 923

506 Commercial Cooking Exhaust Equipment

506.3.7 Grease Duct Slope Exception *“Factory-built grease ducts shall be installed at a slope that is in accordance with the listing and manufacturer's installation instructions.”*

506.3.9 Grease duct horizontal cleanouts – need to be within 3 feet of horizontal discharge fans.

New 506.5.2 Pollution Control Unit

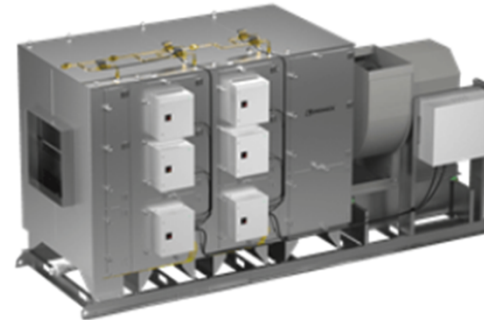
“Manufactured equipment that is installed in a grease exhaust duct system for the purpose of extracting smoke, grease particles and odors from the exhaust flow by means of a series of filters.”



Chapter 5: Exhaust Systems

506.5.2 Pollution-control units. The installation of pollution-control units shall be in accordance with all of the following:

1. Pollution-control units shall be *listed and labeled* in accordance with UL 8782.
2. Fans serving pollution-control units shall be *listed and labeled* in accordance with UL 762.
3. Bracing and supports for pollution-control units shall be of noncombustible material securely attached to the structure and designed to carry gravity and seismic loads within the stress limitations of the *International Building Code*.
4. Pollution-control units located indoors shall be *listed and labeled* for such use. Where enclosed duct systems, as required by Section 506.3.11, are connected to a pollution control unit, such unit shall be *listed and labeled*, in accordance with UL 2221 or ASTM E2336, for location in an enclosure having the same fire-resistance rating as the duct enclosure. Access shall be provided for servicing and cleaning of the unit. The space or enclosure shall be ventilated in accordance with the manufacturer's installation instructions.
5. *Clearances* shall be maintained between the pollution-control unit and combustible material in accordance with the listing.
6. Roof-mounted pollution-control units shall be listed for outdoor installation and shall be mounted not less than 18 inches (457 mm) above the roof.
7. Exhaust outlets for pollution-control units shall be in accordance with Section 506.3.13.
8. An airflow differential pressure control shall be provided to monitor the pressure drop across the filter sections of a pollution-control unit. When the airflow is reduced below the design velocity, the airflow differential pressure control shall activate a visual alarm located in the area where cooking operations occur.
9. Pollution-control units shall be provided with a factory-installed fire suppression system.
10. Service space shall be provided in accordance with the manufacturer's instructions for the pollution control unit and the requirements of Section 306.
11. Wash-down drains shall discharge through a grease interceptor and shall be sized for the flow. Drains shall be sealed with a trap or other approved means to prevent air bypass. Where a trap is utilized it shall have a seal depth that accounts for the system pressurization and evaporation between cleanings.
12. Protection from freezing shall be provided for the water supply and fire suppression systems where such systems are subject to freezing.
13. Duct connections to pollution-control units shall be in accordance with Section 506.3.2.3. Where water splash or carryover can occur in the transition duct as a result of a washing operation, the transition duct shall slope downward toward the cabinet drain pan for a length not less than 18 inches (457 mm). Ducts shall transition to the full size of the unit's inlet and outlet openings.
14. Extra-heavy-duty *appliance* exhaust systems shall not be connected to pollution-control units except where such units are specifically designed and listed for use with solid fuels.
15. Pollution-control units shall be maintained in accordance with the manufacturer's instructions.



Chapter 5: Exhaust Systems

507 Commercial Kitchen Hoods

507.1 – added exception for smoker ovens with integral exhaust systems

507.2.6 – 18" clearance not required if Type I hood is listed and labelled per UL 710

507.6.1 – Capture and containment test with actual cooking or with “smoke generators” (note: “*smoke candles, smoke puffers and similar means*” deleted)

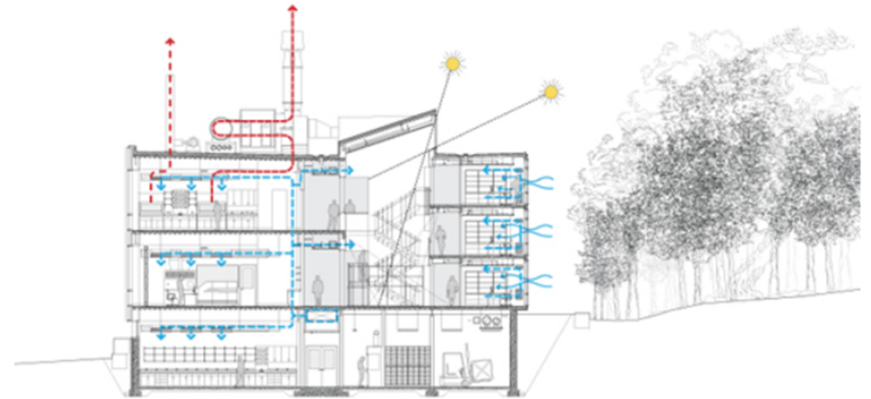


Chapter 5: Exhaust Systems

510 Hazardous Exhaust Systems

Deleted “510.4 Independent System. Hazardous exhaust systems shall be independent of other type of exhaust systems.”

“510.5.5 Makeup air. Makeup air from all sources shall be provided during operations at a rate approximately equal to the rate that air is exhausted by the hazardous exhaust system. Makeup air shall be provided by gravity or mechanical means or both. Mechanical makeup air systems shall be automatically controlled to start and operate simultaneously with the exhaust system. The makeup air shall not reduce the effectiveness of the exhaust system. Makeup air intakes shall be located in accordance with Section 401.4.”



Chapter 5: Exhaust Systems

Section 511 Dust, Stock and Refuse Conveying Systems

511.1.5 *Explosion relief vents replaced with Explosion Control.*

Explosion control shall be provided in accordance with the requirements of the International Fire Code on all systems that convey combustible dust or combustible refuse or stock of an explosive nature, that produces combustible dusts in such a manner that the concentration and conditions could create a fire or explosion hazard. Determination of concentrations or conditions that are deemed to not create a fire or explosion hazard shall be based on a Dust Hazard Analysis prepared in accordance with Section 2203.2 of the International Fire Code.

Section 514 Energy Recovery Ventilation Systems

514.2 Prohibited applications: added Commercial kitchen exhaust systems serving Type I hoods.



Chapter 6: Duct Systems

CT State Building Code - Amendments to IMC

Chapter 6 Duct Systems

606.2 Where Required: Smoke detectors shall be installed where indicated in Section 606.2.1 to 606.2.3 inclusive.

2018 - Amd 606.2,1 : Supply Air Systems

Amd 602.2.2: Common Supply and Return Air Systems

Amd 602.2.3: Return Air Risers

2022 - Amendments removed

Chapter 6: Duct System

601 General

601.2 Air Movement in Egress Elements

Corridors shall not serve as supply, return, relief or ventilation ducts.

Exception 4:

2015 – Incidental air movement from pressurized rooms within health care facilities, provided that the corridor is not the primary source of supply or return air to the room

2021 – Transfer air movement required to maintain pressurization differences within health care facilities in accordance with ASHRAE 170

601.5 Return Air Openings

Return air openings for heating, ventilation and air conditioning systems shall comply with all of the following:

- 2021 – Removed exception to requirement 7, concerning return air from a kitchen
 - Added an 8th requirement with two exceptions, concerning return air from natatoriums.

Chapter 6: Duct System

602 Plenums

602.1 General-

Outlines types of spaces that can be used as supply, return, exhaust, relief plenums

2021 – Added framing of cavities to limits of spaces that can be used for plenums

602.2 Construction-

2021 – Added clarification on use of gypsum plenums (below 125°F, above dew point) and prohibiting use for supply air on systems with direct evaporative cooling.

602.2.1.6

2015 – Title is **Foam Plastic Insulation**. Includes Sub-sections 602.2.1.6.1, Separation Required; 602.2.1.6.2, Approval; 602.2.1.6.3 Covering. It involves specification of flame and smoke spread, agency approval, physical protection.

2021 – Title is **Foam Plastics in Plenums as Interior Finish or Interior Trim**. This section is a reformatting and clarification 2015, accounting for better specification of materials

Chapter 6: Duct System

603 Duct Construction and Installation

603.5 Nonmetallic Ducts

603.5.2 Phenolic Ducts

2021 – This is a new section

603.8 Underground Ducts

603.8.2 Sealing

2015 – Ducts shall be sealed, secured prior to pouring the concrete encasement

2021 – Ducts shall be sealed, secured and tested prior to concrete encasement or direct burial. Ducts shall be leak tested as required by Section C403 of the IEEC

Chapter 6: Duct System

604 Insulation

604.3 Coverings and Linings

Concerns the specification of flame and smoke spread, agency approval.

2021 – Added Exceptions Section:

Exception: Polyurethane foam insulation that is spray applied to the exterior of ducts in attics and crawl spaces shall be subject to all of the following requirements:

1. The foam plastic insulation shall have a flame spread index not greater than 25 and a smoke-developed index not greater than 450, when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mourning procedures of ASTM E2231.
2. The foam plastic insulation shall not flame, glow, smolder or smoke when tested in accordance with ASTM C411 at the temperature to which they are exposed in service. The test temperature shall no fall below 250° F (121° C)
3. The foam plastic insulation complies with the requirements of Section 2603 of the IBC
4. The foam plastic insulation is protected against ignition in accordance with the requirements of Section 2603.4.1.6 of the IBC

Chapter 6: Duct System

606 Smoke Detection Systems (Control)

606.2 Where Required

606.2.1 Return Air Systems

2015, 2021 -

Smoke Detectors shall be installed in return air systems with a design capacity greater than 2,000 cfm, in the return air duct or plenum upstream of any filters, exhaust air connections, outdoor air connections or decontamination equipment and appliances.

Exception: Smoke detectors are not required in the return air system where all portions of the building served by the air distribution system are protected by area smoke detectors connected to a fire alarm system in accordance with the IFC. The area smoke detection system shall comply with Section 606.4

Chapter 6: Duct System

606.2.2 Common Supply and Return Air Systems

2015, 2021 –

Where multiple air-handling systems share common supply or return air ducts or plenums with a combined design capacity greater than 2,000 cfm (0.9 m³/s), the return air system shall be provided with smoke detectors in accordance with Section 606.2.1.

Exception: Individual Smoke detectors are not required for each fan-powered terminal unit, provided that such units do not have an individual design capacity greater than 2,000 cfm and will be shut down by activation of one of the following:

1. Smoke detectors required by Section 606.2.1 and 606.2.3
2. An approved area smoke detector system located in the return air plenum serving such units.
3. An area smoke detector system as prescribed in the exception to Section 606.2.1

Chapter 6: Duct System

607 Duct and Transfer Openings

607.1 General

The provisions of this section shall govern the protection of penetrations of duct penetrations and air transfers in assemblies required to be protected.

607.2 Installation

2021 – Added Section 607.2.3 Static Dampers

607.3 Damper Testing, Ratings and Actuation

607.3.1 Damper Testing

2021 – Removed sentence from paragraph (due to addition of 607.2.3)

Only fire dampers and ceiling radiation dampers labeled for use in dynamic system shall be installed in heating ventilation, and air conditioning systems designed to operate with fans on during a fire

Chapter 6: Duct System

607.4 Access and Identification

2015-

Fire and smoke dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the integrity fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access point shall be permanently identified on the exterior by a label having letters not less than 0.5 inch in height reading: FIRES/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER. Access doors in duct shall be tight fitting and suitable for the required duct connections.

2021 -

Access and identification of fire and smoke dampers shall comply with Sections 607.4.1 through 607.4.2

Chapter 6: Duct System

607.4 Access and Identification

2021 – Continued

607.4.1 Access

Fire and smoke dampers shall be provided with an approved means of access that is large enough to permit inspection and maintenance for the damper and its operating parts. Dampers equipped with fusible links, inertial operators or both shall be provided with an access door that is not less than 12 inches square or provided with a removable duct section

607.4.1.1 Fire-Resistance Rating

The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

607.4.1.2 Restricted Access

Where space constraining or physical barriers restrict access to a damper for periodic inspection and testing, the damper shall be a single- or multi-blade damper and shall comply with the remote inspection requirement of NFPA 80 or NPFA 105

607.4.2 Identification

Access points shall be permanently identified on the exterior by a label having letters no less than ½ inch in height reading: FIRES/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER

Chapter 6: Duct System

607.5 Where Required

607.5.2 Fire Barriers

Exception: Fire dampers are not required at penetrations where any of the following apply:

2015 –

3. Such wall are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the IFC. For the purposes of this exception, a ducted HVAC system shall be a duct system for the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

Chapter 6: Duct System

607.5.2 Fire Barriers

Continued

2021 –

3. Such wall and ceiling penetrations by fully ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the IFC. For the purposes of this exception, a fully ducted HVAC system shall be a duct system for the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals. Flexible air connections shall be permitted in a fully ducted system, limited to the following installations:

3.1 Nonmetallic flexible connections that connect a duct to an air handling unit or equipment located within a mechanical room in accordance with Section 603.9

3.2 Nonmetallic flexible air connectors in accordance with Section 603.6.2 that connect an overhead metal duct to a ceiling diffuser where the metal duct and ceiling diffuser are located within the same room.

Chapter 6: Duct System

607.5.5 Shaft Enclosures

Exception:

1. Fire dampers are not required at penetrations of shafts where any of the following apply:

2015 –

1.1 Steel exhaust subducts extend not less than 22 inches vertically in exhaust shafts provided that there is a continuous airflow upward to the outdoors.

2021 –

1.1 Steel exhaust subducts having a wall thickness of not less than 0.0187 inch extend not less than 22 inches vertically in exhaust shafts and an exhaust fan is installed at the upper terminus of the shaft that is powered continuously, in accordance with Section 909.11 if the IBC, so as to maintain a continuous airflow upward to the outdoors.

607.5.5.1 Continuous Upward Flow

Fire dampers and smoke dampers shall not be installed in shafts that are required to maintain continuous airflow upward where closure of the damper would result in loss of airflow

Chapter 6: Duct System

607.6.2 Membrane Penetrations

2015-

Ducts and air transfer openings constructed of approved materials, in accordance with Section 603, that penetrate the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protect with one of the following:

1. A shaft enclosure in accordance with Section 713 of the IBC
2. A listed ceiling radiation damper installed at the ceiling line where a duct penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.
3. A listed ceiling radiation damper installed at the ceiling line where a diffuser with no duct attached penetrates the ceiling of a fire-resistance-rated floor/ceiling assembly.

Chapter 6: Duct System

607.6.2 Membrane Penetrations

2021-

Ducts and air transfer openings constructed of approved materials, in accordance with Section 603, that penetrate the ceiling membrane of fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with one of the following:

1. A shaft enclosure in accordance with Section 713 of the IBC
2. A listed ceiling radiation damper installed at the ceiling line where a duct penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.

Exceptions:

1. A fire-resistance rated assembly tested in accordance with ASTM E119 or UL 263 showing that ceiling radiation dampers are not required in order to maintain the fire-resistance rating of the assembly.
 2. Where exhaust duct or outdoor air duct penetrations are protected in accordance with Section 714.5.1.2 of the IBC, are located within the cavity of a wall and do not pass through another dwelling unit or tenant spaces.
 3. Where duct and air transfer openings are protected with a duct outlet penetration system tested as part of a fire-resistance-rated assembly in accordance with ASTM E119 or UL263
3. A listed ceiling radiation damper installed at the ceiling line where a diffuser with no duct attached penetrates the ceiling of a fire-resistance-rated floor/ceiling assembly.

Exceptions:

1. A fire-resistance-rated assembly tested in accordance with ASTM E119 or UL 263 showing that ceiling radiation dampers are not required in order to maintain the fire-resistance rating of the assembly
2. Where duct and air transfer openings are protected with a duct outlet penetration system tested as part of a fire-resistance-rated assembly in accordance with ASTM E119 or UL 263

Chapter 6: Duct System

607.6.2.1 Ceiling Radiation Dampers

2015-

Ceiling radiation dampers shall be tested in accordance with Section 607.3.1. Ceiling radiation dampers shall be installed in accordance with the details listed in the fire-resistance-rated assembly and the manufacturer's installation instructions and the listing. Ceiling radiation dampers are not required where any of the following apply:

1. Tested in accordance with ASTM E 119 or UL 263 have shown that ceiling radiation dampers are not necessary to maintain the fire-resistance rating of the assembly.
2. Where exhaust duct penetrations are protected in accordance with Section 714.4.1.2 of the International Building Code, are located within the cavity of a wall, and do not pass through another dwelling unit or tenant space.
3. Where duct and air transfer openings are protected with a duct outlet protection system tested as part of a fire-resistance-rated assembly in accordance with ASTM E 119 or UL 263.

Chapter 6: Duct System

607.6.2.1 Ceiling Radiation Dampers

2021- Revised for static and dynamic dampers

607.6.2.1 Ceiling Radiation Dampers Testing and Installation

Ceiling radiation dampers shall be tested in accordance with Section 607.3.1. Ceiling radiation dampers shall be installed in accordance with the details listed in the fire-resistance-rated assembly and the manufacturer's installation instructions and the listing.

607.6.2.1.1 Dynamic Systems

Ceiling radiation dampers installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire shall be labelled for use in dynamic systems.

607.6.2.1.2 Static Systems

Static ceiling radiation dampers shall be installed only in systems that are not designed to operate during a fire.

Exceptions:

1. Where a static ceiling radiation damper is installed at the opening of a duct, a smoke detector shall be installed inside the duct or outside the duct with sampling tubes protruding into the duct. The detector or tubes within the duct shall be within 5 feet (1524 mm) of the damper. Air outlets and inlets shall not be located between the detector or tubes and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a static ceiling radiation damper is installed in a ceiling, the ceiling radiation damper shall be permitted to be controlled by a smoke detection system installed within the same room or area as the ceiling radiation damper.
3. A static ceiling radiation damper shall be permitted to be installed within a room where an occupant sensor is provided within the room that will shut down the system.

Chapter 6: Duct System

608 Balancing

2015 – Does not exist

2021-

Air distribution, ventilation and exhaust systems shall be provided with means to adjust the system to achieve the design airflow rates and shall be balanced by an approved method. Ventilation air distribution shall be balanced by an approved method and such balancing shall verify that the air distribution system is capable of supplying and exhausting the airflow rates required by Chapter 4.

Chapter 7: Combustion Air

701 General

2021- No Changes to Chapter

Chapter 8: Chimneys & Vents

801.21 Block Vent Switch

2021 – Oiled fired appliances shall be equipped with a device that will stop the burner operation in the event that the venting system is obstructed. Such device shall have a manual reset and shall be installed in accordance with the manufacturer's instructions

805.3 Factory-built Fireplaces

2021 – Chimneys for use with factory built fireplaces shall comply with the requirements of UL127

Chapter 8: Chimneys & Vents

801.21 Insulation Shield

2021 – Where factory built chimneys pass through insulated assemblies, an insulation shield constructed of steel having a thickness of not less than 0.0187 inch (No. 26 Gauge) shall be installed to provide clearance between the chimney and the insulation material. The clearance shall be not less than the clearance to combustibles specified by the chimney's manufacturer's installation instruction.

Where chimneys pass through attic space, the shield shall terminate not less than 2 inches above the insulation materials and shall be secured in place to prevent displacement. Insulation shields provided as part of a listed chimney system shall be installed in accordance with the manufacturer's instructions.

Chapter 9: Specific Appliances, Fireplaces and Solid Burning Fuel

901 General - Added "901.4 *Solid fuel-burning fireplaces and appliances in Group I-2, Condition 2.*" Solid fuel-burning fireplaces and appliances are prohibited.

908.1 – Factory built cooling towers must be listed in accordance with UL 1995 "or UL/CSA 60335-2-40.

916.1 – Modified to "Oil-fired pool and spa heaters shall be tested in accordance with UL 1261. Pool and spa heat pump water heaters shall comply with UL 1995, or UL/CSA 60335-2-40 or CSA C22.2 No. 236.

Exception: Portable residential spas and portable residential exercise spas shall comply with UL 1563 or CSA C22.2 No. 218.1."

918.1 – Forced air furnaces: Electric furnaces and electric heat pumps must comply with UL 1995 or UL/CSA 60335-2-40.



Chapter 9: Specific Appliances, Fireplaces and Solid Burning Fuel

920 – Added “920.4 Prohibited uses. In Group I-2 and ambulatory care facilities, suspended-type unit heaters are prohibited in corridors, exit access stairways and ramps, exit stairways and ramps, and patient sleeping areas.”

Added



SECTION 929 UNVENTED ALCOHOL FUEL-BURNING DECORATIVE APPLIANCES

929.1 General. Unvented alcohol fuel-burning decorative appliances shall be listed and labeled in accordance with UL 1370 and shall be installed in accordance with the conditions of the listing, manufacturer's installation instructions and Chapter 3.

SECTION 930 HIGH-VOLUME LARGE-DIAMETER CEILING FANS

929.1930.1 General. Where provided, high-volume large-diameter ceiling fans shall be tested and labeled in accordance with AMCA 230, listed and labeled in accordance with UL 507, and installed in accordance with the manufacturer's instructions.



Chapter 10 Boilers, Water Heaters and Pressure Vessels

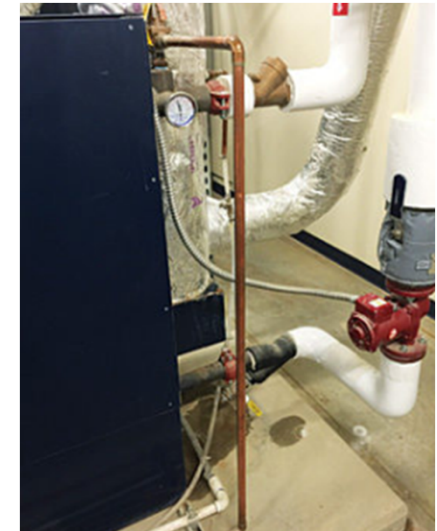
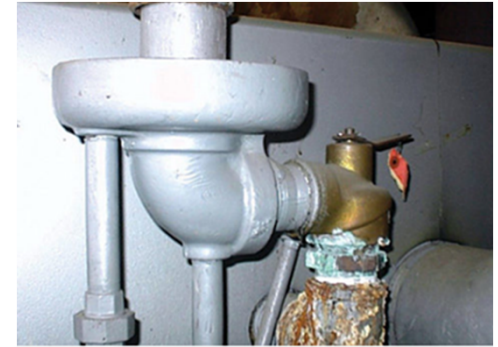
1002.1 – Replaced UL references for solar thermal water heating systems with ICC 900/SRCC 300.

1004.1 – Boilers with input rating greater than or equal to 12,500,000 Btu/hr....

1006.6 Safety and relief valve discharge:

1006.6 Safety and relief valve discharge. Safety and relief valve discharge pipes shall be of rigid pipe that is *approved* for the temperature of the system. High-pressure-steam safety valves shall be vented to the outside of the structure. The discharge piping serving pressure relief valves, temperature relief valves and combinations of such valves shall:

1. Not be directly connected to the drainage system.
2. Discharge through an air break located in the same room as the *appliance*.
3. Not be smaller than the diameter of the outlet of the valve served and shall discharge full size to the air break.
4. Serve a single relief device and shall not connect to piping serving any other relief device or *equipment*.
5. Discharge to the floor, to the pan serving the boiler or storage tank, to a waste receptor or to the outdoors.
6. Discharge in a manner that does not cause personal injury or structural damage.
7. Discharge to a termination point that is readily observable by the building occupants.
8. Not be trapped.
9. Be installed so as to flow by gravity.
10. Not terminate more than 6 inches (152 mm) above the floor or waste receptor.
11. Not have a threaded connection at the end of such piping.
12. Not have valves or tee fittings.
13. Be constructed of those materials listed in Section 605.4 of the *International Plumbing Code* or materials tested, rated and approved for such use in accordance with ASME A112.4.1.



Chapter 11: Refrigeration

1101 General

1101.1 Scope

2015 –

This chapter shall govern the design, installation, construction and repair of refrigeration systems that vaporize and liquefy a fluid during the refrigerating cycle. Refrigerant piping design and installation, including pressure vessels and pressure relief devices, shall conform to this code. Permanently installed refrigerant storage systems and other components shall be considered as part of the refrigeration system to which they are attached.

2021 –

This chapter shall govern the design, installation, construction and repair of refrigeration systems that vaporize and liquefy a fluid during the refrigerating cycle. Permanently installed refrigerant storage systems and other components shall be considered as part of the refrigeration system to which they are attached.

1101.1.1 Refrigerants Other Than Ammonia

Refrigerant piping design and installation for systems containing a refrigerant other than ammonia, including pressure vessels and pressure relief devices, shall comply with this chapter and ASHRAE 15.

1101.1.2 Ammonia Refrigerant

Refrigeration systems using ammonia as the refrigerant shall comply with IIAR 2, IIAR 3, IIAR 4 and IIAR 5 and shall not be required to comply with this chapter.

Chapter 11: Refrigeration

1101.2 Factory-Built Equipment and Appliances

2015

Listed and labeled self-contained, factory-built equipment and appliances shall be tested in accordance with UL 207, 412, 471 or 1995. Such equipment and appliances are deemed to meet the design, manufacture and factory test requirements of this code if installed in accordance with their listing and the manufacturer's instructions.

Chapter 11: Refrigeration

1101.2 Factory-Built Equipment and Appliances

2021 –

Listed and [labeled](#) self-contained, factory-built [equipment](#) and [appliances](#) shall be tested in accordance with Table 1101.2 Such [equipment](#) and [appliances](#) are deemed to meet the design, manufacture and factory test requirements of this code if installed in accordance with their listing and the manufacturer's instructions.

TABLE 1101.2
FACTORY-BUILT [EQUIPMENT](#) AND [APPLIANCES](#)

EQUIPMENT	STANDARDS
Refrigeration fittings, including press-connect, flared and threaded	UL 109 and UL 207
Air-conditioning equipment	UL 1995 or UL/CSA 60335-2-40
Packaged terminal air conditioners and heat pumps	UL 484 or UL/CSA 60335-2-40
Split-system air conditioners and heat pumps	UL 1995 or UL/CSA 60335-2-40
Dehumidifiers	UL 474 or UL/CSA 60335-2-40
Unit coolers	UL 412 or UL/CSA 60335-2-89
Commercial refrigerators, freezers, beverage coolers and walk-in coolers	UL 471 or UL/CSA 60335-2-89
Refrigerating units and walk-in coolers	UL 427 or UL 60335-2-89
Refrigerant -containing components and accessories	UL 207

Chapter 11: Refrigeration

1101.6 General

2015 –

Refrigeration systems shall comply with the requirement of this code and, except as modified by this code, ASHRAE15. Ammonia- refrigeration systems shall comply with this code and, except as modified by this code, ASHRAE 15 and IIAR 2

2021 – Previous paragraph incorporated in 1101.1. 1101.7, Maintenance, now 1101.6

1103 Refrigeration Systems Classifications

1103.1 Refrigerant Classifications

Lists name, classifications, allowable concentration, OEL, hazard, ASHRAE 34

2015 – Table 1103.1 Refrigerant list includes 117 refrigerants,

2021 – Table 1103.1 Refrigerant list includes 168 refrigerants. R-717, Ammonia, is removed.

Chapter 11: Refrigeration

1104 System Applications and Requirements

1104.2 Machine Room Requirements

1104.2.2 Industrial Occupancies and Refrigerated Rooms

2015 –

This section applies only to industrial [occupancies](#) and refrigerated rooms for manufacturing, food and beverage preparation, meat cutting, other processes and storage. [Machinery rooms](#) are not required where all of the following conditions are met:

4. Refrigerant detectors are installed as required for [machinery rooms](#) in accordance with [Section 1105.3](#).

2021 –

This section applies only to rooms and spaces that: are within industrial [occupancies](#); contain a [refrigerant evaporator](#); are maintained at temperatures below 68° F (20° C); and are used for manufacturing, food and beverage preparation, meat cutting, other processes and storage. Where a [machinery room](#) would otherwise be required by [Section 1104.2](#), a [machinery room](#) shall not be required where all of the following conditions are met:

3. Refrigerant detectors are installed as required for [machinery rooms](#) in accordance with [Section 1105.3](#).

Exception: [Refrigerant](#) detectors are not required in unoccupied areas that contain only continuous [piping](#) that does not include valves, valve assemblies, [equipment](#) or [equipment](#) connections.

Chapter 11: Refrigeration

1104.4 Volume Calculations

For allowable #/1000ft³ and OEL values, Table 1103.1

1104.4.2 Communicating Spaces

2015 –

Fuel-burning appliances and equipment having open flames and that use combustion air from the machinery room shall not be installed in a machinery room.

Exceptions:

1. Where the refrigerant is carbon dioxide or water.
2. Fuel-burning appliances shall not be prohibited in the same machinery room with refrigerant containing equipment or appliances where combustion air is ducted from outside the machinery room and sealed in such a manner as to prevent any refrigerant leakage from entering the combustion chamber, or where a refrigerant vapor detector is employed to automatically shut off the combustion process in the event of refrigerant leakage.

2021 –

Where an evaporator or condenser is located in an air duct system, the volume of the smallest, enclosed occupied space served by the duct system shall be used to determine the maximum allowable quantity of refrigerant in the system.

Exception:

If airflow to any enclosed space cannot be reduced below one-quarter of its maximum, the entire space served by the air duct system shall be used to determine the maximum allowable quantity of refrigerant in the system.

Chapter 11: Refrigeration

1105 Machinery Room General Requirements

1105.6 Ventilation

2021 – Added section

1105.6.1.1 Indoor Exhaust Opening Location

Indoor mechanical exhaust intake openings shall be located where refrigerant leakage is likely to concentrate based on the refrigerant's relative density to air, and the locations of the air current paths and refrigerating machinery.

1106 Machinery Room Special Requirements

1106.3

2015 – Title is Ammonia Room Ventilation. Removed

2021 – Flammable Refrigerants (previously 1106.4). Exception changed.

Exception: Machinery rooms for systems containing Group A2L refrigerants that are provided with ventilation in accordance with Section 1106.4.

Chapter 11: Refrigeration

1106 Machinery Room Special Requirements

2021 – Added sections.

1106.4 Special Requirements for Group A2L Refrigerant Machinery Rooms

Machinery rooms with systems containing Group A2L refrigerants that do not conform to the Class I, Division 2, hazardous location electrical requirements of NFPA 70, as permitted by the exception to Section 1106.3, shall comply with Sections 1106.4.1 through 1106.4.3.

Exception: Machinery rooms conforming to the Class I, Division 2, hazardous location classification requirements of NFPA70 are not required to comply with Sections 1106.4.1 and 1106.4.2.

1106.4.1 Ventilation System Activation

Ventilation shall be activated by the refrigerant detection system in the machinery room. Refrigerant detection systems shall be in accordance with Section 608.9 of the International Fire Code and all of the following:

1. The detectors shall activate at or below a refrigerant concentration of 25 percent of the LFL.
2. Upon activation, the detection system shall activate the emergency ventilation system required by Section 1106.4.2.
3. The detection, signaling and control circuits shall be supervised.

1106.4.2 Emergency Ventilation System

An emergency ventilation system shall be provided at the minimum exhaust rate specified in ASHRAE 15 or Table 1106.4.2. Shutdown of the emergency ventilation system shall be by manual means.

Chapter 11: Refrigeration

1106 Machinery Room Special Requirements Continued

TABLE 1106.4.2
MINIMUM EXHAUST RATES

REFRIGERANT	Q(m/sec)	Q(cfm)
R32	15.4	32,600
R143	13.6	28,700
R444A	6.46	13,700
R444B	10.6	22,400
R445A	7.83	16,600
R446A	23.9	50,700
R447A	23.8	50,400
R451A	7.04	15,000
R451B	7.05	15,000
R1234yf	7.80	16,600
R1234ze(E)	5.92	12,600

1106.4.3 Emergency Ventilation System Discharge

The emergency ventilation system point of discharge to the atmosphere shall be located outside of the structure at not less than 15 feet (4572 mm) above the adjoining grade level and not less than 20 feet (6096 mm) from any window, ventilation opening or exit.

Chapter 11: Refrigeration

1107 Refrigerant Piping

2015 –

1107.1 General

1107.2 Piping Location

1107.2.1 Piping in Concrete Floors

1107.2.2 Refrigerant Penetrations

1107.3 Pipe Enclosures

1107.4 Condensation

1107.5 Materials for Refrigerant Pipe and Tubing

1107.5.1 Steel Pipe

1107.5.2 Copper and Brass Pipe

1107.5.3 Copper Tube

1107.5.4 Copper Tubing Joints

1107.5.5 Aluminum Tube

1107.6 Joints and Refrigerant-Containing Parts in Air Ducts

1107.7 Exposure of Refrigerant Pipe Joints

1107.8 Stop Valves

1107.8.1 Liquid Receivers

1107.8.2 Copper Tubing

1107.8.3 Identification

Chapter 11: Refrigeration

2021 –

1107 Piping Material

1107.1 Piping

1107.2 Used Materials

1107.3 Materials Rating

1107.4 Piping Materials Standards

TABLE 1107.4 Pipe Standards

1107.4.1 Steel Pipe Groups A2, A3, B2, and B3

1107.5 Pipe Fittings

TABLE 1107.5 Pipe Fittings

1107.5.1 Copper Brazed Field Swaged

TABLE 1107.5.1 Copper Brazed Swage Cup Depths

1107.6 Valves

1107.7 Flexible Connectors, Expansion and Vibration Compensators

1108 Joints and Connections

1108.1 Approval

1108.1.1 Joints Between Different Piping Materials

1108.2 Preparation of Pipe Ends

1108.3 Joint Preparation and Installation

1108.3.1 Brazed Joints

1108.3.2 Mechanical Joints

1108.3.2.1 Flared Joints

1108.3.2.2 Press-Connect Joints

1108.3.3 Soldered Joints

1108.3.4 Threaded Joints

1108.3.5 Welded Joints

1108.4 Aluminum Tube

1108.5 Brass (Copper Alloy) Pipe

1108.6 Copper Pipe

1108.7 Copper Tube

1108.8 Steel Pipe

1108.9 Steel Tube

1109 Refrigerant Pipe Installation

1109.1 General

1109.2 Piping Location

1109.2.1 Minimum Height

1109.2.2 Refrigerant Pipe Enclosure

1109.2.3 Prohibited Locations

1109.2.4 Piping in Concrete Floors

1109.2.5 Refrigerant Pipe Shafts

1109.2.6 Exposed Piping Surface Temperature

1109.2.7 Pipe Identification

1109.3 Installation Requirements for Group A2L or B2L Refrigerant

1109.3.1 Pipe Protection

1109.3.2 Shaft Ventilation

TABLE 1109.3.2 Shaft Ventilation Velocity

1109.4 Installation Requirements for Group A2, A3, B2 or B3 Refrigerant

1109.4.1 Piping Material

1109.4.2 Shaft Ventilation

1109.5 Refrigerant Pipe Penetrations

1109.6 Stress and Strain

1109.7 Condensate Control

1109.8 Stop Valves

1109.8.1 Refrigerating Systems Containing More Than 6.6 Pounds (3.0 kg) of Refrigerant

1109.8.2 Refrigerating Systems Containing More Than 100 Pounds (45 kg) of Refrigerant

1109.8.3 Stop Valve Support

1109.8.4 Identification

Chapter 11: Refrigeration

1108 Field Test

2015 –

- 1108.1 General
 - 1108.1.1 Booster Compressor
 - 1108.1.2 Centrifugal/Nonpositive Displacement Compressors
- 1108.2 Test Gases
- 1108.3 Test Apparatus
- 1108.4 Declaration

2021 – Section Number Changed, expanded content.

- 1110.1 General
- 1110.2 Exposure of Refrigerant Piping System
- 1110.3 Test Gases
- 1110.4 Test Apparatus
- 1110.5 Piping System Pressure Test and Leak Test
 - 1110.5.1 Joints and Refrigerant-Containing Parts in Air Ducts
 - 1110.5.2 Limited Charge Systems
- 1110.6 Booster Compressor
- 1110.7 Centrifugal/Nonpositive Displacement Compressors
- 1110.8 Contractor or Engineer Declaration

Chapter 12: Hydronic Piping

1203 Joints & Connections



1203.10 Cross-linked polyethylene (PEX) Tubing

2018 – added push-fit fittings

2021 – modified this requirement for push-fit fittings to comply with ASSE 1061 and be used with PEX tubing that is rated for use with such fittings by the tubing manufacturer.

1203.15 Raised Temp Polyethene Plastic Tubing (PE-RT)

2018 – added push-fit fittings

2021 – modified this requirement for push-fit fittings to comply with ASSE 1061 and be used with PE-RT tubing that is rated for use with such fittings by the tubing manufacturer.

Chapter 12: Hydronic Piping

Chapter 12: Hydronic Piping

1208 Tests

1208.01 General

2018 – adds exception to hydrostatic testing for PEX tubing. Pex tubing can be tested using compressed air or other pressurized gas per manufacture instructions

2021 – maintains this exception.

Chapter 12: Hydronic Piping

Chapter 12: Hydronic Piping

1209 Embedded Piping

1209.3.5 Cross-linked polyethylene (PEX) Joints

2018 – Added PEX joints for embedded piping

2021 – No further revision

1209.5 Thermal Barrier Required

2018 – Requires insulation R-values for slab-on-grade and suspended floor installation to follow IECC. Table C402.1.3 in IECC

2021 – No further revision



5 AND MARINE 4	
All other	Group R

R-30ci	R-30ci
R-19 + R-11 LS	R-19 + R-11 LS
R-49	R-49

R-11.4ci	R-13.3ci
R-13 + R-14ci	R-13 + R-14ci
R-13 + R-10ci	R-13 + R-10ci
R-13 + R-7.5ci or R20 + R3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci

R-7.5ci	R-10ci
---------	--------

R-14.6ci	R-16.7ci
R-30	R-30

Unheated slabs	R-15 for 24" below	R-20 for 24" below
Heated slabs [§]	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab

Chapter 13: Fuel Oil Piping and Storage

No significant changes

1302 Material

1302.8 Piping Systems

2021 – added UL listing requirements

Aboveground piping – UL 1369

Underground piping – UL 971A

Chapter 14: Solar Thermal Systems

1401 General

1401.4 Solar Thermal Equipment and Appliances

2018 – Added requirements for solar thermal equipment and appliances to comply with Standard for Solar Water Heating Systems ICC 900/SRCC 300

2021 – No further revisions

1402 Design and Installation

1402.2 Access

2018 – Added requirements for access for maintenance of thermal solar equipment.

2021 – No further revisions



Chapter 14: Solar Thermal Systems

1402 Design and Installation

1402.4.1 Drain-back Systems

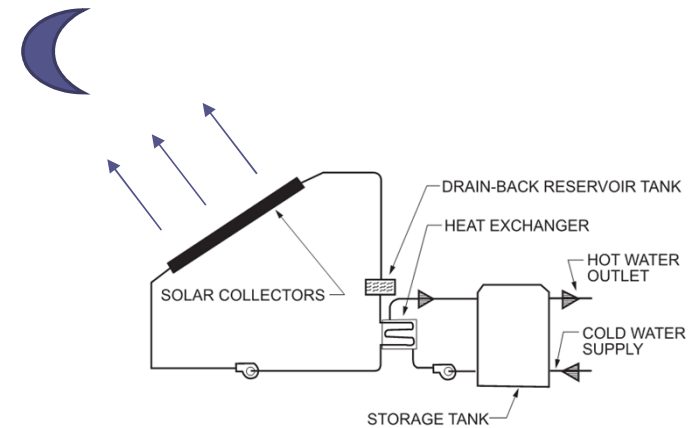
2018 – Added requirements for draining systems subject to freezing back to conditioned spaces with $\frac{1}{4}$ " per foot slope.

2021 – No further revisions

1402.4.2 Freeze-protection Valves

2018 – Added requirements for discharge of freeze protection valves to not cause damage to the building

2021 – No further revisions



Commentary Figure 1402.5.3
SIMPLIFIED SCHEMATIC OF DRAINBACK FREEZE PROTECTION SYSTEM

Chapter 14: Solar Thermal Systems

1402 Design and Installation

1402.5 Protection of Potable Water

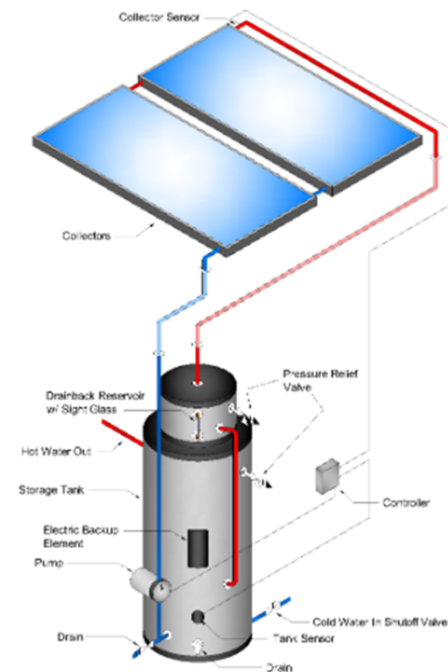
2018 – Added requirements for any potable water connected to a solar heating loop to be protected against back flow and be in accordance with IPC

2021 – No further revisions

1402.7 Protection of structure

2018 – Added requirements for protecting structure and sealing penetrations in accordance with section 302

2021 – No further revisions



Chapter 14: Solar Thermal Systems

1402 Design and Installation

1402.8.1 Collectors and panels

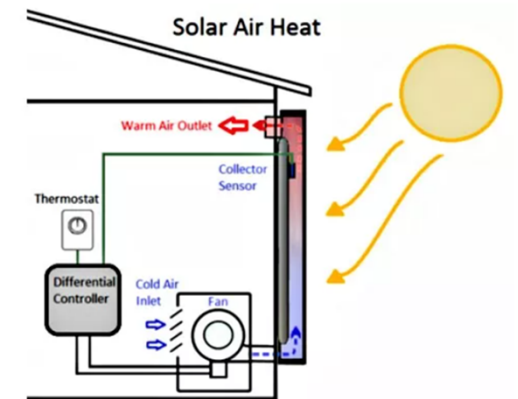
2018 – Added requirements for Solar collectors and panels to be listed under ICC 901/SRCC 100. Added requirements for roof structure to support load of equipment. Add requirements for collector sensors to be installed and protected in accordance with ICC900/ SRCC 300, NFPA 70

2021 – No further revisions

1402.8.2 Ducts

2018 – Added requirements for ducts utilized in solar systems to comply with Chapter 6 and have filters on supply ductwork to occupied space using force mechanical air to distribute in accordance with section 605.

2021 – No further revisions



Chapter 14: Solar Thermal Systems

1402 Design and Installation

1402.8.3 Piping

2018 – Added insulation requirements, the entire solar loop including fittings shall be insulated with some exceptions

2021 – No further revisions

1402.8.2 Heat Exchangers

2018 – Added clarification for when double wall versus single wall heat exchangers are required.

2021 – No further revisions

1402.8.2 Water Heaters and Hot Water Storage Tanks

2018 – Added requirements to comply with Standard for Solar Water Heating Systems ICC 900/SRCC 300

2021 – No further revisions



Chapter 14: Solar Thermal Systems

1402 Design and Installation

1402.8.2 Water Heaters and Hot Water Storage Tanks

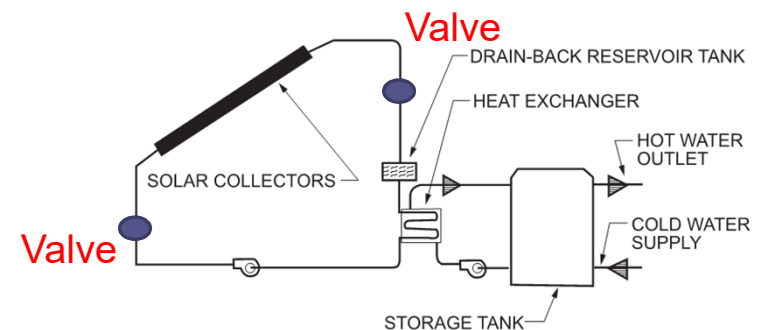
2018 – Added requirements to comply with Standard for Solar Water Heating Systems ICC 900/SRCC 300. Insulation on storage tank shall have an R value of R-12.5 or greater.

2021 – No further revisions

1402.8.6 Solar Loop Isolation

2018 – Added requirements for valves to isolate the solar loop from the rest of the system.

2021 – No further revisions



Commentary Figure 1402.5.3
SIMPLIFIED SCHEMATIC OF DRAINBACK FREEZE PROTECTION SYSTEM

Chapter 14: Solar Thermal Systems

1402 Design and Installation

1402.8.7 Expansion Tanks

2018 – The expansion tanks must be sized to have an acceptance volume equal to the volume of liquid contained within the solar collector and piping system.

2021 – No further revisions

1403 Heat Transfer Fluids

1403.2, 1403.3, 1403.4 Heat transfer fluids, Food-grade additives, Toxicity


2018 – The Heat transfer fluids, Food-grade additives, Toxicity sections were added.

2021 – No further revisions

Questions?



15 minute break, IECC presentation starting at 10:15am

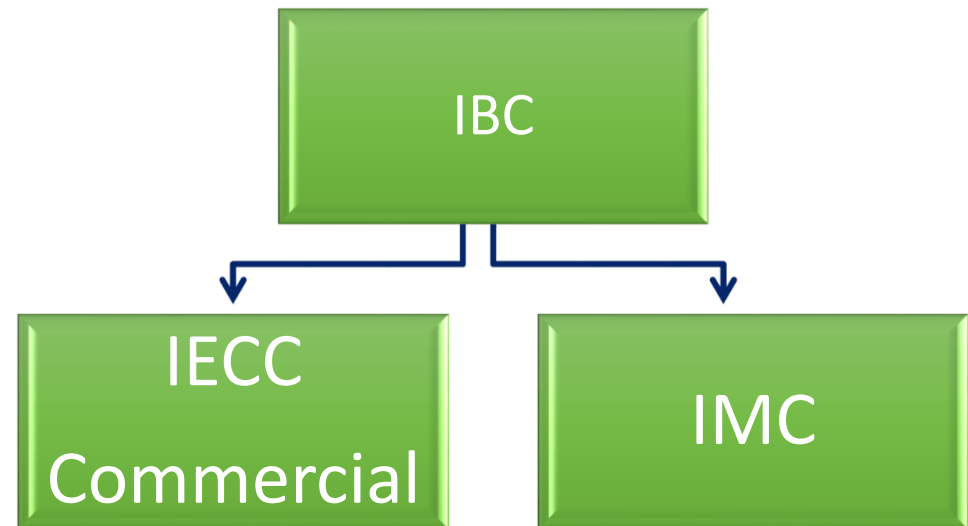
The background of the slide is a photograph of industrial mechanical equipment, possibly a boiler or engine room, with various pipes, valves, and electrical components. A semi-transparent blue overlay covers the entire image, and the title text is centered on this overlay.

2021 IECC International Energy Conservation Code 2015 vs. 2018 vs. 2021

The International Building Code

The International Building Code (IBC) applies to all commercial projects

IBC Chapter 13: Energy Efficiency refers us to the International Energy Code (IECC) and International Mechanical Code (IMC)



IECC Commercial Provisions

The IECC Commercial Provisions include the following chapters

CHAPTER 1 SCOPE AND ADMINISTRATION

CHAPTER 2 DEFINITIONS

CHAPTER 3 GENERAL REQUIREMENTS

CHAPTER 4 COMMERCIAL ENERGY EFFICIENCY

CHAPTER 5 EXISTING BUILDINGS

CHAPTER 6 REFERENCED STANDARDS

APPENDIX CA BOARD OF APPEALS – COMMERCIAL [Added in 2021]

APPENDIX CB SOLAR-READY ZONE – COMMERCIAL [Added in 2018]

APPENDIX CC ZERO ENERGY – COMMERCIAL BUILDING PROVISIONS [Added in 2021]



IECC Chapter 1: Scope and Administration

C102 Alternative Materials, Design and Methods of Construction and Equipment

2018 requires the alternative be equal in “**quality, strength, effectiveness, fire resistance, durability and safety**”

2021 requires that the owner provide a **written application requesting the code official evaluate the proposed alternate.**

C103 Construction Documents

2018 requires contractors to provide the owner with record documents (as-builts) and compliance documents

2021 version adds a requirement to include the following on the drawings

Energy compliance path

Air barrier and air sealing details, including the location of the air barrier

IECC Chapter 1: Scope and Administration

C105 Inspections

2018 allows inspection by a **designated agent or approved agency in lieu of the code official**



IECC Chapter 4: Commercial Energy Efficiency

C401.2 Application – Specifies three compliance options

Prescriptive Compliance - Sections C402 through C406 and Section C408

Total Building Performance – Section C407

ASHRAE 90.1 (outside of the scope of today's presentation)

C401.3 Thermal envelope certificate

2021 – Requires a permanent thermal envelope certificate to be posted on site. Must include the following:

R-values of all insulation installed including ducts outside of the conditioned envelope

U-factors and solar heat gain coefficients (SHGC) of fenestrations.

Results from building envelope air leakage tests

IECC Chapter 4: Commercial Energy Efficiency

C402 Building Envelope Requirements

There were changes throughout this section in 2018 and again in 2021

For the envelope components prescriptive R-value, U-factor and SHGC requirements have been updated as well as installation requirements



IECC Chapter 4: Commercial Energy Efficiency

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

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8		
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	
Roofs																	
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci	
Metal buildings ^b	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + 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	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-25 + R-11 + R-11 LS	R-25 + R-11 + R-11 LS	
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-60	R-60	R-60	R-60	
Walls, above grade																	
Mass ^f	R-5.7ci ^e	R-5.7ci ^e	R-5.7ci ^e	R-5.7ci ^e	R-5.7ci ^e	R-5.7ci ^e	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-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	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	R-13 + R-3.8ci or R-20
Walls, below grade																	
Below-grade wall ^d	NR	NR	NR	NR	NR	NR	R-7.5ci	R-10ci	R-7.5ci	R-10ci	R-10ci	R-15ci	R-15ci	R-15ci	R-15ci	R-15ci	R-15ci
Floors																	
Mass ^e	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-14.6ci	R-16.7ci	R-14.6ci	R-16.7ci	R-16.7ci	R-16.7ci	R-16.7ci	R-20.9ci	R-20.9ci	R-23ci	R-23ci
Joist/framing	R-13	R-13	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38	R-38
Slab-on-grade floors																	
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below	R-20 for 24" below	R-20 for 24" below	R-20 for 24" below	R-20 for 24" below	R-20 for 24" below	R-25 for 48" below
Heated slabs ^e	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-20 for 24" below+ R-5 full slab	R-20 for 24" below+ R-5 full slab	R-20 for 24" below+ R-5 full slab	R-20 for 24" below+ R-5 full slab	R-20 for 24" below+ R-5 full slab	R-20 for 24" below+ R-5 full slab

2015 R-38
2018 R-38

2015 R-13 + R-13ci
2018 R-13 + R-13ci

IECC Chapter 4: Commercial Energy Efficiency

**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								
Vertical fenestration																
U-factor																
Fixed fenestration	0.50	0.45	0.42	0.36	0.36	0.38	0.36	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								
SHGC																
	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	0.38				
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
Skylights																
U-factor	0.70	0.65	0.55	0.50	0.50	0.50	0.50	0.44	0.41							
SHGC	0.30	0.30	0.30	0.40	0.40	0.40	0.40	NR	NR							

2015 IECC - 0.38
2018 IECC - 0.38

2015 IECC - 0.77
2018 IECC - 0.77

2015 IECC - Orientation SEW & N
2018 IECC - Orientation SEW & N

NR = No Requirement, PF = Projection Factor.

IECC Chapter 4: Commercial Energy Efficiency

C402.5 Air leakage—thermal envelope

2021 – the following changes were made

Buildings must comply with C402.5.1 -11 or have an air leakage test performed.

Installation verification **by code official, a registered design professional or approved agency**

Requires review of the following;

Review of the construction documents

Inspection of air barrier during construction

Review of final commissioning report

2022 CSBC Amendment – Requires air leakage test for all new construction.

IECC Chapter 4: Commercial Energy Efficiency

C403 Building Mechanical Systems

C403.2 System design

2021 – added requirements for fault detection and diagnostics (FDD) for new buildings over 100,000 gross square feet of conditioned space

Monitor the HVAC system's performance.

Automatically identify and report HVAC system faults to authorized personnel

Automatically provide recommendations for repairs based on analysis of data collected.

Be capable of transmitting the fault repair recommendations to remotely located authorized person

C403.3 Heating and cooling equipment efficiencies

2021 – updated the minimum efficiency requirements for all HVAC systems and added new tables to address newer HVAC technologies available

IECC Chapter 4: Commercial Energy Efficiency

C403 Building Mechanical Systems

C403.4 Heating and cooling system controls

2018 – The following changes were made

Added requirements for heated or cooled vestibules

Now requires part-load controls on hydronic systems 300,000 Btu/h and up vs. 500,000 Btu/h

Requires automatic control for pump systems starting at 2 HP vs 10 HP.

Added more detailed requirements to automatically vary pump flow on heating-water systems, chilled-water systems and heat rejection loops serving water-cooled unitary air conditioners.

2021 – The following changes were made

Updated the controls required for heat pump supplementary heat.

Added requirements for automatic stop controls that reduce the HVAC system's heating setpoint and increase the cooling setpoint before scheduled unoccupied periods

IECC Chapter 4: Commercial Energy Efficiency

C403 Building Mechanical Systems

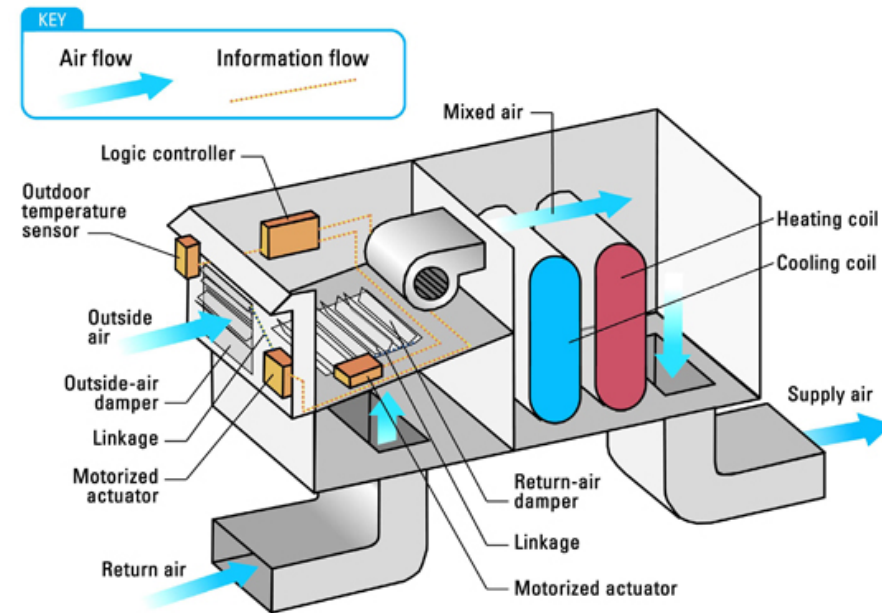
C403.5 Economizers

2021 – added an exemption for VRF systems installed with DOA systems

C403.6 Requirements for mechanical systems serving multiple zones

2018 – modified control requirements. Added specific control requirements for parallel-flow fan-powered VAV air terminal units regarding when the terminal fan can be operated

2021 - modified requirements for supply-air temperature reset controls. Allows reset based on zone humidity in Connecticut.



IECC Chapter 4: Commercial Energy Efficiency

C403 Building Mechanical Systems

C403.7.1 Demand control ventilation

2021 – Required for any system that serves spaces large than 500 sf, with an average occupant load of (25) **15** people/1000 sf or greater and has one or more of the following

1. Air side economizer
2. Automatic modulating control of the OA damper
3. A design outdoor airflow greater than 3,000 CFM

There are exceptions for systems with energy recovery, multi zone system without DDC, **OA less than 750 cfm, 75% of OA required for make-up air, or special occupancies**

IECC Chapter 4: Commercial Energy Efficiency

C403 Building Mechanical Systems

C403.7.4 Energy recovery systems

2021 requires energy recovery systems for non-transient dwelling units.

2021 refers to the ENERGY RECOVERY REQUIREMENT TABLES for occupancies other than non-transient dwelling units.

Example: A system capacity of 900 CFM with design OA of 720 CFM or 80%. Energy recovery is required.

TABLE C403.7.4(1)
ENERGY RECOVERY REQUIREMENT
 (Ventilation systems operating less than 8,000 hours per year)

CLIMATE ZONE	PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
	≥ 10% and < 20%	≥ 20% and < 30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
DESIGN SUPPLY FAN AIRFLOW RATE (cfm)								
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	NR	NR	NR	NR
1B, 2B, 5C	NR	NR	NR	NR	≥ 26,000	≥ 12,000	≥ 5,000	≥ 4,000
6B	≥ 28,000	≥ 26,500	≥ 11,000	≥ 5,500	≥ 4,500	≥ 3,500	≥ 2,500	≥ 1,500
1A, 2A, 3A, 4A, 5A, 6A	≥ 26,000	≥ 16,000	≥ 5,500	≥ 4,500	≥ 3,500	≥ 2,000	≥ 1,000	> 120
7, 8	≥ 4,500	≥ 4,000	≥ 2,500	≥ 1,000	>140	> 120	> 100	> 80

For SI: 1 cfm = 0.4719 L/s.
 NR = Not Required.

TABLE C403.7.4(2)
ENERGY RECOVERY REQUIREMENT
 (Ventilation systems operating not less than 8,000 hours per year)

CLIMATE ZONE	PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
	≥ 10% and < 20%	≥ 20% and < 30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
Design Supply Fan Airflow Rate (cfm)								
3C	NR	NR	NR	NR	NR	NR	NR	NR
1B, 2B, 3B, 4C, 5C	NR	≥ 19,500	≥ 9,000	≥ 5,000	≥ 4,000	≥ 3,000	≥ 1,500	≥ 120
1A, 2A, 3A, 4B, 5B	≥ 2,500	≥ 2,000	≥ 1,000	≥ 500	≥ 140	≥ 120	≥ 100	≥ 80
4A, 5A, 6A, 6B, 7, 8	≥ 200	≥ 130	≥ 100	≥ 80	≥ 70	≥ 60	≥ 50	≥ 40

For SI: 1 cfm = 0.4719 L/s.
 NR = Not Required.

IECC Chapter 4: Commercial Energy Efficiency

C403 Building Mechanical Systems

C403.7.6 Automatic control of HVAC systems serving guestrooms

2018 added a requirement for temperature setpoint control based whether the space is rented but unoccupied, unrented and unoccupied, or occupied.

2018 added a requirement for ventilation controls

C403.8 Fans and fan controls

2021 – added efficiency requirements for fans with motors less than 1/12 HP.

TABLE C403.8.5
LOW-CAPACITY VENTILATION FAN EFFICACY^a

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

IECC Chapter 4: Commercial Energy Efficiency

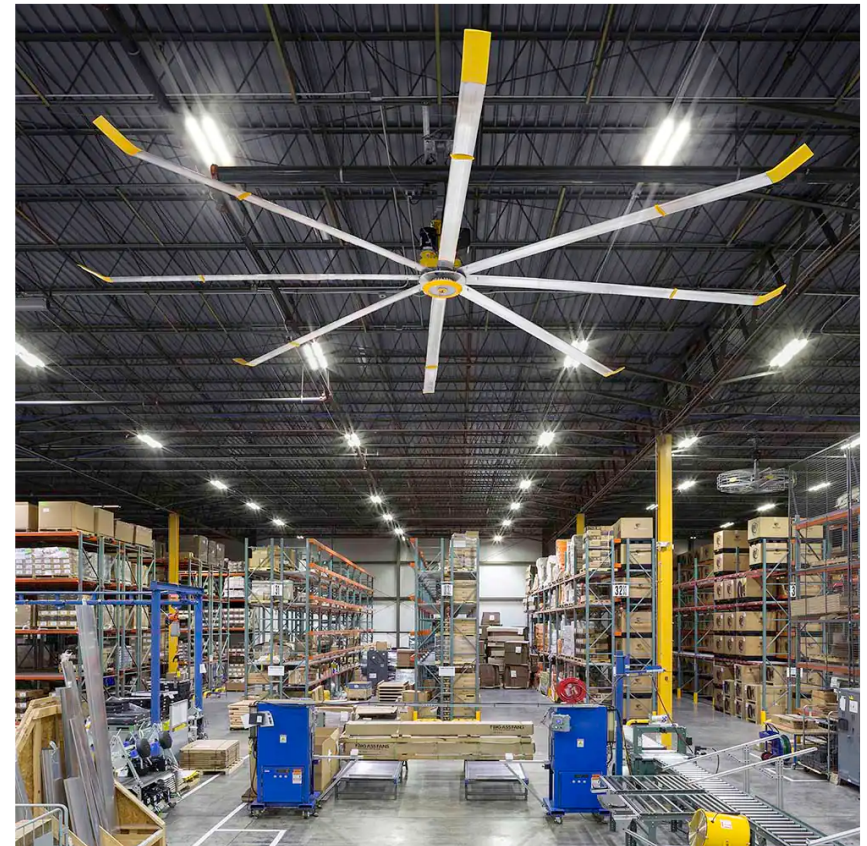
C403 Building Mechanical Systems

C403.9 Large-diameter ceiling fans

2021 – added a requirements for large-diameter ceiling fans to be tested and labeled with AMCA 230

C403.10.2 Heat rejection equipment

2018 – fan speed control required at 5 hp instead of 7.5 hp



IECC Chapter 4: Commercial Energy Efficiency

C403 Building Mechanical Systems

C403.12 Construction of HVAC system elements

2021 – requires that ducts located underground beneath buildings be insulated as required for ducts located outside of the building.

C403.13 Mechanical systems located outside of the building thermal envelope

2018 – added this section:

Heating systems installed outside of the building envelope must be radiant and be controlled by an occupancy sensor

Snow and ice melt systems must have automatic controls to shut off if the pavement temperature is above 50F.

Freeze protection systems shall be self regulating and must include controls to shut the system off when outdoor air temperature is above 40F



IECC Chapter 4: Commercial Energy Efficiency

C404 Service Water Heating

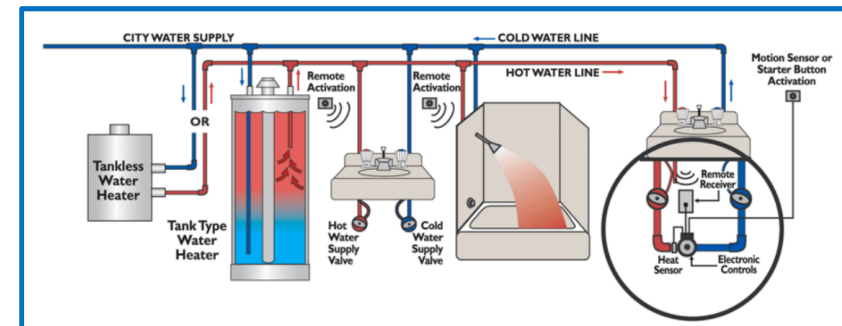
C404.2 Service water-heating equipment performance efficiency

2018 – updated TABLE C404.2

MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

C404.6 Heated-water circulating and temperature maintenance systems

2021 - modified requirements for circulation systems controls. Limit temperature of the water entering the cold water piping to not greater than 104°F.



C404.8 Energy consumption of pools and permanent spas

2018 – exemption for cover now requires 75% of the energy for heating from site-recovered energy vs. previous requirement of 70%

IECC Chapter 4: Commercial Energy Efficiency



C405 Electrical Power and Lighting Systems

C405.1.1 Lighting for dwelling units

2021 – requires 90% of the permanently installed lighting in dwelling units to have lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/W or have daylight-responsive controls and meet the interior lighting power requirements of C405.3

C405.2 Lighting controls

2018 – added the option to provide luminaire level lighting controls (LLLC). These are luminaires with built-in controls. The built-in controls would need to provide the following

- Monitoring occupant activity to brighten or dim lighting when occupied or unoccupied, respectively.

- Monitoring ambient light and brighten or dim artificial light to maintain desired light level.

2021 - made changes throughout this section, making control requirements more stringent for all applications

IECC Chapter 4: Commercial Energy Efficiency

C405 Electrical Power and Lighting Systems

C405.3 Interior lighting power requirements

2018 and 2021 - TABLE C405.3.2(1) INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD and TABLE C405.3.2(2) INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD were updated with more stringent requirements

TABLE C405.3.2(1) INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD			
BUILDING AREA TYPE	2021 IECC	2018 IECC	2015 IECC
	LPD (watts/ft ²)		
Automotive facility	0.75	0.71	0.80
Convention center	0.64	0.76	1.01
Courthouse	0.79	0.90	1.01
Dining: bar lounge/leisure	0.80	0.90	1.01
Dining: cafeteria/fast food	0.76	0.79	0.90
Dining: family	0.71	0.78	0.95
Dormitory	0.53	0.61	0.57
Exercise center	0.72	0.65	0.84
Fire station	0.56	0.53	0.67
Gymnasium	0.76	0.68	0.94
Health care clinic	0.81	0.82	0.90
Hospital	0.96	1.05	1.05
Hotel/Motel	0.56	0.75	0.87
Library	0.83	0.78	1.19
Manufacturing facility	0.82	0.90	1.17
Motion picture theater	0.44	0.83	0.76
Multiple-family	0.45	0.68	0.51
Museum	0.55	1.06	1.02
Office	0.64	0.79	0.82

IECC Chapter 4: Commercial Energy Efficiency

C405 Electrical Power and Lighting Systems

C405.4 Lighting for plant growth and maintenance

2021 – added this section. 95% of permanently installed luminaires used for plant growth and maintenance shall be high efficiency ($1.6 \mu\text{mol}/\text{J}$)

C405.5 Exterior lighting power requirements

2018 – revised the entire section, including what lighting is included and what is exempt. Specific requirements have been added for gas-fired lighting - continuously burning pilots are not allowed

2021 – revised the method of calculating the exterior lighting power allowance (watts).



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C405 Electrical Power and Lighting Systems

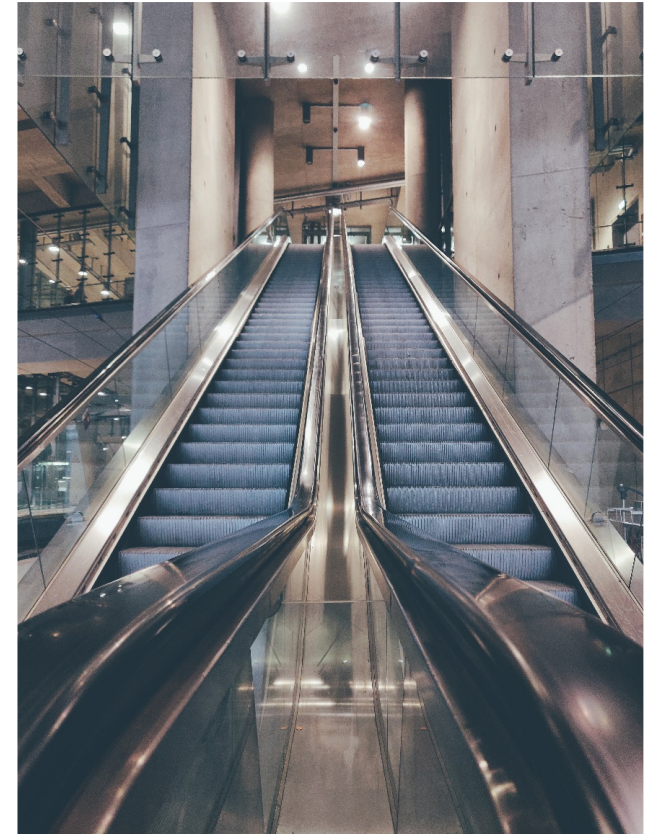
C405.9 Vertical and horizontal transportation systems and equipment

2018 – escalators and moving walks can either reduce speed when not conveying people or use a variable voltage drive system to reduce operating voltage in response to light loading

2021 – escalators shall be designed to recover electrical energy when resisting overspeed in the down direction

C405.10 Voltage drop

2018 – added this section. Limits maximum allowable voltage drop across feeders and branch circuits to 5%.



IECC Chapter 4: Commercial Energy Efficiency

C405 Electrical Power and Lighting Systems

C405.11 Automatic receptacle control

2021 – added this section. It requires automatic control of the following receptacles

At least 50% 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.

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

Control shall turn off the receptacles based on an occupancy schedule, occupancy sensor or other control or alarm system.

Receptacles for equipment requiring continuous operation, and spaces where an automatic control would endanger the safety or security of the room or building occupants are exempt

IECC Chapter 4: Commercial Energy Efficiency

C405 Electrical Power and Lighting Systems

C405.12 Energy monitoring, 2021 – added this section:

New buildings 25,000 sf or larger must measure, record and report energy consumption data

R-2 occupancies and individual tenant spaces, 5,000 sf or less, are exempt if they have their own utility services

The end-use categories in Table C405.12.2 must be metered

A data acquisition system capable of storing a 36 months data is required

A reporting mechanism must be provided in the building, accessible by building operation and management personnel, and must be able to graphically provide the energy consumption for each end-use category at least every hour, day, month and year for the previous 36 months

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.

IECC Chapter 4: Commercial Energy Efficiency

C406 Additional Efficiency Packages

2018 required compliance with **one or more of the following**

1. More efficient HVAC performance
2. Reduced lighting power.
3. Enhanced lighting controls
4. On-site supply of renewable energy
5. Provision of a dedicated outdoor air system for certain HVAC equipment
6. High-efficiency service water heating
7. Enhanced envelope performance [added in 2018]
8. Reduced air infiltration [added in 2018]

IECC Chapter 4: Commercial Energy Efficiency

C406 Additional Efficiency Packages

2021 requires new buildings **earn 10 additional energy efficiency credits**. Available credits and credit values are detailed in Tables C406.1(1) through C406.1(5). Credits can be earned in one or more of the following categories:

1. More efficient HVAC performance
2. Reduced lighting power.
3. Enhanced lighting controls
4. On-site supply of renewable energy
5. Provision of a dedicated outdoor air system for certain HVAC equipment
6. High-efficiency service water heating
7. Enhanced envelope performance
8. Reduced air infiltration
9. Non-required energy monitoring system
10. Non-required fault detection and diagnostics (FDD) system
11. Efficient kitchen equipment

IECC Chapter 4: Commercial Energy Efficiency

C406 Additional Efficiency Packages

Very LEED like process including prerequisites

Tables are based on occupancy classification and use

Different sections have different potentially available credit values

Each section of C406 details how to earn credits

TABLE C406.1(2)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP R AND I OCCUPANCIES

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	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406.2.2: 5% cooling efficiency improvement	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406.2.4: 10% cooling efficiency improvement	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406.3: Reduced lighting power	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
C406.4: Enhanced digital lighting controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.5: On-site renewable energy	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406.6: Dedicated outdoor air system	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406.7.2: Recovered or renewable water heating	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.3: Efficient fossil fuel water heater	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.4: Heat pump water heater	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: Enhanced envelope performance	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406.9: Reduced air infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3
C406.10: Energy monitoring	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406.11: Fault detection and diagnostics system	1	1	1	1	1	1	NA	1	1	NA	1	1	NA	1	1	1	1

NA = Not Applicable.

IECC Chapter 4: Commercial Energy Efficiency

EXAMPLE:C406.5 On-site renewable energy

C406.5.1 Basic renewable credit. Not less than 0.86 Btu/h per sf or 0.25 W/sf or 2% of the annual energy used for mechanical, service water-heating equipment and lighting.

Meet this and you get **7 credits**

C406.5.2 Enhanced renewable credit. Exceed Section C406.5.1, and use Equation 4-14

$AEECRRa = AEEC2.5 \times RRa/RR1$ (Equation 4-14)

$AEECRRa$ = Section C406.5.2 additional energy efficiency credits.

$AEEC2.5$ = Section C406.5 credits from Tables C406.1(1) through C406.1(5). **7 credits**

RRa = Actual ratings of on-site renewable energy systems (in Btu/h or watts/sf). **0.50 W/sf**

$RR1$ = Minimum ratings of on-site renewable energy systems required by Section C406.5.1 (in Btu/h or watts/sf). **0.25 W/sf**

$AEECRRa = 7 \times 0.5/0.25 = 14$ **credits**

IECC Chapter 4: Commercial Energy Efficiency

EXAMPLE: 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% Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with Section C404.2.1

C404.2.1 High input service water-heating systems. This section applies to gas fired water heaters with capacities (singular or combined) of 1,000,000 Btu/h or greater.

Given:

(2) Commercial gas fired water heaters, each rated for the following: 75 Gal. storage, 129 GPH recovery @ 90F rise, **96% thermal** efficiency, 100,000 Btu/h input. 200,000 Btu/h total input

96% Et \geq 95% Et required. Building is not required to comply with C404.2.1. Credits are taken directly from Table C406.1(2) = **9 credits**

IECC Chapter 4: Commercial Energy Efficiency

EXAMPLE: C406.9 Reduced air infiltration.
Air infiltration shall be verified by third party testing.

Measured air-leakage rate
 ≤ 0.25 cfm/sf @ 0.3 in.w.c.

This credit option allows the designer to demonstrate that the building has **less air leakage than the maximum** air leakage rate of 0.4 cfm/sf through pressure testing.

Credits are taken directly from Tables
C406.1(2) = **9 credits**



IECC Chapter 4: Commercial Energy Efficiency

C407 Total Building Performance

C407.1 Scope

2018 - energy used to recharge or refuel vehicles that are used for on-road and off-site transportation purposes are not included in the energy model

C407.2 Mandatory requirements

2018 - annual energy cost that is less than or equal to the annual energy cost of the standard reference design

2021 - annual energy cost that is less than or equal to **80% of the annual energy cost** of the standard reference design

IECC Chapter 4: Commercial Energy Efficiency

C408 1.1 – Maintenance Information

Building Operations and Maintenance Information:

O&M information should be provided to the Owner at project closeout

Manufacturers information and specs

Recommendations

Programming procedures

Narratives

Required regular maintenance actions for equipment

Clearly stated and visible



IECC Chapter 4: Commercial Energy Efficiency

C408.2 – Systems Commissioning

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C408.2 – Systems Commissioning

What is required to be commissioned:

Mechanical Systems and Service Water Heating Systems Commissioning

Occupancy Sensor Controls



Total cooling capacity is less than 480,000 btu/h (140.7 kw)

Total heating capacity is less than 600,000 btu/h (175.8 kw)

Systems included in Section C403.5 that serve individual dwelling and sleeping units

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C408.2 – Commissioning Plan

Commissioning Plan identifies:

Associated tasks

Listing of equipment to be tested

Details on functions to be tested

Conditions under which testing shall be performed

Seasonal testing requirements

Measurable criteria for performance



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C408 – Testing and Balancing

Performed by certified TAB contractor

Air Side Exception: Fans with motors of 1hp or less

Water Side Exception: Pumps with pump motors of 5 hp or less

Typical review by CxA

Review reporting concurrently with Engineer of Record

Sample readings onsite



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C408 – Functional Testing

Equipment: “Equipment functional performance testing shall demonstrate the installation and operation of controls, components, systems and system-to-system confirming operation, function and maintenance serviceability”

All modes in the sequence of operations

Redundant or automatic back up mode

Alarm performance

Modes of operation under loss of and restoration of power

Calibrations



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C408 – Lighting Systems

Automatic Lighting Controls

Occupant Sensor Controls

Located/aimed properly

Operation, sensitivity and timing for vacancy and occupancy sensor

Time Switch Controls

Programming verification and associated documentation of settings

Verify correct time and date in place in the switch

Verify that the override limit is set to not more than 2 hours

Simulation of occupied/unoccupied conditions



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C408 – Lighting Systems

Daylight Responsive Controls

Proper location and field calibration

Controlled lighting loads adjust in response

Calibration adjustment readily accessible to facilities staff



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C408 – Reporting

Final Report:

Results of testing

Disposition of Deficiencies and corrective measures used/proposed

Test procedures

Exception: Deferred/Seasonal Testing



IECC Chapter 4: Commercial Energy Efficiency



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 2021 IECC.

Signature of Building Owner or Owner's Representative _____ Date _____

IECC Chapter 5 Existing Buildings

C503 Alterations

2018 – the following changes were made

Alterations that replace less than 50% of the luminaires in a space are no longer exempt

If an unconditioned space becomes a conditioned space, it must comply with this section

Fenestration amounts can exceed the maximums provided the alteration does not increase the total amount of fenestration. Also applies to Additions and Change of Occupancy or Use

The amount of skylight area can exceed allowable limits as long as the alteration does not increase the amount of skylight area

2021 – the following changes were made

Roof replacements, shall not reduce the R-value of the existing roof or increase the U-factor

Replacement fenestration must meet the U-factor and SHGC for new fenestration.

Questions?

What's A Wind
Turbines Favorite
Color?

Blew

A photograph of a wind farm with several white wind turbines on a green hill under a blue sky. The word 'Blew' is overlaid in blue text.