M O N T A N A

Commercial Energy Code Summary

2018 International Energy Conservation Code

As Amended

A Summary of Montana's
Commercial Energy Code

Montana Commercial Energy Code Summary

Based on the 2018 International Energy Conservation Code (as amended)

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2021

At the time of publication Montana is holding listening sessions for the 2021 IECC with adoption anticipated in early 2022. Check the NorthWestern Energy Efficiency Plus website for details.

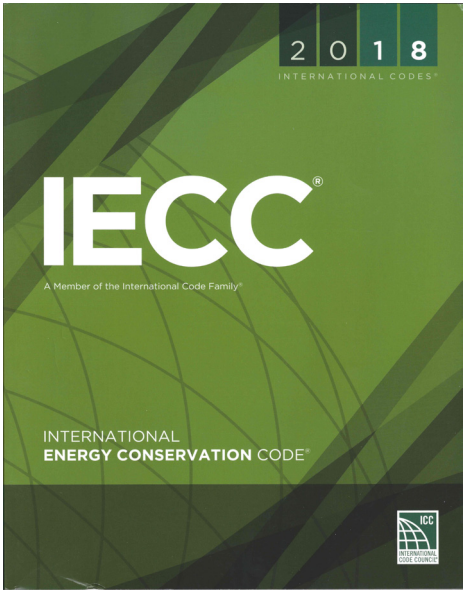
Contents

Code Reference Notation

Unless otherwise noted, code references, such as C402.1, refer to the 2018 International Energy Conservation Code (IECC). References to the 2018 International Mechanical Code (IMC) are preceded with an IMC, as in IMC 403.

Introduction and General Requirements

This document was produced to assist architects, engineers, and builders in understanding and complying with Montana's commercial building energy code. This document identifies key provisions and emphasizes the changes between the 2012 International Energy Conservation Code (IECC) and the 2018 IECC. ***This summary is no substitute for the full text of the code and is too brief to include all detailed requirements, exceptions, and tables that are critical for a complete and thorough application of the code.***



Montana Energy Code Enforcement

The International Code Council (ICC) family of codes are developed to work together. The IECC is unique among the ICC codes in that it does not specifically address life, safety, and property protection. Instead, the intent of the IECC is to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building."

In Montana, the state government establishes the building codes that are enforced by both state and local code jurisdictions. The state Building Codes Advisory Council reviews all code updates, accepts testimony from stakeholders, and makes recommendations to state administration officials who make the final code language determination and establish implementation dates. City and county jurisdictions may choose whether to enforce the codes locally but may not modify the code language. If a local jurisdiction chooses not to enforce the commercial building and energy provisions locally, then the State of Montana Building Codes Bureau becomes the enforcement agency for any commercial projects constructed within that jurisdiction. The state is responsible for code enforcement outside of local code enforcement jurisdicitons. If a jurisdiction chooses to enforce the building code, then the jurisdiction must also enforce the energy code.

The code official with jurisdictional authority is responsible for conducting a plan review of a project's construction documents to determine compliance with the code. The code official is then responsible for inspecting the construction to ascertain whether the constructed building complies with the code in accordance with the construction documents.

2018 IECC Changes

The IECC is updated every three years by the ICC. By adopting the 2018 IECC, Montana moved from enforcing the 2012 IECC to the 2018 IECC. Understanding the 2018 IECC requires being aware of changes made to both the 2015 IECC and the 2018 IECC.

The energy savings associated with the 2018 IECC are modest compared to the savings from the 2012 IECC. More significant than energy savings are the changes that make the 2018 IECC more user-friendly, and that make it more probable to realize the targeted energy savings. Several of the most significant changes are listed below:

- Modified Solar Heat Gain Coefficient (SHGC) requirements
- Additional provisions for lighting controls
- Requirements for rooms containing fuel-burning appliances
- New requirements for hotel guest-room HVAC system controls
- Reorganized Mechanical Systems section
- New requirements for walk-in coolers/freezers and refrigerated display cases
- Reduced shower flow rate
- Reduced Interior Lighting Power Allowances
- Reduced Exterior Lighting Power Allowances
- Clarification and scope of commissioning requirements
- Additional Efficiency Package Options
- New Existing Buildings chapter

Does My Project Fall Under the Commercial or Residential Provisions of the Code?

The IECC has two major divisions. The first division includes commercial provisions, and the second division includes residential provisions. Commercial buildings are defined as any building that does not meet the definition of a residential building. A residential building is defined as:

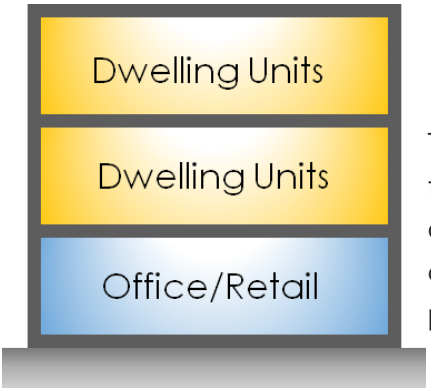
- Detached one- and two-family dwellings
- Multiple single-family dwellings (townhouses)
- Group R-2, R-3, and R-4 buildings less than four stories in height

  Group R-2: Occupants in the building are permanent in nature, such as in apartment houses, dormitories, non-transient hotels, fraternities, and sororities.

Group R-3: A catchall category that includes occupancies other than R-1, R-2, and R-4. Includes buildings with care facilities of less than five occupants for less than 24 hours.

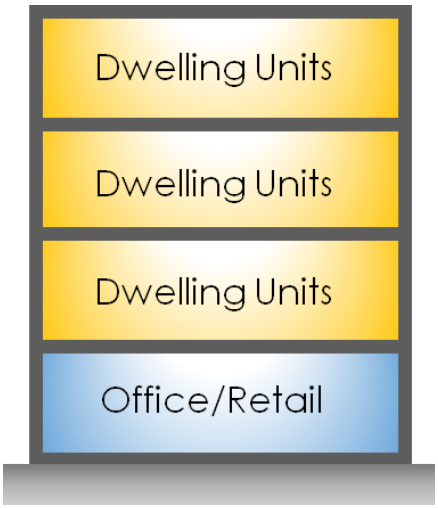
Group R-4: Residential care and assisted-living facilities with six to 15 occupants.

The following diagrams provide examples of how to determine if the commerical or residential provisions of the IECC apply to specific building configurations.



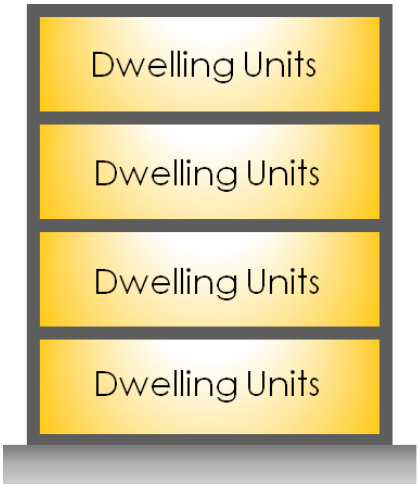
Three-Story, Mixed-Occupancy Building

The first floor must comply with the commercial provisions and the upper two floors must comply with the residential provisions.



Four-Story, Mixed-Occupancy Building

Commercial provisions apply to all floors since the building is over three stories in height.



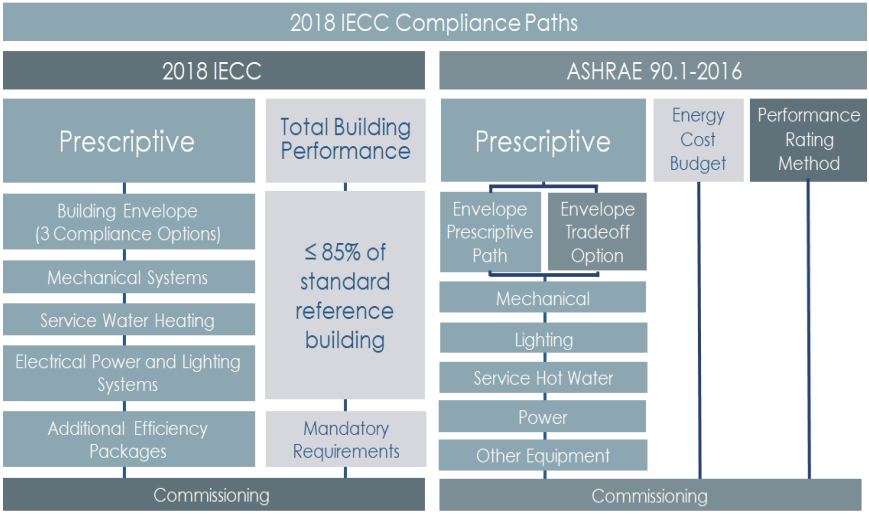
Four-Story Residential Building
Commerical provisions apply to all floors since the building is over three stories in height.

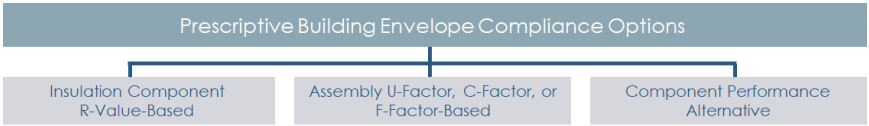
The commercial provisions include thermal envelope requirements for residential occupancies (Group R) separate from thermal envelope requirements for non-residential buildings.

Compliance Paths

The 2018 IECC states that commercial buildings must comply with either the IECC or with ASHRAE Standard 90.1-2016. The purpose of multiple pathways is to provide flexibility in application of the energy code. Once the designer elects to comply with either the 2018 IECC or ASHRAE 90.1, that code or standard must be used for the entire project.

Within the IECC, there are two compliance options: the Prescriptive and the Total Building Performance compliance paths. Within the Prescriptive path, there are also three building envelope compliance options. The advantage of the Total Building Performance compliance path over the Prescriptive is that tradeoffs are allowed between the envelope, mechanical systems, lighting systems, and service hot-water systems. The effort required to apply the Total Building Performance compliance path is significantly greater during the design phase of the project. The focus of this code summary is the Prescriptive compliance path of the IECC. ASHRAE 90.1-2016 also offers a Prescriptive Path, along with an Energy Cost Budget Path and a new Performace Rating Method.





Section C407 of the IECC details how to comply using the Total Building Performance path. Using this compliance path, the proposed building energy cost based on computer energy simulation must be equal to or less than 85% of the standard reference design (C401.2). As in previous editions, the IECC's mandatory provisions must be met when applying the Total Building Performance path. Provision C407.2 lists all applicable mandatory requirements of the Total Building Performance path. The Total Building Performance compiance path may not be used for existing buildings. There are a couple of changes to Total Building Performance compliance path in the 2018 IECC: It is not necessary to include energy used to recharge or refuel vehicles that are used for on-road and off-site transportation; and the reduction in energy cost of the proposed design from on-site energy generation can be no more than five percent of the total energy cost.

Additions and alterations are now governed by the Existing Buildings Chapter that was added to the 2018 IECC.

Commercial Compliance Using COMcheck™

COMcheck software makes it easier for architects, builders, designers, and contractors to determine whether new commercial or high-rise residential buildings, additions, and alterations meet the requirements of the IECC and ASHRAE Standard 90.1. COMcheck also simplifies compliance for building officials, plan checkers, and inspectors by allowing them to more efficiently determine if a building project complies with the code.

COMcheck provides an optional method to demonstrate compliance with the commercial and high-rise residential building energy code. Commercial buildings include all use groups except single-family and multifamily buildings not over three stories in height.

COMcheck Desktop may be downloaded and installed directly to your computer, while COMcheck-Web™ is accessible directly from the website without having to download and install the software.

The COMcheck materials (software, manual, and reference guides) simplify and clarify commercial and high-rise residential energy code compliance. Forms and checklists are included for documenting compliance. Using the tradeoff compliance method, COMcheck can provide more design flexibility when compared to prescriptive requirements. Once the basic building description has been entered into the program, design changes or the building location can be quickly modified, and compliance assessed. The program can be downloaded free of charge from www.energycodes.gov/comcheck.

Envelope Requirements

Tables C402.1.3 (Opaque Thermal Envelope Insulation Component Minimum Requirements) and C402.4 (Fenestration Requirements) include the prescriptive envelope requirements for commercial buildings. As an alternative to Table C402.1.3, a table of assembly U-factors (Table C402.1.4) may be used. Commercial buildings or portions of commercial buildings enclosing Group R occupancies are to use the “Group R” column in these tables. Other occupancies are to use the “All Other” column.

The table on the next page has been modified to inlcude only the requirements applicable to Montana’s climate zone. R-5 insulation is now required under all heated slabs.

Wood Framed Walls (C402.2.2)

Continuous insulation is mandatory for wood-frame walls using the prescriptive path. Wood-frame walls must either provide at least R-13 cavity insulation plus R-7.5 continuous insulation, or R-20 cavity insulation plus R-3.8 continuous insulation.

Table C402.1.3 Opaque Thermal Envelope Minimum Requirements R-Value Method[a] (Partial)

Climate Zone 6	All Other	Group R
Roofs		
Insulation Above Deck	R-30ci	R-30ci
Metal Buildings[b]	R-25 + R-11 LS	R-25 + R-11 LS
Attic and Other	R-49	R-49
Walls, Above Grade		
Mass[g]	R-13.3ci	R-15.2ci
Metal Building	R-13 + R-13ci	R-13 + R-13ci
Metal Framed	R-13 + R-7.5ci	R-13 + R-7.5ci
Wood Framed and Other	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci
Walls, Below Grade		
Below-Grade Wall[d]	R-7.5ci	R-7.5ci
Floors		
Mass[c]	R-12.5ci	R-12.5ci
Joist/Framing	R-30	R-30[f]
Slab-on-Grade Floors		
Unheated Slabs	R-10 for 24" below	R-15 for 24" below
Heated Slabs[h]	R-15 for 36" below + R5 full slab	R-20 for 48" below + R5 full slab
Opaque Doors		
Nonswinging	R-4.75	R-4.75

Footnotes to Table C402.1.3

ci = Continuous Insulation; LS = Liner System

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

b. Where using R-value compliance method, a thermal spacer block shall be provided; otherwise, use the U-factor compliance method in Table C402.1.4.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. "Mass floors" shall be in accordance with Section C402.2.3.

f. Steel floor joist systems shall be insulated to R-38.

g. "Mass walls" shall be in accordance with Section C402.2.2.

h. First value is perimeter insulation (not required to extend below bottom of slab); second value is insulation under full slab.

Slab-On-Grade Insulation (C402.2.4)

Perimeter insulation is not required when the slab-on-grade is greater than 24 inches below the finished exterior grade. Requirements for heated slab insulation have changed. The code now requires R-5 insulation below the full heated slab and perimeter insulation is not required to extend below the bottom of the slab.

Fenestration (C402.4)

An area-weighted average is permitted to satisfy the U-factor requirements of each fenestration product category listed. Fenestration products from different categories listed may not be combined in calculating the area-weighted average U-factor.

Table C402.4 Building Envelope Fenestration Maximum U-Factor and SHGC Requirements

Climate Zone 6		
Vertical Fenestration		
U-Factor		
Fixed Fenestration	0.36	
Operable Fenestration	0.43	
Entrance Doors	0.77	
SHGC		
Orientation[a]	SEW	N
PF<0.2	0.4	0.53
0.2≤PF<0.5	0.48	0.58
PF≥0.5	0.64	0.64
Skylights		
U-Factor	0.5	
SHGC	0.4	

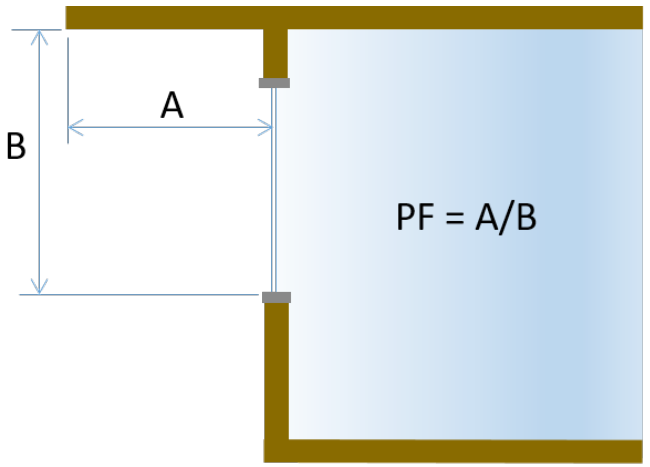
a. “N” indicates vertical fenestration oriented within 45 degrees of true north. “SEW”indicates orientation other than “N.”

In the 2018 IECC, the Solar Heat Gain Coefficient (SHGC) requirements are based on the fenestration orientation and the projection factor. SHGC adjustments must also be considered.

U-factors of windows, skylights, and doors are to be determined per the National Fenestration Rating Council (NFRC) standards. Products lacking an NFRC certification label must use default values included in Section C303.1.3. These default values generally do not meet the prescriptive requirements. Similarly, if a fenestration product does not have an NFRC certification label that includes the SHGC or visual transmittance, then the appropriate default table value in Section 303.1.3 is to be used.

Projection Factor (C402.4.3)

The projection factor (PF), illustrated in the diagram below, is used to determine the SHGC. Distance A is measured horizontally from the farthest edge of the overhang to the surface of the glazing. Distance B is measured vertically from the bottom of the glazing to the underside of the overhang. Where different windows or glass doors have different PF values, they must each be evaluated separately.



Projection Factor

Maximum Fenestration Area (C402.4.1)

Vertical Fenestration Basic Allowance. Thirty percent of above-grade wall area is allowed in vertical fenestration. The fenestration area does not include opaque doors or opaque spandrel panels.

Increased Allowance Vertical Fenestration. Forty percent of above-grade wall area is allowed if the following four conditions are met:

1. In buildings less than three stories above grade, not less than 50% of the net floor area must be within a daylight zone.
2. In buildings three stories or more above grade, not less than 25% of net floor area must be within a daylight zone.
3. At least 50% of the conditioned floor area must be within daylight zones where automatic daylighting controls are installed.
4. Visual transmittance of vertical fenestration is ≥ 1.1 times the SHGC.

Skylight Area Basic Allowance. A maxium of 3% of the gross roof area may be skylight, but this may be increased up to 6% of the roof area if code- compliant daylight-responsive controls are installed in toplit daylight zones.

Definitions

Skylights. Glass or other transparent or translucent glazing material installed at a slope of less than 60° from the horizontal, including unit skylights, tubular daylighting devices, and glazing materials in solariums, sunrooms, roofs, and sloped walls.

Vertical Fenestration. Windows that are fixed or operable, opaque doors, glazed doors, glazed block, and combination opaque and glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope not less than 60° from the horizontal.

Daylight Zone. That portion of a building's interior floor area that is illuminated by natural light. Daylight zones, including toplit zones and sidelit zones, must comply with the controls specified in C405.2.3.2 and C405.2.3.3, as applicable.

Increased Skylight SHGC and U-Factor (C402.4.3.1)

Skylight SHGC may be as high as 0.60 if located above daylight zones with daylight-responsive controls. Skylight U-factor may be as high as 0.75 if located above daylight zones with daylight-responsive controls.

Air Leakage - Thermal Envelope (C402.5)

The thermal barrier must comply with the air barrier provisions or be tested for tightness.

Envelope Tightness Testing. If performed, envelope tightness testing must be in accordance with ASTM E 779 at a pressure of 75 Pascals. The tested air leakage of the buiding envelope may be no greater than 0.40 CFM/ft^2 of thermal envelope area.

It should be noted that the envelope tightness testing procedure for commercial buildings is significantly different than for residential buildings. The allowable leakage area is based on the area of the building envelope for commercial buildings, while the allowed leakage of residential buildings is based on building volume. Residential envelope tightness testing is performed at 50 Pascals, while commercial testing is performed at 75 Pascals pressure difference. If envelope testing is performed as a means of compliance with air leakage in commercial buildings, then several additional provisions are mandatory. Air intakes, stairways, shafts, and exhaust openings must be dampered per the code. Loading docks must be weathersealed. Vestibules must be installed unless one of the exceptions listed in the energy code applies.

Air Barriers (C402.5). The continuous air barrier must comply either through the *Materials Compliance Option* or the *Assemblies Compliance Option*. The mandatory air barrier must be continuous for all assemblies that make up the thermal envelope. All joints must be sealed. All penetrations must be sealed securely. While the IECC does not specify where the air barrier is to be installed, the Montana amendment to the air barrier definition requires that an air barrier be installed on the warm side of the assembly.

The materials of the air barrier must be able to withstand the positive and negative pressure of the wind, stack effect, and mechanical ventilation. The integrity of the air barrier must be maintained across penetrations, such as recessed light fixtures. The energy code details how the joints, seams, penetrations, and recessed light fixtures are to be sealed.

Materials Compliance Option (C402.5.1.2.1). The energy code specifies the required air permeability characteristics of materials that meet the air barrier requirements. Materials must have an air permeance of less than or equal to 0.004 CFM/ft^2 under a pressure differential of 0.3 inches water gauge (75 Pascals). The energy code lists 15 materials that are deemed to comply.

Assemblies Compliance Option (C402.5.1.2.2). The code sets air permeability limits for assemblies that may be used to comply with the air barrier requirement. For more information about air barriers, refer to the Air Barrier Association of America. Assemblies of materials and components (sealants, tapes, etc.) must have an average air leakage less than or equal to 0.04 CFM/ft^2 at 0.3 inches water gauge (75 Pascals). The code lists three concrete masonry unit, clay or shale masonry unit, and stucco/plaster assemblies that are deemed to comply.

Building Tightness Compliance Options (Based on C402.5)

Reference	Testing	Air Barrers	
		Materals	Assemblies
Compliance	Building Envelope Tested ≤ 0.40 CFM/Ft^2 Per ASTM E 779	Air Permeability <0.004 CFM/ft^2	Average Air Permeability ≤0.004 CFM/ft2
	NA	Air Barrier Construction Provisions:	
		Air Barrier To Be Continuous	
		All Joints and Seams To Be Sealed	
		All Penetrations To Be Sealed	
	NA	Fenestration Air Leakage Requirements	
	NA	Combustion Closets Required	
C402.5.4	NA	Access Openings to Shafts, Chutes, Stairways, and Elevator Lobbies to be Gasketed, Weatherstripped, or Sealed	
C402.5.5	Stairway/Shafts Air Intakes and Exhaust Openings		
C402.5.6	Loading Dock Weatherseals		
C402.5.7	Vestibule Requirements		
C402.5.8	Recessed Lighting: IC Rated, Air Leakage Rated, Sealed to Interior Wall or Ceiling		
	* Refer to IECC for more detailed requirements and exceptions.		

Rooms Containing Fuel-Burning Appliances (C402.5.3)

Where combustion air is supplied through openings in an exterior wall to a space containing a space-conditioning, fuel-burning appliance, the space must be enclosed and isolated from conditioned spaces. Such rooms must comply with all of the following:

The walls, floors, and ceilings that separate the space from conditioned spaces must be insulated as if they were an exterior below-grade wall. The wall, floors, and ceilings that separate the space from conditioned spaces must be sealed as if they were exterior walls. The doors into the space must be fully gasketed. Water lines and ducts in the space must be insulated per code.

Mechanical Systems
and Service Water Heating

The Mechanical Systems section of the IECC is too complex to review in depth. Refer to the full 2018 IECC for complete details and exceptions. The following discussion identifies the key changes from the former state code that was based on the 2012 IECC. The Mechancial Systems section has been restructured. Controls, dampers, variable-air-volume systems, fan systems, and exhaust systems have been grouped together. Mechanical provisions are no longer separated into simple and complex systems.

System Design (C403.2)

Zone Isolation. Heating, ventilation, and air-conditioning (HVAC) systems serving zones over 25,000 ft^2 in floor area or that span more than one floor and are designed to be occupied at different times must be divided into isolation areas. Each isolation area must be equipped with isolation devices and controls that shut off the supply of conditioned air and outdoor air to and exhaust air from the isolation area. Each isolation zone must be controlled independently.

Ventilation. Ventilation must be provided according to Chapter 4 of the International Mechanical Code (IMC). Mechanical ventilation must be capable of reducing outdoor air supply to the minimum required by that chapter.

Heating and Cooling Equipment Efficiency (C403.3)

The series of minimum performance tables [C403.3.2(1) through C403.3.2(10)] in this section of the IECC have been updated and, in some cases, new categories have been added. The following table summarizes the changes in the equipment performance tables of the 2018 IECC compared to the 2012 edition.

HVAC Equipment Performance Requirements Tables	
Table	Changes
Table C403.3.2(1) **Minimum Efficiency Requirements: Electrically Operated Unitary Air Conditioners and Condensing Units**	Some SEER and many IEER values have been increased.
Table C403.3.2(2) **Minimum Efficiency Requirements: Electrically Operated Unitary and Applied Heat Pumps**	Revised terminology for water-source and ground-source heat pump equipment types. Increased values in about half of the minimum-efficiency values.
Table C403.3.2(3) **Minimum Efficiency Requirements: Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Packaged Vertical Air Conditioners, Single Vertical Heat Pumps, Room Air Conditioners, and Room Air-Conditioner Heat Pumps**	Increases in about half of the minimum efficiency values.
Table 403.3.2(4) **Warm-Air Furnaces and Combination Warm Air Furnaces/Air-Conditioning Units, Warm-Air Furnaces and Unit Heaters, Minimum Efficiency Requirements**	Minimum efficiency AFUE values increased for gas- and oil-fired warm-air furnaces.
TABLE C403.3.2(5) **Minimum Efficiency Requirements: Gas- and Oil-Fired Boilers**	Minimum efficiency AFUE values increased for gas and oil-fired warm air furnaces.
Table C403.3.2(6) **Minimum Efficiency Requirements: Condensing Units, Electrically Operated**	Category reorganization. Some modest efficiency increases.
Table C403.3.2(7) **Minimum Efficiency Requirements: Water Chilling Packages**	EER values for air-cooled chiller Path A added. Some kW/ton values changed for water cooled, electricially operated, positive displacement and centrifugal chillers.
Table C403.3.2(8) **Minimum Efficiency Requirements: Heat Rejection Equipment**	Four additional equipment types added.
Table C403.3.2(9) **Minimum Efficiency Air Conditioners and Condensing Units Serving Computer Rooms**	Entirely new table.
Table C403.3.2(10) **Heat Transfer Equipment**	No changes.

The equipment efficiency must be verified through certification under an approved certification program. Where a certification program does not exist, the ratings must be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements apply, the equipment must satisfy all requirements.

Heating and Cooling System Controls (C403.4)

Thermostatic Controls (C403.4.1). The supply of heating and cooling energy to each zone must be controlled by individual thermostats. There are some exceptions for independent perimeter systems.

Heat Pump Supplementary Heat (C403.4.1.1). Heat pumps with supplemental electric heat must have controls that, except during defrost, prevent supplemental heat operation when the heat pump can provide the heating load.

Deadband (C403.4.1.2). Zone thermostatic controls that control both heating and cooling must provide a deadband of not less than 5˚F. In that deadband, the supply of heating and cooling energy must be shut off or reduced to a minimum.

Heated or Cooled Vestibules (C403.4.1.4). The heating systems for vestibules or air curtains with integral heat must have controls to shut off the heat when the outdoor air temperature is greater than 45˚F. Vestibule heating and cooling must be controlled to a temperature of 60˚F for heating and 85˚F for cooling.

Hot-Water Boiler Outdoor Temperature Setback Control (C403.4.1.5). One-pipe or two-pipe hot-water boiler systems must have outdoor setback control that lowers the boiler water temperature based on the outdoor temperature.

Off-Hour Controls C403.4.2). Each zone must have thermostatic setback controls with either an automatic time clock or a programmable control system, unless the zones will be operatied continuously. Such controls are not required if the full HVAC load demand is less than or equal to

6,800 Btu/h and an accessible shutoff switch is provided. Control bands must be capable of maintaining termperatures between 55˚F and 85˚F. Automatic time clock or programmable controls must be capable of seven different daily schedules per week with a manual override of up to two hours or an occupancy sensor. Automatic start controls must be able to bring each space to occupied temperature immediately prior to occupancy.

Hydronic System Controls (C403.4.3). Refer to the code text for the requirements of hydronic systems. Three-pipe systems that use a common return are prohibited. The requirements include deadbands and heat rejection for water-loop heat pump systems. The heat rejection requirements for water-loop heat pump systems have been changed.

Hydronic Part-Load Controls (C403.4.4). Hydronic part-load control requirements apply to systems greater than or equal to 300,000 Btu/h. These provisions have been modified in the 2018 IECC.

Economizers (C403.5)

Economizers improve cooling system efficiency by using outside air for building cooling. The provisions for economizers have been reorganized and modified significantly. They are too detailed to include in their entirety here. Following is a summary of the cooling systems for which an air or water economiser is required:

Chilled Water Systems. Chilled-water systems with a total cooling capacity, less cooling capacity provided with air economizers, of 1,320,000 Btu/h for local water cooled chilled-water systems and 1,720,000 Btu/h for air-cooled chilled-water or district chilled-water systems.

Other Than Group R Occupancies. Individual fan systems with cooling capacity greater than or equal to 54,000 Btu/h.

Group R Occupancies. Individual fan systems with a cooling capacity greater than or equal to 270,000 Btu/h. The total supply capacity of

all fan cooling units not provided with economizers may not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 1,500,000 Btu/h, whichever is greater.

Exceptions: Economizers are not required for the following:

- Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F dewpoint temperature to satisfy process needs
- Systems expected to operate less than 20 hours per week
- Systems serving supermarket areas with open refrigerated casework
- Systems that include a heat-recovery system in accordance with Section C403.9.5

Integrated Economizer Control (C403.5.1). Economizer systems must be integrated with the mechanical cooling system and be configured to provide partial cooling, even where additional mechanical cooling is required to provide the remainder of the cooling load.

Economizer Heating System Impact (C403.5.2). HVAC system economizer operation may not increase building heating energy use during normal operation except on variable-air-volume (VAV) systems that cause zone-level heating to increase because of a reduction in supply air temperature.

Air Economizers (C403.5.3). High-limit shutoff control types for specific climates are shown in the table that follows. Air economizers must be configured to automatically reduce outdoor air intake to the design minimum outdoor air quantity when outdoor air intake will not reduce cooling energy usage.

Economizers must be capable of relieving excess outdoor air during air economizer operation to prevent over-pressurizing the building. The relief air outlet is to be located to avoid recirculation of the exhaust air back into the building.

Table C403.5.3.3 High-Limit Shutoff Control Setting for Air Economizers (Abridged for Montana)	
Allowed Control Types	Required High Limit (Economiser Off When):
Fixed Dry Bulb	Outdoor air temperature exceeds 75°F
Differential Dry Bulb	Outdoor air temperature exceeds return air temperature
Fixed Enthalpy with Fixed Dry-Bulb Temperatures	Outdoor air enthalpy exceeds 28 Btu/lb of dry air or outdoor air temperature exceeds 75°F
Differential Enthalpy with Fixed Dry-Bulb Temperature	Outdoor air enthalpy exceeds return air enthalpy or outdoor air temperature exceeds 75°F

Water-Side Economizers (C403.5.4). Water-side economizer systems must cool supply air by indirect evaporation. Such systems must provide up to 100 percent of the expected system cooling load at outdoor air temperatures of not greater than 50°F dry bulb/45°F wet bulb. There are two exceptions for computer roooms and an exception for where dehumidification requirements cannot be met using outdoor air.

Unlike air-side economizers, water-side economizers have parasitic energy losses that reduce the cooling energy savings. One of these losses comes from possible increases in pumping energy. This provison attempts to limit those losses. Precooling coils and water-to-water heat exchangers used in water economizer systems must have either a water-side pressure drop of less than 15 feet of water, or a secondary loop created so the coil or heat exchanger drop isn't sensed by circulating pumps when system is in normal cooling mode.

Economizer Fault Detection and Diagnostics (C403.5.5). These provisions were added because HVAC systems in commercial buildings have had problems with economizer functions. Most manufactuers are already manufacturing to these provisions.

Mechanical Systems Serving Multiple Zones (C403.6)

The IECC includes a series of provisions that address buildings with multiple zones. C403.2.1 requires isolation devices so that zones can be operated independently. The code text includes a set of provisions

based on system type. The types of systems addressed are variable-air-volume (VAV) and multiple-zone systems, single-duct VAV systems (terminal devices), dual-duct and mixing VAV systems (terminal devices), single-fan dual-duct sytems, and mixing VAV systems (economizers). Other provisions address supply-air temperature reset controls, multiple-zone VAV system ventilation optimization control, parallel-flow fan-powered VAV air terminal control, setpoints for direct digital control, and static pressure sensor location.

Ventilation and Exhaust Systems (C403.7)

Demand Control Ventilation (C403.7.3). Another major change in HVAC mandatory controls requirements has to do with demand controlled ventilation. Demand controlled ventilation provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than the design occupancy. The code requires that demand controlled ventilation be provided for each zone with spaces greater than 500 ft² and with an average occupant load greater than 25 people/1,000 ft². This applies to HVAC systems that have an air-side economizer or an automatic modulating control of the outdoor air damper or a design outdoor airflow greater than 3,000 CFM. A number of important exceptions follow:

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

Enclosed Parking Garage Ventilation Control (C403.7.2). The IMC requires a minimum design ventilation rate of 0.75 CFM/ft^2. The IMC

allows another option where the garage exhaust cycles to a minimum standby rate of 0.05 CFM/ft^2 with automatic controls. Controls must be capable of staging fans to an average airflow of 50 percent or less of design capacity.

Energy-Recovery Ventilation Systems (C403.7.4). Energy-recovery ventilation (ERV) systems employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying, or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. This provision in the 2018 IECC establishes when energy recovery ventilation (ERV) systems are required based on the following table. Additional exceptions, not included in this summary, further establish when energy recovery is required.

Tables C403.7.4(1) and C403.7.4(2) Energy Recovery Requirement (Abridged for Montana)							
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%
Ventilation System Operating **Less** Than 8,000/Year Design Supply Fan Airflow Rate (CFM)							
≥ 28000	≥ 26500	≥ 11000	≥ 5500	≥ 4500	≥ 3500	≥ 2500	≥ 1500
Ventilation System Operating **Not Less** Than 8,000/Year Design Supply Fan Airflow Rate (CFM)							
≥ 200	≥ 130	≥ 100	≥ 80	≥ 70	≥ 600	≥ 50	≥ 400

Kitchen Exhaust Systems (C403.7.5). These provisions essentially eliminate use of short-circuit kitchen hoods by limiting replacement air that enters the exhaust hood to 10 percent of the exhaust airflow rate. Where total kitchen hood exhaust airflow rate is greater than 5,000 CFM, each hood must be a factory-built commercial exhaust hood listed by a nationally recognized testing laboratory in compliance with UL 710 and comply with some addional provisions. The code includes a table that establishes the maximum net exhaust flow rate in CFM per linear foot of hood length.

Automatic Control of HVAC Systems Serving Guest Rooms (C403.7.6). In Group R-1 buildings containing more than 50 guest rooms, each guestroom must have controls on each HVAC system capable of automatically raising the cooling setpoint and lowering the heating setpoint by at least 4°F from the occupant setpoint within 30 minutes of occupants leaving. The controls must automatically raise the cooling setpoint to at least 80°F and lower the heating setpoint to no higher than 60°F when the guest room is unrented or has not been continuously occupied for more than 16 hours.

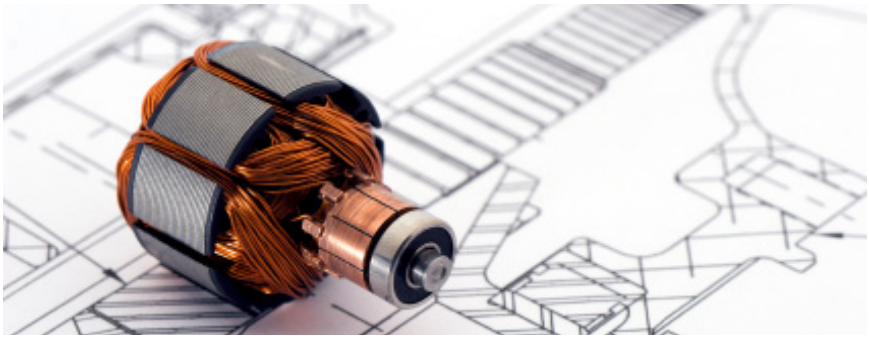
In Group R-1 buildings containing more than 50 guest rooms, guest room controls must be provided on each HVAC system to automatically turn off the ventilation and exhaust fans during unoccupied periods. Control options such as occupant sensors and captive key systems would meet the intent of these provisions.

Fans and Fan Controls (C403.8)

HVAC systems with a total HVAC fan motor nameplate exceeding five horsepower (hp) must comply with one of two options. This includes supply fans, exhaust fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling. Single-zone VAV systems must comply with the constant-volume fan power limitation.

The simplest compliance option is based on fan system motor nameplate hp. The more complex option is based on fan system brake hp, along with other design components. A table is provided in the code with compliance formulas for constant- and variable-volume systems based on one of these two options.

There are also provisions that limit the fan size and efficiency. The fan efficiency compliance is based on fan efficiency grade. Motors for fans at least 1/12 hp but less than one hp must be electronically commutated motors (ECM) or have a minimum efficiency of 70 percent.



Refrigeration Equipment (C403.10)

There is an extensive section in the IECC that addresses refrigeration systems. These provisions have been significantly reorganized for the 2018 IECC. The minimum efficiency requirements are included in two tables. One table addresses commercial refrigeration systems, while the other addresses commercial refrigerators and freezers. Walk-in coolers and walk-in freezers must meet these provisions starting in 2020.

Construction of HVAC System Elements (C403.11)

The provisions of this section establish how ducts, plenums, and piping are to be constructed and insulated. Factory installed components are generally exempt.

Supply and return air ducts and plenums must be insulated with at least R-6 insulation where located in unconditioned spaces and with not less than R-12 insulation where located outside the building. Where located within a building envelope assembly, the duct or plenum must be separated from the exterior or unconditioned spaces by at least R-12 insulation.

Medium-pressure and high-pressure ducts and plenums must be sealed as specified in the energy code. This includes duct systems operating at static pressure greater than 2 inches water gauge (w.g.).

Table C403.11.3, not included in this summary, specifies the thermal insulation required for piping serving heating and cooling systems.

Systems Located Outside the Buiding Envelope (C403.12)

Systems installed to provide heat outside a building must be radiant systems that are controlled by an occupancy sensor or a timer switch, so that the system is automatically turned off when the area is unoccupied.

Snow- and ice-melting systems must have automatic controls configured to shut off the system when the pavement temperature is above 50°F and precipitation is not falling, and an automatic or manual control to turn off the heat when the outdoor temperature is above 40°F.

Freeze-protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, must have automatic controls to shut off the systems when outdoor air temperatures are above 40°F or when the conditions of the protected fluid will prevent freezing. Heat tracing is also referred to as heat tape.

Service Water Heating (C404)

The service water-heating provisions have been reorganized in the 2018 IECC. Service water heating is the supply of hot water for purposes other than space heating, such as hot water for kitchens, restrooms, showers, laundries, and pools.

Service Water-Heating Equipment Performance Efficiency (C404.2). The minimum required efficiencies for service water-heating equipment are delineated in Table C404.2 of the code. The table is too large to include in its entirety, but an abridged version with values for smaller units is included on the following page. The National Appliance Energy Conservation Act (NAECA) establishes the efficiency requirements for smaller equipment. The efficiency requirement is given as Energy Factor (EF), thermal efficiency (E_t), or maximum standby loss (SL). The NAECA efficiency standards for smaller equipment must be achieved by the manufacturer and are included in the first five equipment types included in Table C404.2 in the IECC. The last five equipment types included in Table C404.2 set the efficiency requirements of equipment not covered by the NAECA.

Table C404.2 Minimum Performance of Water-Heating Equipment (Abridged)			
Equipment Type	Input Size Category	Subcategory	Performance Required[a, b]
Water heaters, electric	≤ 12 kW[d]	Tabletop[e], ≥ 20 gallons and ≤ 120 gallons	0.93 - 0.00132V, EF
		Resistance ≥ 20 gallons and ≤ 55 gallons	0.960 - 0.0003V, EF
		Grid-enabledf > 75 gallons and ≤ 120 gallons	1.061 - 0.00168V, EF
	> 12 kW	Resistance	(0.3 + 27/*V* m), %/h
	≤ 24 amps and ≤ 250 volts	Heat pump > 55 gallons and ≤ 120 gallons	2.057 - 0.00113V, EF
Storage water heaters, gas	≤ 75,000 Btu/h	≥ 20 gallons and ≤ 55 gallons	0.675 - 0.0015V, EF
		> 55 gallons and ≤ 100 gallons	0.8012 - 0.00078V, EF
	> 75,000 Btu/h and ≤ 155,000 Btu/h	< 4,000 Btu/h/gal	80% Et (Q/800 + 110 √*V*) SL, Btu/h
	> 155,000 Btu/h	< 4,000 Btu/h/gal	80% Et, (Q/800 + 110 √*V*)SL, Btu/h
Instantaneous water heaters	> 50,000 Btu/h and < 200,000 Btu/h[c]	≥ 4,000 (Btu/h)/gal and < 2 gal	0.82 - 0.00 19V, EF
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal < 10 gal	80% Et
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal	80% Et, (Q/800 + 110 √*V*)SL, Btu/h
a. Energy factor (EF) and thermal efficiency (E_t) are minimum requirements. In the EF equation, *V* is the rated volume in gallons.			
b. Standby loss (SL) is the maximum Btu/h based on a nominal 70°F temperature difference between stored water and ambient requirements. In the SL equation Q is the nameplate input rate in Btu/h. In the equations for electric water heaters, *V* is the rated volume in gallons and Vm is the measured volume in gallons. In the SL equation for oil and gas water heaters and boilers, V is the rated volume in gallons.			
c. Instantaneous water heaters with input rates below 200,000 Btu/h shall comply with these requirements where the water heater is designed to heat water to temperatures 180°F or higher.			
d. Electric water heaters with an input rating of 12 kW (40,950 Btu/hr) or less that are designed to heat water to temperatures of 180°F or greater shall comply with the requirements for electric water heaters that have an input rating			
e. A tabletop water heater is a water heater that is enclosed in a rectangular cabinet with a flat top surface not more than 3 feet in height.			

High-Input Service Water-Heating Systems (C404.2.1). If the total input rating of water-heating equipment in a new building is equal to or greater than 1,000,000 Btu/h, the equipment must have at least a 90-percent thermal efficiency. There are a number of exceptions that are not included in this summary.

Insulation of Piping (C404.4). Piping from the water heater to the fixture must be insulated in accordance with Table C403.11.3 in the code. Table C403.11.3 is not included in this code summary. The required insulation is given in thickness based on the pipe size, the operating temperature of the fluid, and the conductivity of the insulation. On both the inlet and outlet piping of a storage water heater or heated water-storage tank,

the piping to a heat trap or the first 8 feet of piping, whichever is less, must be insulated.

Heated Water-Supply Piping (C404.5). This provision limits the volume of water in the hot water-supply piping to reduce the amount of time required for hot water to get to the outlet. Two compliance options are provided. One option limits the length of the pipe based on size. The second option involves a calculation of the volume of water in the piping system.

Other Service Water-Heating Provisions. The energy code includes requierments for several other system features not addressed in this summary, including circulating and temperature maintenance systems, demand recirculation controls, drain water heat- recovery units, as well as pools and spas.

Electrical Power and Lighting

Lighting technology continues to evolve as the industry develops more efficient options. Increased use of light-emitting diode (LED) lighting is driving the industry. The energy code reflects these ongoing developments. Provisions addressing luminaire level lighting controls (LLLC) are now included in the 2018 IECC.

The code sets limits on the lighting wattage that may be used in specific situations and requires control strategies that limit use when light is not needed. The 2018 IECC continues the trend of maximizing the use of daylighting when feasible. This section of the IECC includes requirements

for indoor, as well as outdoor, lighting. It also includes provisions that address electrical metering, transformers, motors, and transportation systems, but those provisions are not addressed in this summary.

Dwelling Units Within Multifamily Buildings (C405.1). Dwelling units within multifamily buildings must comply with the lighting provisions of the residential portion of the energy code (Section R404.1: 90% of fixtures must have high-efficacy lamps). All other dwelling units must comply with either Section R404.1 or Section C405.2.4 (specific application controls) and C405.3 (Lighting Power Allowance). Sleeping units must comply with Section C405.2.4, and with Section R404.1 or C405.3.

Refrigeration Systems (C405.1). The lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers, and refrigerated warehouse freezers must comply with either C403.10.1 or C403.10.2.

Interior LIghting Controls (C405.2)

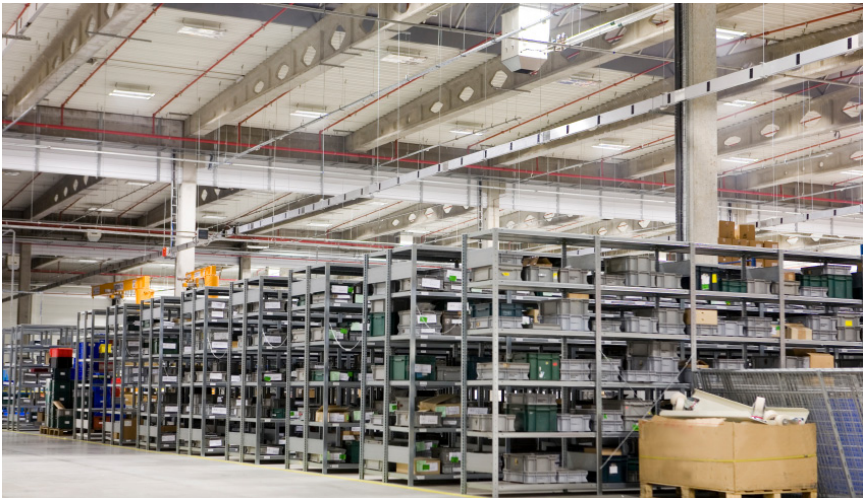
Lighting-control strategies must comply with either standard control requirements (C405.2.1 through C405.2.6), or LLLC (C405.2.1, C405.2.4, and C405.2.5).

Occupant Sensor Controls (C405.2.1). Occupant-sensor controls must be installed to control lights in the following spaces:

1. Classrooms/lecture/training rooms
2. Conference/meeting/multipurpose rooms
3. Copy/print rooms
4. Lounges/breakrooms
5. Enclosed offices
6. Open-plan office areas
7. Restrooms
8. Storage rooms
9. Locker rooms
10. Other spaces 300 ft^2 or less enclosed by floor-to-ceiling partitions
11. Warehouse storage areas

LLLC. LLLC is a control strategy where each fixture is equipped with its own sensors to maximize incremental control within very small areas. Fixtures equipped with LLLC monitor occupant activity to brighten or dim electric light levels when occupied or unoccupied to maintain the desired light level. If LLLC are installed, the provisions for *Occupant Sensor Controls* (C405.2.4), *Specific Application Controls* (C405.2.4) and *Manual Controls* (C405.2.5) still apply.

Occupant-Sensor Control Functions - General (C405.2.1.1). Controls must automatically turn off lights within 20 minutes after all occupants have left the space. Lighting may be turned on to no more than 50-percent power, either manually or automatically. Full automatic control is permitted in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would be a danger. Manual control must be available to occupants to turn lights off.



Occupant-Sensor Control Functions - Warehouses (C405.2.1.2). Lighting in aisleways and open areas must be controlled with occupant sensors that automatically reduce lighting power by not less than 50 percent when the areas are unoccupied. The occupant sensors must control lighting in each aisleway independently.

Occupant-Sensor Control Functions - Open Office Areas (C405.2.1.3). Spaces of less than 300 ft^2 must comply with general occupant-sensor control functions. In other open office areas, the control area may be no greater than 600 ft^2. The controls must automatically turn off general lighting within 20 minutes after all occupants have left.

The general lighting power in each control zone must be reduced, in a reasonably uniform manner, by at least 80 percent within 20 minutes of all occupants leaving.

Time-Switch Controls (C405.2.2). Areas of the building that do not have occupant-sensor controls must have time-switch controls. If the area has manual light-reduction control, time-switch controls are not required for direct patient-care spaces, where safety or security is an issue, spaces with continuous lighting, and shop and laboratory classrooms.

Spaces with time-switch controls must have light-reduction controls. Time-switch controls must have: 1) a minimum seven-day clock; 2) be capable of seven different day types per week; 3) have an automatic holiday "shutoff" feature; 4) have program backup capabilities; and 5) include an override switch with manual control that allows the lighting to remain on for not more than two hours. Any individual override switch may control the lighting for an area no larger than 5,000 ft^2. There are exceptions for mall concourses, auditoriums, sales areas, manufacturing facilities, and sports arenas.

Light-Reduction Controls (C405.2.2.2). Spaces required to have light-reduction controls must have a manual control to reduce the lighting load uniformly by at least 50 percent. This may be achieved by: 1) controlling all lamps or fixtures; 2) dual switching of alternate rows of fixtures, alternate fixtures, or alternate lamps; 3) switching the middle lamp luminaires independently of the outer lamps; or 4) switching each luminaire or each lamp. Light-reduction controls are not required in daylight zones with daylight-responsive controls.

Daylight-Responsive Controls (C405.2.3). Controls are required for electric lights within daylight zones in sidelit zones with more than 150 watts of general lighting and in toplit zones with more than 150 watts of general lighting. There are a number of exceptions for direct-care healthcare facilities, Group A-2, and M-1 occupancies. There is also an exception based on calculation of total connected lighting power.

Daylight-responsive controls for each space must control lights in toplit zones independently of lights in sidelit zones. Controls must allow calibration with ready access from within that space.

Where located in offices, classrooms, laboratories, and library reading rooms, daylight-responsive controls must dim lights continuously from full light output to 15 percent of full light output or lower. Controls must allow all controlled lights to be shut off.

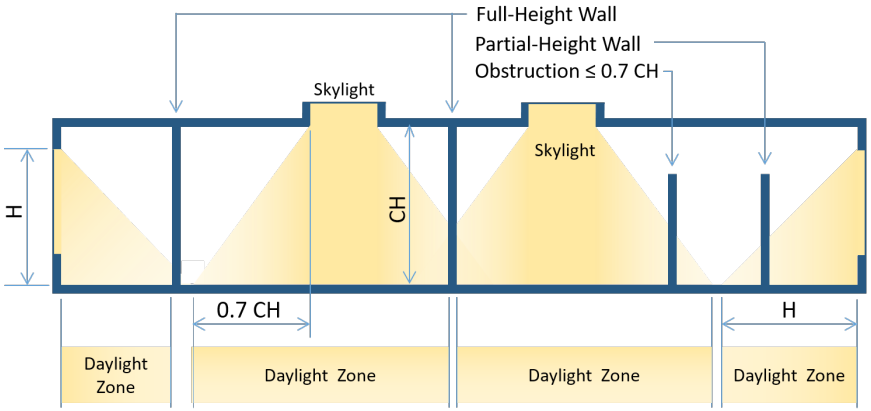
Lights in sidelit zones facing different cardinal orientations (within 45 degrees of due north, east, south, west) must be controlled independently of each other. Up to 150 watts of lighting in each space is permitted to be controlled together with lighting in a daylight zone facing a different cardinal orientation.

Sidelit Zone (C405.2.3.2). A sidelit tone is the floor area adjacent to vertical fenestration. The definition of sidelit daylight zones is illustrated in the diagrams on the following pages. If the distance from the vertical fenestration to any building or geological formation that would block access to daylight is greater than the height from the bottom of the fenestration to the top of the building or geologic formation, then the sidelit zone is not considered a daylight zone. The visible transmittance of the fenestration must be 0.20 or greater for the sidelit zone to be considered a daylight zone.

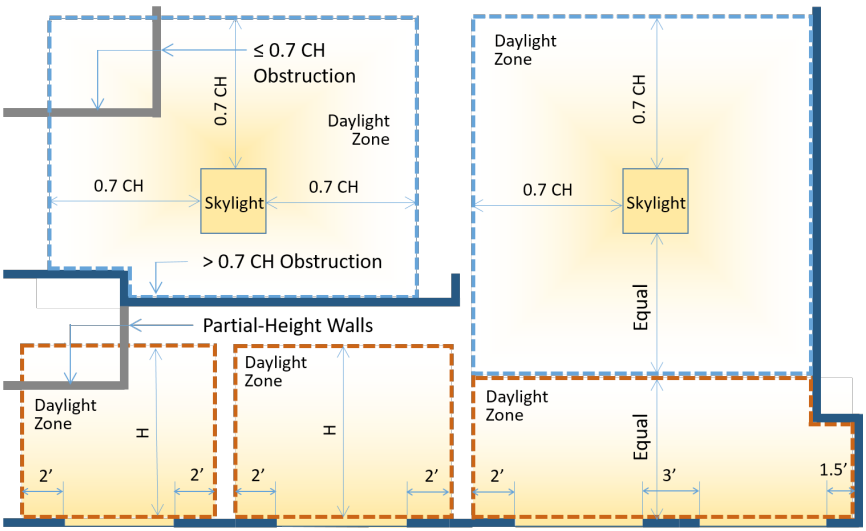
Toplit Zone (C405.2.3.3). A toplit zone is the floor area underneath a roof fenestration assembly, such as a skylight or rooftop monitor. The definition of toplit daylight zones is illustrated in the diagrams on the

following pages. To meet the definition of a toplit daylight zone, the direct sunlight must not be blocked from hitting the roof fenestration at the peak solar angle on the summer solstice by buildings or geological formations. The product of the visible transmittance of the roof fenestration assembly and the area of its rough opening divided by the area of the toplit zone must be 0.008 or greater to meet the definition of a toplit daylight zone.

Sidelit and Toplit Daylight Zones - Section View

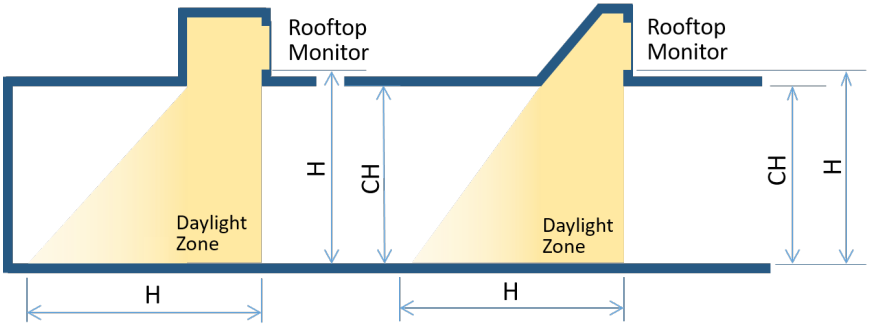


Sidelit and Toplit Daylight Zones - Plan View

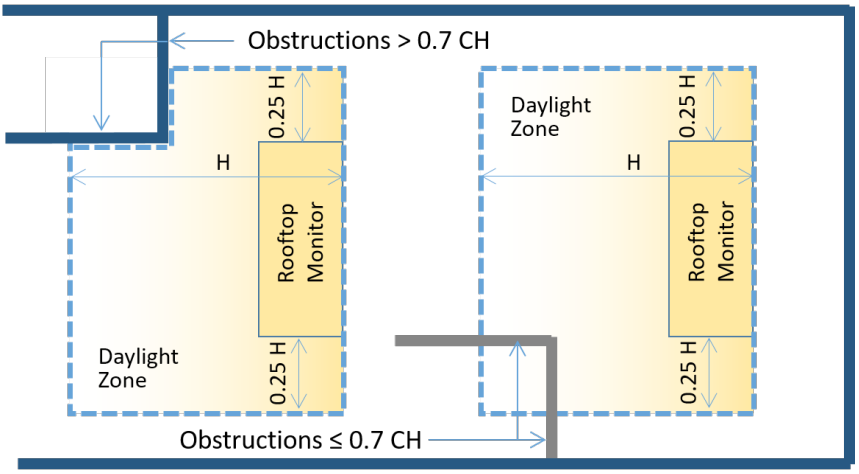


Specific Application Controls (C405.2.4). Display and accent lighting, lighting in display cases, supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, must be controlled by an occupant sensor or a time-switch control. A manual control must be provided to control such lighting separately from the general lighting in the space.

Rooftop Monitor Daylight Zones - Section View



Rooftop Monitor Daylight Zones - Plan View



Sleeping units must have control devices or systems that are configured to automatically switch off all permanently installed fixtures and switched receptacles within 20 minutes after all occupants leave the unit. Exceptions include lighting and switched receptacles controlled by

card-key controls, and spaces where patient care is directly provided. Permanently installed fixtures within dwelling units must be provided with occupant-sensor and light-reduction controls. Lighting for nonvisual applications, such as plant growth and food warming, must have time-switch controls that are independent of other lighting within the room or space.

*Manual Controls (*C405.2.5). Where required, manual light controls must be in a location with ready access for occupants. They must be located where the controlled lights are visible, or must identify the area served by the lights and indicate their status.

Interior Lighting Power Allowance (C405.3)

The allowable interior lighting power may be determined by either the *Building Area Method* or the *Space-by-Space Method*. The connected power associated with the following lighting equipment and applications is not included in calculating total connected lighting power:

1. Television broadcast lighting for playing areas in sports arenas
2. Emergency lighting automatically off during normal operation
3. Lighting in spaces specifically for special-lighting-needs occupants
4. Casino gaming areas
5. Mirror lighting in dressing rooms
6. Task lighting for medical or dental purposes
7. Display lighting in galleries, museums, and monuments
8. Lighting for theatrical purposes
9. Lighting for photographic processes
10. Lighting integral to equipment or instrumentation
11. Task lighting for plant growth or maintenance
12. Advertising or directional signage
13. Lighting for food warming
14. Lighting equipment that is for sale
15. Lighting demonstration equipment in lighting-education facilities
16. Lighting approved because of safety considerations
17. Retail display window lighting enclosed by ceiling-height partitions

18. Furniture-mounted task lighting with automatic shutoff
19. Exit signs

Building Area Method (C405.3.2.1). The Building Area Method interior lighting power allowance is the floor area for each building area type multiplied by the value from the Building Area Method Table. An "area" is defined as all contiguous spaces that accommodate or are associated with a single building area type as listed in the table. Each building area type is treated as a separate area.

Space-by-Space Method (C405.3.2.2). The Space-by-Space Method interior lighting power allowance is the sum of the floor areas of each space multiplied by the value for that space type in the Space-by-Space Table that most closely represents the proposed use of the space. Once the total allowance is calculated, the actual installed wattage in each space need not adhere to the values calculated for a particular space.

When using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions in two cases. The additional lighting must be automatically controlled, separately from the general lighting, to be turned off during nonbusiness hours. This additional power may only be used for the specified fixtures.

Sales Areas Additional Allowance. The additional allowance, in sales areas to highlight merchandise, is 1,000 watts plus the merchandise lighting allowance for each of the four retail area types noted below:

Retail Area 1: All other areas (0.45 W/ft^2)

Retail Area 2: Vehicles, sporting goods, small electronics (0.45 W/ft^2)

Retail Area 3: Furniture, clothing, cosmetics, artwork (1.05 W/ft^2)

Retail Area 4: Jewelry, crystal, china (1.87 W/ft^2)

Decoration or Highlighting. An additional allowance is permitted for spaces where lighting is installed for the purpose of decorative appearance or for highlighting art or exhibits. This allowance is in addition to the general lighting. The additional lighting allowance is 0.9 W/ft^2 in lobbies and 0.75 W/ft^2 in other spaces.

TABLE C405.3.2(1)

Interior Lighting Power Allowance: Building Area Method

Building Area Type	LPD (w/ft^2)
Automotive facility	0.71
Convention center	0.76
Courthouse	0.90
Dining: bar lounge/leisure	0.90
Dining: cafeteria/fast food	0.79
Dining: family	0.78
Dormitory [a, b]	0.61
Exercise center	0.65
Fire station [a]	0.53
Gymnasium	0.68
Healthcare clinic	0.82
Hospital	1.05
Hotel/Motel [a, b]	0.75
Library	0.78
Manufacturing facility	0.90
Motion picture theater	0.83
Multifamily [c]	0.68
Museum	1.06
Office	0.79
Parking garage	0.15
Penitentiary	0.75
Performing arts theater	1.18
Police station	0.80
Post office	0.67
Religious building	0.94
Retail	1.06
School/university	0.81
Sports arena	0.87
Town hall	0.80
Transportation	0.61
Warehouse	0.48
Workshop	0.90

TABLE C405.3.2(2)

Interior Lighting Power Allowances: Space-by-Space Method

Common Space Types [a]	LPD (w/ft^2)	Common Space Types [a]	LPD (w/ft^2)
Atrium		Sales area	1.22
Less than 40 feet in total height	0.03/ft	Seating area, general	0.42
Greater than 40 feet in height	0.40 + 0.02/ft	Stairway (see Space Containing Stairway)	
Audience seating area		Stairwell	0.58
In an auditorium	0.63	Storage room	0.46
In a convention center	0.82	Vehicular maintenance area	0.56
In a gymnasium	0.65	Workshop	1.14
In a motion picture theater	1.14		
In a penitentiary	0.28		
In a performing arts theater	2.03	**Building Type Specific Space Types [a]**	**LPD (w/ft^2)**
In a religious building	1.53	Automotive (see Vehicular)	
In a sports arena	0.43	Convention center—exhibit space	0.88
Otherwise	0.43	Dormitory—living quarters[c,d]	0.54
Banking activity area	0.86	Facility for the	
Breakroom (See Lounge/breakroom)		In a chapel [i]	1.06
Classroom/lecture hall/training room		In a recreation room [i]	1.80
In a penitentiary	1.34	Fire Station—sleeping quarters [c]	0.20
Otherwise	0.96	Gymnasium/fitness center	
Computer Room	1.33	In an exercise area	0.50
Conference/meeting/multipurpose	1.07	In a playing area	0.82
Copy/print	0.56	Healthcare facility	
Corridor		In an exam/treatment room	1.68
Facility for visually impaired [b,i]	0.92	In an imaging room	1.06
In a hospital	0.92	In a medical supply room	0.54
In a manufacturing facility	0.29	In a nursery	1.00
Otherwise	0.66	In a nurse's station	0.81
Courtroom	1.39	In an operating room	2.17
Dining		In a patient room[c]	0.62
In bar/lounge or leisure dining	0.93	In a physical therapy room	0.84
In cafeteria or fast food	0.63	In a recovery room	1.03
Facility for visually impaired [b,i]	2.00	Library	
In family dining	0.71	In a reading area	0.82
In a penitentiary	0.96	In the stacks	1.20
Otherwise	0.63	Manufacturing facility	
Electrical/mechanical room	0.43	In a detailed manufacturing area	0.93
Emergency vehicle garage	0.41	In an equipment room	0.65
Food preparation area	1.06	Extra-high-bay area (>50' height)	1.05
Guestroom [c, d]	0.77	High-bay area (25-50' height)	0.75
Laboratory		Low-bay area (< 25' height)	0.96
In or as a classroom	1.20	Museum	
Otherwise	1.45	In a general exhibition area	1.05
Laundry/washing area	0.43	In a restoration room	0.85
Loading dock, interior	0.58	Performing arts theater—dressing	0.36
Lobby		Post office—sorting area	0.68
For an elevator	0.68	Religious buildings	
Facility for visually impaired [b,i]	2.03	In a fellowship hall	0.55
In a hotel	1.06	In a worship/pulpit/choir area	1.53
In a motion picture theater	0.45	Retail facilities	
In a performing arts theater	1.70	In a dressing/fitting room	0.50
Otherwise	1.00	In a mall concourse	0.90
Locker room	0.48	Sports arena—playing area	
Lounge/breakroom		For a Class I facility[e]	2.47
In a healthcare facility	0.78	For a Class II facility[f]	1.96
Otherwise	0.62	For a Class III facility[g]	1.70
Office		For a Class IV facility[h]	1.13
Enclosed	0.93	Transportation facility	
Open plan	0.81	In a baggage/carousel area	0.45
Parking area, interior	0.14	In an airport concourse	0.31
Pharmacy area	1.34	At a terminal ticket counter	0.62
Restroom		Warehouse—storage area	
Facility for visually impaired [b,i]	0.96	Medium to bulky, pallet-sized	0.35
Otherwise	0.85	For smaller, hand-carried items	0.69

Footnotes to Building Area Method Table:

a. Where sleeping units are excluded from lighting power calculations, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.

b. Where dwelling units are excluded from lighting power calculations, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.

c. Dwelling units are excluded. Neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.

Footnotes to Space-by-Space Method Table:

a. In cases where both a common space type and a building area-specific space type are listed, the building area-specific space type applies.

b. A *Facility for the Visually Impaired* is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support, or people with special visual needs.

c. Where sleeping units are excluded from lighting power calculations, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.

d. Where dwelling units are excluded from lighting power calculations, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.

e. Class I facilities consist of professional facilities; and semiprofessional, collegiate, or club facilities with seating for 5,000 or more spectators.

f. Class II facilities consist of collegiate and semiprofessional facilities with seating for fewer than 5,000 spectators; club facilities with seating for between 2,000 and 5,000 spectators; and amateur league and high-school facilities with seating for more than 2,000 spectators.

g. Class III facilities consist of club, amateur league, and high-school facilities with seating for 2,000 or fewer spectators.

h. Class IV facilities consist of elementary-school and recreational facilities; and amateur league and high-school facilities without provision for spectators.

Exterior Lighting

Exterior lighting controls (C405.2.6). Lighting must be automatically turned off when adequate daylight is present. Building facade and landscape lighting must automatically shut off from one hour after business closing to one hour before business opening.

Lighting for covered vehicle entrances and exits from buildings and parking structures where required for eye adaptation are exempt from lighting controls provisions. Lighting controlled from within dwelling units is also exempted.

Lighting that is not automatically turned off based on business hours must be controlled so that the total wattage is automatically reduced by at least 30 percent from midnight to 6 a.m., from one hour after business closing to one hour before business opening, or during any time where activity has not been detected for 15 minutes.

Time-switch controls for exterior lighting must be capable of being programmed for at least seven days, be capable of being set for seven different day types per week, must incorporate an automatic holiday setback, and must have program backup capabilities.

Exterior Lighting Power Allowance (C405.4). The following applications are not included in the total connected exterior building lighting power:

1. Lighting approved because of safety considerations
2. Emergency lighting automatically off during normal business
3. Exit signs
4. Transportation-related signal, directional, and marker lighting
5. Advertising or directional signage
6. Integral to equipment or instrumentation
7. Theatrical purposes
8. Athletic playing areas
9. Temporary lighting
10. Industrial production, material handling, transportation sites, and associated storage areas
11. Theme elements in theme/amusement parks
12. Used to highlight features of art, monuments, or the national flag
13. Lighting for water features and swimming pools
14. Lighting controlled from within dwelling units

The total exterior lighting power allowance is the sum of the base site allowance plus the individual allowances for areas that are to be illuminated per the Lighting Power Allowances for Building Exteriors Table (C405.4.2(2)). The exterior lighting zones are defined in the following table.

TABLE C405.4.2(1)

Exteror Lighting Zones	
Zone 1	Developed areas of national parks, state parks, forest land, and rural areas
Zone 2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use, and residential mixed-use areas
Zone 3	All other areas not classified as lighting zone 1, 2, or 4
Zone 4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

Additional lighting power allowances for building exteriors are shown in the Individual Lighting Power Allowances for Building Exteriors Table (C405.4.2(3)). The additional power allowed by this table may only be used for the fixtures serving these applications.

TABLE C405.4.2(2)

Lighting Power Allowances for Building Exteriors

	Lighting Zones			
	Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance	350 W	400 W	500 W	900 W
Uncovered Parking Areas				
Parking areas and drives	0.03 W/ft^2	0.04 W/ft^2	0.06 W/ft^2	0.08 W/ft^2
Building Grounds				
Walkways and ramps less than 10 feet wide	0.5 W/LF	0.5 W/LF	0.6 W/LF	0.7 W/LF
Walkways and ramps 10 feet wide or greater, plaza areas, special feature areas	0.1 W/ft^2	0.1 W/ft^2	0.11 W/ft^2	0.14 W/ft^2
Dining areas	0.65 W/ft^2	0.65 W/ft^2	0.75 W/ft^2	0.95 W/ft^2
Stairways	0.6 W/ft^2	0.7 W/ft^2	0.7 W/ft^2	0.7 W/ft^2
Pedestrian tunnels	0.12 W/ft^2	0.12 W/ft^2	0.14 W/ft^2	0.21 W/ft^2
Landscaping	0.3 W/ft^2	0.4 W/ft^2	0.4 W/ft^2	0.4 W/ft^2
Building Entrances and Exits				
Pedestrian and vehicular entrances and exits	14 W/LF of opening	14 W/LF of opening	21 W/LF of opening	21 W/LF of opening
Entry canopies	0.2 W/ft^2	0.25 W/ft^2	0.4 W/ft^2	0.4 W/ft^2
Loading docks	0.35 W/ft^2	0.35 W/ft^2	0.35 W/ft^2	0.35 W/ft^2
Sales Canopies				
Free-standing and attached	0.4 W/ft^2	0.4 W/ft^2	0.6 W/ft^2	0.6 W/ft^2
Outdoor Sales				
Open areas (including vehicle sales lots)	0.02 W/ft^2	0.02 W/ft^2	0.35 W/ft^2	0.05 W/ft^2
Street frontage for vehicle sales lots in addition to "open area" allowance	No Allowance	7 W/LF	7 W/LF	21 W/LF

W = Watt; LF = Linear Feet

TABLE C405.4.2(3)

Individual Lighting Power Allowances for Building Exteriors				
	Lighting Zones			
	Zone 1	Zone 2	Zone 3	Zone 4
Building facades	No Allowance	0.075 W/ft^2 of gross above-grade wall area	0.113 W/ft^2 of gross above-grade wall area	0.15 W/ft^2 of gross above-grade wall area
Automated teller machines (ATM) and night depositories	135 W per location plus 45 W per additional ATM per location			
Uncovered entrances and gate-house inspection stations at guarded facilities	0.5 W/ft^2 of area			
Uncovered loading areas for law enforcement, fire, ambulance, and other emergency-service vehicles	0.35 W/ft^2 of area			
Drive-up windows and doors	200 W per drive through			
Parking near 24-hour retail entrances	400 W per main entry			

W = Watt

Additional Efficiency Packages (C406)

If the prescriptive path is used to comply with the code, then at least one of the eight additional efficiency package options must be included. There were only three addional efficiency package options in the 2012 IECC. The Additional Efficiency Package requirement is not applicable if the Total Building Performance path of the IECC or the ASHRAE 90.1 compliance paths are used.

Tenant spaces must comply with either package options 2, 3, 4, 6, or 7. Alternatively, tenant spaces comply if the entire building is in compliance. Previously occupied tenant spaces must comply through the Existing Buildings Chapter.

Package 1. More-Efficient HVAC Equipment (C406.2)

HVAC equipment must exceed the basic minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by 10 percent, in addition to the other requirements of Section C403.

Package 2. Reduced Lighting Power (C406.3)

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

Package 3. Enhanced Digital Lighting Controls (C406.4)

Interior lighting in the building must have enhanced lighting controls located, scheduled, and operated in accordance with Section C405.2.2. This option essentially requires a digital control system that provides continuous dimming and control of individual fixtures. The code text includes six required design features. Luminaire-Level Lighting Control (LLLC) systems can play a major role in complying with this package.

Package 4. On-Site Renewable Energy (C406.5)

On-site renewable energy systems must be either at least 1.71 Btu/h per ft^2 or 0.50 watts per ft^2 of conditioned floor area; or not less than 3 percent of the energy used for building mechanical and service water-heating equipment and lighting.

Package 5. Dedicated Outdoor Air System (C406.6)

Appropriate building types may install a Dedicated Outdoor Air System (DOAS). A DOAS is an independent ventilation system designed to provide 100-percent outdoor air to each individual occupied space, as specified by the IMC. The ventilation system must also be capable of total energy recovery. A DOAS system conditions ventilation air seperately from the building primary HVAC system that meets the envelope and internal gain thermal demand.

Package 6. Reduced Energy Use - Service Water Heating (C406.7)

Some heat recovery from condensers for certain applications is required by C403.9.5. This additional efficiency package option requires that 100 percent of the building's annual hot water requirements be met if that provision already applies. If C403.9.5 does not apply, then 60 percent of the building's annual hot water requirements must be met from either of two features:

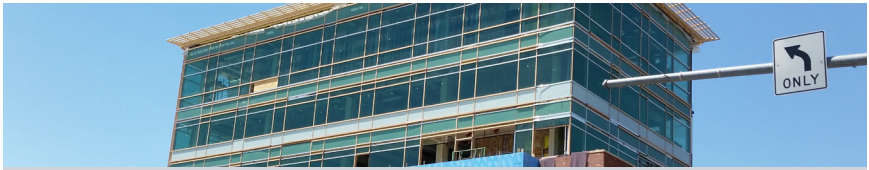
1. Waste-heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment

2. On-site renewable-energy water-heating system

This efficiency package may be applied to only the following:

- Group R-1: Boarding houses, hotels, or motels
- Group I-2: Hospitals, psychiatric hospitals, and nursing homes

- Group A-2: Restaurants and banquet halls or buildings containing food-preparation areas
- Group F: Laundries
- Group R-2. Multifamily buildings with permanent residents
- Group A-3: Health clubs and spas
- Buildings showing a service hot-water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407



Package 7. Enhanced Envelope Performance (C406.8)

The total UA of the building thermal envelope must be at least 15 percent below the total UA of the building thermal envelope designed to the prescriptive envelope requirements. The UA is the product of the areas and thermal characteristics considering all assembly components.

Package 8. Reduced Air Infiltration (C406.9)

The measured air-leakage rate of the building envelope must be no greater than 0.25 CFM/ft^2 of envelope surface area under a pressure differential of 75 Pa. The surface area is the sum of the above- and below-grade building envelope. Air infiltration must be verified by whole-building pressurization testing conducted in accordance with ASTM E779 or ASTM E1827 by an independent third party. Whole-building tightness testing to 0.4 CFM/ft^2 is the basic code requirement for compliance.

Commissioning

Section C408 of the 2018 IECC details the requirements for mechanical and lighting systems functional testing and commissioning. Commissioning is a systematic procedure of verification and documentation. This section has been significantly revised. More detailed requirements for lighting functional testing have been added. The primary goal of commissioning is to ensure that a building's HVAC systems are installed and operating as intended.

Mechancial Systems and Service Water Heating (C408.20)

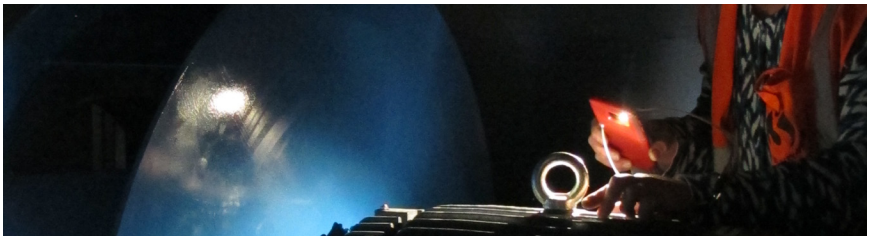
Commissioning requirements include:

- Preliminary Commissioning Report
- Drawings and Manuals
- System Balancing Report
- Final Commissioning Report
- Functional Testing of HVAC, Lighting, and Electrical Systems

Building Operations and Maintenance Information (C408.1.1).
Building operations and maintenance documents provided to the owner must include manufacturers' information, specifications and recommendations; programming procedures and data points; narratives; and other means of illustrating how the building, equipment, and systems are intended to be installed, maintained, and operated. Required regular maintenance actions must be clearly stated on a readily visible label.

Prior to the final mechanical and plumbing inspections, the registered design professional or approved agency must provide evidence of mechanical systems commissioning and completion. Construction documents must indicate provisions for commissioning and completion requirements in accordance with the code. Copies of all documentation must be given to the owner or owner's authorized agent and made available to the code official upon request.

There are two exemptions from the mechanical commissioning requirements. In buildings where the total mechanical equipment capacity is less than 480,000 Btu/h cooling capacity and 600,000 Btu/h heating capacity, no commissioning is required. HVAC systems that serve individual dwelling units and sleeping units are also exempt.



Commissioning Plan (C408.2.1). The Commissioning Plan must include:

- A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities
- A listing of the specific equipment, appliances, or systems to be tested and a description of the tests to be performed
- Functions to be tested, including but not limited to, calibrations and economizer controls
- Conditions under which the test will be performed (winter and summer design conditions and full outside air conditions)
- Measurable criteria for performance

Documentation (C408.2.5). The construction documents must specify that the System Balancing Report and the Final Comminssioning Report will be provided to the building owner or owner's authorized agent within 90 days of the date of receiving the certificate of occupancy.

System Balancing Report (C408.2.2). The written report must include air- and water-flow rates measured and adjusted to deliver final flow rates within the tolerances provided in the product specifications. Requirements for the air and hydronic systems balancing portions of the report are detailed in this section of the code but not included in this code summary.

Preliminary Commissioning Report (C408.2.4). The preliminary commissioning report of test procedures and results must be completed and certified by the registered design professional or approved agency. It must be provided to the owner or owner's authorized agent. Refer to the required Commissioning Compliance Checkist included on page 54 of this code summary. The report must include:

- Deficiencies found during testing that have not been corrected at the time of report preparation
- Deferred tests that cannot be performed at the time of report preparation because of climatic conditions
- Climatic conditions required for performance of the deferred tests
- Results of functional performance tests
- Functional performance test procedures used during the commissioning process

Buildings, or portions of buildings, are not eligible for final inspection until the code official has received the Preliminary Commissioning Report from the building owner or owner's authorized agent. The code official may require that a copy be provided for review to the building department.

Final Commissioning Report (C408.2.5.2). A Final Commissioning Report must be delivered to the building owner or owner's authorized agent. This report of test procedures and results is to be organized with mechanical system and service hot-water system findings in separate sections. The report must include:

- Results of functional performance tests
- Disposition of deficiencies found during testing, including details of corrective measures used or proposed
- Functional performance test procedures used during the commissioning process, including measurable criteria for test acceptance. Deferred tests that cannot be performed at the time of report preparation due to climatic conditions may be excluded.

Lighting

Functional Testing of Lighting Controls (C408.3). Before passing final inspection, the registered design professional must provide evidence that the lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's instructions. Occupant-sensor controls, time-switch controls, and daylight-responsive controls each have specific testing procedures detailed.

Documentation (C408.3.2). The construction documents must specify that the required documentation will be provided to the building owner or owner's authorized agent within 90 days of recieving the certificate of occupancy. Construction documents must include the location and catalogue number of each piece of equipment. An operating and maintenance manual must be provided that includes the following:

- Name and address of service agency for installed equipment
- Systems operations narratives, including recommended setpoints
- Submittal data indicating all selected options for each piece of lighting equipment and lighting controls
- Operations and maintenance manuals for each piece of lighting equipment with required routine maintenance actions, cleaning, and recommended relamping clearly identified
- A schedule for inspecting and recalibrating all lighting controls

Report (C408.3.2.3). A report of test results must include the results of functional performance tests and disposition of deficiencies found during testing, including details of corrective measures used or proposed.

Occupant-Sensor Controls (C408.3.1.2). Occupant-sensor controls testing procedures must include verification that the sensor has been located and aimed according to manufacturer's instructions. Each sensor must be tested, if there seven or fewer on the project. If more than seven sensors are present, at least 10 percent of sensors and at least one combination of each sensor type and space geometry must be tested. Sensor testing includes the following:

- The controlled lights turn off or down to the permitted level within the required time
- For auto-on occupant-sensor controls, the lights turn on to the permitted level when an occupant enters the space

- For manual-on occupant-sensor controls, the lights turn on only when manually activated
- The lights are not incorrectly turned on by movement in adjacent areas or by HVAC operation

Time-Switch Controls C408.3.1.2. Where time-switch controls are provided, the following procedures must be performed:

- Confirm that the time-switch control is programmed with accurate weekday, weekend and holiday schedules
- Provide documentation to the owner of time-switch controls programming
- Verify the correct time and date in the time switch
- Verify that any battery back-up is installed and energized
- Verify that the override time limit is set to not more than two hours
- Simulate occupied condition
- Simulate unoccupied condition

Daylight Responsive Controls (C408.3.1.3). Verify that:

1. Control devices have been properly located, field calibrated, and set for accurate setpoints and threshold light levels

2. Daylight controlled lighting loads adjust to light-level setpoints in response to available daylight

3. The calibration adjustment equipment is located for ready access only by authorized personnel

Commissioning Compliance Checklist

Project Information: _____Project Name:_____

Project Address: _____

Commissioning Authority: _____

Commissioning Plan (Section C408.2.1)

- ☐ Commissioning Plan was used during construction and includes all items required by Section C408.2.1.
- ☐ Systems Adjusting and Balancing has been completed.
- ☐ HVAC Equipment Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on:

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

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

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

  _____
- ☐ Service Water-Heating System Functional Testing has been executed. If applicable, deferred and follow-up testing is scheduled to be provided on:_____
- ☐ Manual, record documents, and training have been completed or scheduled.
- ☐ Preliminary Commissioning Report submitted to owner and includes all items required by Section C408.2.4.

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

Signature of Building Owner or Owner's Representative

_____ Date_____

Existing Buildings

This new chapter in the 2018 IECC compiles provisions regarding the alteration, repair, addition, and change of occupancy of existing buildings into a single location. The IECC code allows an addition to a building without requiring that the existing building comply with the current code. However, any addition or alteration must comply with all applicable provisions of the energy code. In other words, the energy code is not retroactive to the existing portions of the building unless changes are made to those building elements.

Compliance in Historic Buildings (C501.6). Alteration, repair, or change of occupancy of historic buildings must comply with the energy code unless the code provision would threaten or destroy the reason the building is historic. Where there is such a finding, only that provision may be waived. The remainder of the energy code still applies. To qualify as an historic building, a report must be submitted to the code official that is signed by a registered design professional or a representative of the State Historic Preservation Office.

Additions (C502)

The code's definition of an addition includes an increase in conditioned space, increase in building height, or an increase in the number of stories. The code allows compliance by the addition alone or by the addition and the existing building together as a single building. ASHRAE 90.1 may be used as an alternative compliance path to the IECC. Additions, complying under the IECC, must comply with the prescriptive requirements of Sections C502.2.1 through C502.2.6.2.

Vertical Fenestration (C502.2.1). Vertical fenestration in additions must comply with the maximum area, maximum U-factor, and maximum SHGC provisions of Section 402. Additions that result in a total building vertical fenestration area exceeding 30 percent of total gross wall area of the addition, or the addition plus the existing building, must comply with the 40 percent allowed by installation of daylight-responsive controls. If the total vertical fenestration exceeds 40 percent of the total building wall area, then the Component Performance Alternative (C402.1.5) or the Total Building Performace (C407) approach must be used for compliance.

Skylights (C502.2.2). Skylights in additions with an area less than or equal to the basic allowance of 3 percent of roof area must comply using the Component Performance Alternative (C402.1.5). Additions that result in a total building skylight area or addition skylight area exceeding 3 percent of roof area must comply with the 6 percent allowed by installation of daylight-responsive controls. If the total skylight area exceeds 6 percent of the total roof area, then the Component Performance Alternative (C402.1.5) or the Total Building Performace (C407) approach must be used for compliance.

Mechanical Systems (C502.2.3). New building mechanical systems and equipment that are part of the addition and serve the addition's heating, cooling, and ventilation needs must comply with the basic energy code requirements for mechancial systems. New service water-heating equipment, controls, piping, pools, and in-ground permanently installed spas must comply with Section C404.

Lighting (C502.2.6). New lighting systems including total interior lighting power, and total exterior lighting power for the addition or the total building must comply with the basic requirements of Section C405.

Alterations (C503)

Alterations to existing systems must comply with the provisions of the code as those provisions relate to new construction without requiring

the unaltered portions of the existing building or building systems to comply. There are a number of significant exceptions, provided that the energy use of the building is not increased:

1. Storm windows installed over existing windows
2. Surface-applied window film installed on existing single-pane windows if the code does not require the glazing to be replaced
3. Existing ceiling, wall, or floor cavities exposed during construction, provided that these cavities are filled with insulation
4. Construction where the existing roof, wall, or floor cavity is not exposed
5. Roof recover
6. Air barriers are not required for roof recover and roof replacement where the alterations or renovations do not include changes to the remainder of the building envelope.

Heating and cooling systems, economizers, and service hot-water systems must comply with the basic new construction provisions of the code.

Change in Space Conditioning (C503.2). Any nonconditioned or low-energy space that is altered to become conditioned is required to be brought into full compliance. There are exceptions for the Component Performance Alternative or Total Building Performane compliance paths.

Building Envelope (C503.3). New building envelope assemblies that are part of the alteration must comply with the code requirements for new construction. There is an exception when the existing building exceeds the fenestration area limitations for new construction prior to the alteration if there is no increase in fenestration area.

Roof Replacement (C503.3.1). Roof replacements must comply with the code prescriptive requirements where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck.

Vertical Fenestration (C503.3.2). Vertical fenestration in additions must comply with the maximum area, maximum U-factor, and maximum SHGC provisions of C402. Alterations that result in a total building vertical fenestration area exceeding 30 percent of total gross wall area of the addition, or the addition plus the existing building, must comply with the 40 percent allowed by installation of daylight-responsive controls in the adjacent spaces only. If the total vertical fenestration after the alteration exceeds 40 percent of the total building wall area, then the Component Performance Alternative (C402.1.5) or the Total Building Performace (C407) approach must be used for compliance.

Skylight Area (C503.3.3). Skylights added in an alteration with an area less than or equal to the basic allowance of 3 percent of roof area must comply using the code's prescriptive requirements. Alterations that result in a total building skylight area exceeding 3 percent of roof area must comply with the 6 percent allowed by installation of daylight-responsive controls. If the total skylight area exceeds 6 percent of the total roof area, then the Component Performance Alternative (C402.1.5) or the Total Building Performace (C407) approach must be used for compliance.

Lighting Systems (C503.6). New lighting systems that are part of the alteration must comply with the basic new-building provisions of Section C405. An exception to this requirement is if less than 10 percent of the fixtures in a space are replaced, provided the alterations do not increase the installed interior lighting power.

Repairs (C504)

Work on nondamaged building components that is necessary for the required repair of damaged components are not subject to the requirements for alterations. Where a building was constructed to comply with ASHRAE 90.1, repairs must comply with that standard. For purposes of the energy code, the following are considered repairs:

1. Glass-only replacements in an existing sash and frame

2. Roof repairs
3. Air barriers are not required for roof repair where the repairs to the building do not include changes to the remainder of the building envelope.
4. Installation of a vestibule or revolving door is not required when replacing an existing exterior door if an existing vestibule is not removed.
5. Replacement of only the bulb, the ballast, or both within existing fixtures, if the replacement does not increase the installed interior lighting power

Change of Occupancy (C505)

Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy must comply with the energy code. Where the use in a space changes from one use to another in the interior lighting power tables of Section C405, the installed lighting wattage must comply with provisions of that section.

Where the space undergoing a change in occupancy or use is in a building with a fenestration area that exceeds the maximum area allowed by C402.4.1, the space is exempt from Section C402.4.1 as long as there is no increase in fenestration area. The code includes some exceptions when using the Component Performance Alternative or Total Building Performance for compliance.

References and Resources

2018 International Energy Conservation Code (IECC) and 2018 International Residential Code (IRC)

2018 International Energy Conservation Code International Code Council, Inc.
www.iccsafe.org

ASTM E779 -10 Standard Test Methods for Determining Air Leakage Rate by Fan Pressurization

ASTM International, www.astm.org

ASTM E1827 - 11 Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door

ASTM International, www.astm.org

RESNET Guidelines for Multifamily Ratings

Residential Energy Services Network, Inc.
www.resnet.us/wp-content/uploads/archive/resblog/2014/08/Adopted-RESNET-Guidlines-for-Multifamily-Ratings-8-29-14.pdf

RESNET/ICC 380 ANSI/RESNET/ICC 380-2016 with Addendum A-2017 Standard for Testing Airtightness of Building Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems

Residential Energy Services Network, Inc., www.resnet.us; and International Code Council, Inc., www.iccsafe.org

Internet Resources

ENERGY STAR New Homes
U.S. Environmental Protection Agency
www.energystar.gov/newhomes

Indoor airPlus
U.S. Environmental Protection Agency
www.epa.gov/indoorairplus

Residential Energy Services Network (RESNET)
www.resnet.us

National Fenestration Rating Council (NFRC)
www.nfrc.org

U.S. Department of Energy Building Energy Codes Program
www.energycodes.gov/

Energize Montana (Energy Codes)
Montana Department of Environmental Quality
deq.mt.gov/energy

"Buildings, too, are children of earth and sun."

Frank Lloyd Wright

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At the time of publication Montana is holding listening sessions for the 2021 IECC with adoption anticipated in early 2022. Check the NorthWestern Energy Efficiency Plus website for details.