

Commercial Building Energy Code Summary

July 2011

Overview

The Administrative Rules of Montana (Title 24, Chapter 301.160) require that all commercial buildings, with exceptions noted below, must comply with the International Energy Conservation Code (IECC) 2009 or ASHRAE/IESNA 90.1-2007. This publication is an overview of the 2009 IECC. The complete 2009 IECC and ASHRAE/IESNA 90.1-2007 is available for purchase at the International Code Council (ICC) web site www.iccsafe.org at the ICC store under 2009 International Codes or call 800-786-4452.

Residential buildings (R-2 and R-4) over three stories above grade must comply with these commercial building code requirements. Residential buildings three stories or less above grade are required to follow the residential section of the 2009 IECC with Montana amendments. A summary of the residential energy code requirements are listed at www.energizemontana.com and available from the contact information listed at the bottom of this page.

This publication is a summary overview of the 2009 IECC. Significant changes in the new Montana commercial energy code are explained in more detail in this brochure.

- Higher insulation levels and more efficient windows required
- New exterior lighting requirements
- New interior lighting controls with daylight zone requirements
- New HVAC requirements

This code establishes minimum prescriptive and performance-related regulations for envelope requirements, lighting, mechanical, and service water heating. Alterations to existing conditioned spaces must comply with 2009 IECC requirements or ASHRAE/IESNA 90.1-2007; unchanged portions do not have to comply.

Exceptions: This code does not apply to very low energy-use buildings using less than 3.4 Btu/h per square foot for space heating or buildings that are neither heated nor cooled or designated as historic or which have been determined to be eligible for such listing.

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For more information contact:
Montana Department of Environmental Quality • (406) 841-5200
www.deq.mt.gov/Energy

The information in this Energy Code Summary is based on 2009 IECC. 2009 IECC includes a manual method using prescriptive compliance paths. A software method, COMCheck™, is another way to demonstrate code compliance. COMCheck™ is available free of charge on the internet at www.energycodes.gov.

ASHRAE/IESNA 90.1-2007 is an option and can be used to demonstrate compliance. However, if ASHRAE/IESNA 90.1-2007 is used, it must be used for all parts of code compliance; envelope, lighting, mechanical or service water heating.

Section 101.4.3 Additions, alterations, renovations or repairs

Additions, alterations, renovations or repairs to an existing building, system or portion must conform to the code as they relate to new construction without requiring the unaltered portions of an existing building or system to comply. An addition will comply with the code if the addition alone complies or if the existing building and addition comply as a single building.

The following do not need to comply provided the energy use of the building is not increased.

1. Storm windows installed over existing windows;
2. Glass only replacements;
3. Existing ceiling, wall or floor cavities exposed during construction;
4. Construction where the existing roof, wall or floor cavity is not exposed;
5. Reroofing for roofs where the sheathing and insulation are not exposed. Roofs without insulation in the cavity and where the sheathing is exposed during reroofing shall be insulated either above or below the sheathing;
6. Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided that an existing vestibule that separates a conditioned space from the exterior shall not be removed;
7. Alterations that replace less than one-half the luminaries in a space provided the installed interior lighting power is not increased;
8. Alterations that replace only one bulb and ballast within the existing luminaries in a space provided the alteration does not increase the installed interior lighting power.

Spaces that change occupancies that result in an increase in demand for either fossil fuel or electricity shall comply with the code.

Any unconditioned space that is altered to become conditioned space must be brought into full compliance with the code.

SECTION 502 – BUILDING ENVELOPE REQUIREMENTS

Envelope Requirements

2009 IECC places Montana in climate zone #6 with insulation and glazing requirements listed in Tables 502.2. (1) and 502.3. Commercial building with Group R occupancies must use the “Group R” column of the table. Commercial buildings or portions with occupancies other than Group R must use the “All Other” column. Buildings with vertical fenestration above 40 percent of the above grade wall area or more than 3 percent of roof in skylight must comply with the building envelope provisions of ASHRAE/IESNA 90.1–2007.

TABLE 502.2(1)

BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

	ALL OTHER	GROUP R
Roofs		
Insulation entirely above deck	R-20ci	R-20ci
Metal buildings (with R-5 thermal blocks ^{a,b})	R-13 +R-19	R-19
Attic and other	R-49 ^c	R-49 ^c
Walls, Above Grade		
Mass	R-13.3ci	R-15.2ci
Metal building ^b	R-13 +R-5.6ci	R-13 +R-5.6ci
Metal framed	R-13 +R-7.5ci	R-13 +R-7.5ci
Wood framed and other	R-13 +R-7.5 or R-21 ^c	R-13 +R-7.5 or R-21 ^c
Walls, Below Grade		
Below grade wall ^d	R-7.5ci	R-7.5ci
Floors		
Mass	R-12.5ci	R-14.6ci
Joist/framing steel/ (wood)	R-30	R-30 ^e
Slab-on-Grade Floors		
Unheated slabs	R-10 for 24 in. below	R-15 for 24 in. below
Heated slabs	R-15 for 24 in. below	R-20 for 48 in. below
Opaque doors swinging	U-0.7	U-0.5
Opaque doors roll-up or sliding	U-0.5	U-0.5

Section 502.2.1 Roof Assembly Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered as insulation .

ci = “Continuous insulation” differs from cavity insulation only in that it is placed over structural components rather than in cavities. Continuous insulation, when properly installed, is free of breaks, voids and compression.

- a. When using *R*-value compliance method, a thermal spacer block is required, otherwise use the *U*-factor compliance method. [see Tables 502.1.2 and 502.2(2)].
- b. Assembly descriptions can be found in Table 502.2(2).
- c. Montana amended.
- d. When heated slabs are placed below-grade, below-grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.
- e. Steel floor joist systems must be R-38.

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT,
MAXIMUM U-FACTORS

	All other	Group R
ROOFS		
Insulation entirely above deck	U-0.048	U-0.048
Metal buildings	U-0.049	U-0.049
Attic and other	U-0.027	U-0.027
WALLS, ABOVE GRADE		
Mass	U-0.080	U-0.071
Metal building	U-0.069	U-0.069
Metal framed	U-0.064	U-0.057
Wood framed and other	U-0.051	U-0.051
WALLS, BELOW GRADE		
Below-grade wall ^a	C-0.119	C-0.119
FLOORS		
Mass	U-0.064	U-0.057
Joist/Framing	U-0.033	U-0.033
SLAB-ON-GRADE FLOORS		
Unheated slabs	F-0.540	F-0.520
Heated slabs	F-0.860	F-0.688

- a. When heated slabs are placed below-grade, below-grade walls must meet the *F*-factor requirements for perimeter insulation according to the heated slab-on-grade construction.

Insulation Requirements

“Cavity insulation” is the placement of insulation in cavities, such as spaces between framed walls, studs or floor joists. The insulation should fill all voids but not be compressed.

Slab on Grade

Slab edge insulation is required on the outside or inside of the foundation wall. The insulation shall extend downward from the top of the slab for a minimum of 24 inches (48 inches for Group R with heated slab) or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for a minimum of 24 inches (48 inches for Group R with heated slab).

Heated slab-on-grade include slab floors with heating elements, hydronic tubing, or when the hot air distribution system is in contact with or placed within or under the slab.

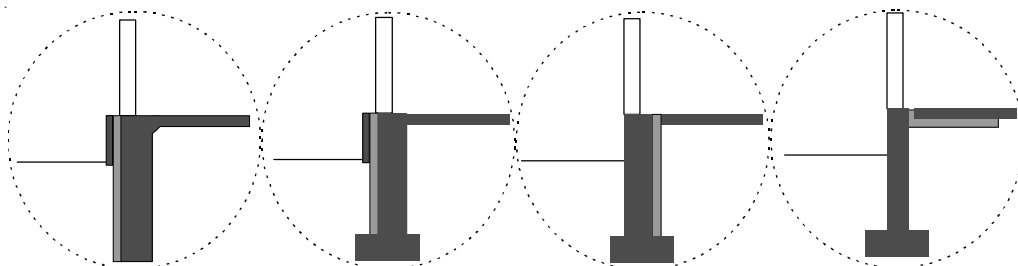


TABLE 502.2(2)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

ROOFS	DESCRIPTION	REFERENCE
R-19	<p>Standing seam roof with single fiberglass insulation layer.</p> <p>This construction is R-19 faced fiberglass insulation batts draped perpendicular over the purlins. A minimum of R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins</p>	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"
R-13 + R-13 R-13 + R-19	<p>Standing seam roof with two fiberglass insulation layers.</p> <p>The first <i>R</i>-value is for faced fiberglass insulation batts draped over purlins. The second <i>R</i>-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum of R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.</p>	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"
R-11 + R-19 FC	<p>Filled cavity fiberglass insulation.</p> <p>A continuous vapor barrier is installed below the purlins and uninterrupted by framing members. Both layers of uncompressed, unfaced fiberglass insulation rest on top of the vapor barrier and are installed parallel, between the purlins. A minimum of R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.</p>	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"
R-16, R-19	<p>Single fiberglass insulation layer.</p> <p>The construction is faced fiberglass insulation batts installed vertically and compressed between the metal wall panels and the steel framing.</p>	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"
R-13 + R-5.6 ci R-19 + R-5.6 ci	<p>The first <i>R</i>-value is for faced fiberglass insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated <i>R</i>-value is for continuous rigid insulation installed between the metal wall panel and steel framing, or on the interior of the steel framing.</p>	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"

502.3 Fenestration (Prescriptive). Shall comply with Table 502.3

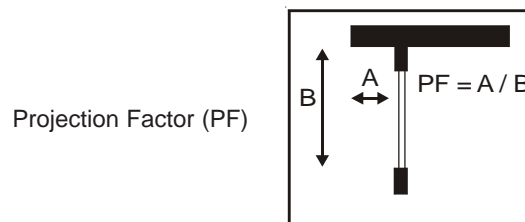
Fenestration: Skylights, roof windows, vertical windows (fixed or moveable), opaque doors, glazed doors, glazed block and combination opaque/glazed doors. Fenestration includes products with glass and nonglass glazing materials.

**TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION**

Framing materials other than metal with or without metal reinforcement or cladding	
<i>U</i> -factor	0.35
Metal framing with or without thermal break	
Curtain wall/storefront <i>U</i> -factor	0.45
Entrance door <i>U</i> -factor	0.80
All other <i>U</i> -factor ^a	0.55
SHGC – All frame types	
SHGC: PF < 0.25	0.40
SHGC: 0.25 ≤ PF < 0.5	NR
SHGC: PF ≥ 0.5	NR
Skylights (3% maximum)	
<i>U</i> -factor	0.60
SHGC	0.40

NR = No requirement.

PF = Projection factor.



a. All others includes operable windows, fixed windows and nonentrance doors.

502.3.1 Maximum area

The vertical fenestration area (not including opaque doors) must not exceed 40 percent of the above - grade wall area. The skylight area must not exceed 3% of the gross roof area. If either exceeds these limits another method must be used for code compliance.

Fenestration product rating. Section 303.1.3 lists that U-factors for windows, doors and skylights must be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. If a product lacks a labeled U -factor, a default U- factor from Table 303.1.3 (1) or (2) must be used.

The solar heat gain coefficient (SHGC) for windows, glazed doors and skylights must be determined in accordance with NFRC 200 by an accredited, independent laboratory and labeled and certified by the manufacturer. If a product lacks a labeled SHGC, a default SHGC form Table 303.1.3(3) must be used.

**TABLE 303.1.3(1)
DEFAULT GLAZED FENESTRATION U-FACTOR**

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

**TABLE 303.1.3(2)
DEFAULT DOOR U-FACTORS**

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

**TABLE 303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC**

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
0.8	0.7	0.7	0.6	0.6

502.4 Air Leakage

502.4.1 Window and door assemblies

Air leakage from window and sliding or swinging door assemblies must be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400 by an accredited, independent laboratory, and labeled and certified by the manufacturer and shall not exceed the values listed in AAMA Section 402.4.2.

Exceptions: Site built windows and doors that are weather-stripped or sealed in accordance with Section 502.4.3.

502.4.2 Curtain wall, storefront glazing and commercial swinging entrance doors

Curtain wall, storefront glazing and commercial swinging entrance doors must be tested for air leakage at 1.57 psi in accordance with ASTM E-283. For curtain walls and storefront glazing, the maximum air leakage rate must be .3 cfm per sq.ft. of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage rate shall be 1 cfm per sq.ft. of the door area.

502.4.3 Sealing of the building envelope

Openings and penetrations in the building envelope must be sealed with caulking material or closed with gasketing systems compatible with the construction materials and location. Joints and seams must be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing material spanning joints between construction materials shall allow for expansion and contraction of the construction material.

502.4.4 Hot gas bypass limitation.

Cooling systems must not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot gas bypass shall be limited as indicated on Table 502.4.4 listed below.

Rated Capacity	Max hot gas bypass capacity (% of total capacity)
Less than or equal to 240,000 Btu/h	50%
Greater than 240,000 Btu/h	25%

Exception: Unitary packaged systems with cooling capacities less than 90,000 Btu/h.

502.4.5 Outdoor air intakes and exhaust openings

Stair and elevator shaft vents and other outdoor air intakes and exhaust air openings that are part of the building envelope must be equipped with at least a Class 1 motorized, leakage rated damper with a maximum leakage rate of 4 cfm per sq.ft. at 1 inch water gauge when tested in accordance with AMCA 500 D.

Exception: Gravity dampers are allowed in buildings less than three stories in height above grade.

502.4.6 Loading dock weather seals

Cargo doors and loading doors must have weather seals to restrict infiltration when vehicles are parked in the doorway.

502.4.7 Vestibules

A door that separates conditioned space from the exterior must be protected with an enclosed vestibule, with all doors opening into and out of the vestibule having self-closing devices. Doors operation does not require synchronization.

Exceptions:

1. Non-entrance doors, such as doors to mechanical or electrical equipment rooms.
2. Doors opening directly from sleeping or dwelling units.
3. Doors opening from a space less than 3,000 sq. ft.
4. Revolving doors.

SECTION 503 – BUILDING MECHANICAL SYSTEMS

This code summary booklet contains only partial information from the 2009 IECC Section 503 Building Mechanical Systems. For complete additional information go to the 2009 IECC or ASHRAE 90.1 - 2007.

503.1 General

Mechanical systems and equipment serving the building heating, cooling or ventilation needs must comply with Section 503.2 referred to as the mandatory provisions and either Section 503.3 for simple systems or Section 503.4 for complex systems.

503.2 Provisions applicable to all mechanical systems (Mandatory)

503.2.1 Calculation of heating and cooling loads

Design loads must be determined in accordance with the procedures described in ASHRAE/ACCA Standard 183. Heating and cooling loads must be adjusted to account for load reductions achieved when energy recovery are utilized in accordance with ASHRAE HVAC System and Equipment Handbook. Alternately, design loads can be determined by an approved equivalent computation procedure, using the design parameters specified in Chapter 3.

503.2.2 Equipment and system sizing

Heating and cooling equipment and system capacity shall not exceed the loads calculated in accordance with Section 503.2.1. A single piece of equipment providing both heating and cooling must satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

Exceptions:

1. Required standby equipment and systems provided with controls and devices that allow such systems or equipment to operate automatically only when the primary equipment is not operating.
2. Multiple units of same equipment type with combined capacities exceeding the design load and provided with controls that can sequence the operation of each unit based on load.

503.2.3 HVAC equipment performance requirements

Equipment must meet the minimum efficiency requirements of 2009 IECC Tables 503.2.3 (1-7). Exceptions apply.

503.2.4 HVAC system controls

Each heating and cooling system must be provided with a thermostat control as required in Sections 503.2.4 (1-4) Section 503.4(1-4)

503.2.4.1 Thermostatic controls

The supply of heating and cooling energy to each zone shall be controlled by individual thermostat controls capable of responding to temperature within the zone. Where humidification or dehumidification or both is provided, at least one humidification device must be provided for each humidity control system. Exceptions apply.

503.2.4.1.1. Heat pumps having supplementary heat.

Heat pumps with supplementary electric resistance heat must have controls that, except during defrost, prevent supplementary heat operation when the heat pump can meet the heating load.

503.2.4.2 Set point overlaps restriction

When used for both heating and cooling, zone thermostatic controls shall provide a temperature range or dead band of at least 5F within which the supply of heating and cooling energy to the zone can be shut off or reduced to a minimum.

Exception: Manual changeover thermostat requiring manual changeover between heating and cooling modes.

503.2.4.3 Off-hour controls

Each zone must have thermostatic setback controls that are controlled by either automatic time clock or programmable control system.

Exceptions: zones that will be continuously operated and zones with a full HVAC load demand less than 6,800 Btu/h and having a readily accessible manual shutoff switch.

503.2.4.3.1 Thermostatic setback capabilities

Thermostatic setback controls shall have the capability to set back or temporarily operate the system to maintain zone temperatures down to 55F or up to 85F.

503.2.4.3.2. Automatic setback and shutdown capabilities

Automatic time clock or programmable controls shall be capable of starting and stopping the system for seven different daily schedules per week and retaining their programming and time setting during a loss of power for at least 10 hours. The controls must also have a manual override that allows temporary operation of the system for up to 2 hours and a manually operated timer capable of being adjusted to operate the system for up to 2 hours; or an occupancy sensor.

503.2.4.4 Shutoff damper controls

Both outdoor air supply and exhaust ducts must be equipped with motorized dampers that will automatically shut when the system or spaces served are not in use.

Exception: Gravity dampers are allowed in buildings less than three stories in height. Gravity dampers are allowed for outside air intake or exhaust airflows of 300 cfm or less.

503.2.4.5 Snowmelt system controls

Snow and ice melting systems, supplied through energy service to the building, must include automatic controls capable of shutting off the system when the pavement temperature is above 50F and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40F so that the potential for snow and ice accumulation is negligible.

503.2.5 Ventilation

Ventilation, either natural or mechanical, shall be provided in accordance with Chapter 4 of the International Mechanical Code (IMC). Where mechanical ventilation is provided, the system must provide the capability to reduce the outdoor air supply to the minimum required by Chapter 4 of the IMC.

503.2.5.1 Demand Controlled Ventilation

(DCV) is required for spaces larger than 500 sq. ft. and with average occupant load of 40 people per 1000 sq.ft. of the floor area (as established in Table 403.3 of the IMC) and served by the systems with one or more of the following:

1. Air-side economizer;
2. Automatic modulating control of the outdoor air damper; or
3. A design outdoor airflow greater than 3000 cfm.

Exceptions:

1. Systems with energy recovery complying with Section 503.2.6.
2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3. Systems with design outdoor airflow less than 1,200 cfm.
4. Spaces where supply air flow minus any makeup or outgoing transfer air requirements is less than 1200 cfm.

503.2.6 Energy recovery ventilation systems

Individual fan systems that have both a design supply air capacity of 5,000 cfm or greater and minimum outside air supply of 70 percent or greater of the design supply air quantity shall have an energy recovery system that provides a change in the enthalpy of the outdoor air supply of 50 percent or more of the difference between the outdoor air and return air at design conditions. Provision shall be made to bypass or control the energy recovery system to permit cooling with outdoor air where cooling with outdoor air is required.

Exceptions:

- 1) Where energy recovery ventilation systems are prohibited by the IMC.
- 2) Some laboratory fume hood systems. Systems serving spaces that are not cooled and heated to less than 60F. – other exceptions apply.

503.2.7 Duct and plenum insulation and sealing

All supply and return ducts and plenums shall be insulated with a minimum of R-5 when located in unconditioned spaces and a minimum of R-8 when located outside the building. When located within a building envelope assembly, the duct or plenum must be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.

Exceptions:

1. When located within equipment.
2. When the design temperature difference between the interior and exterior of the duct doesn't exceed 15F.

All ducts, air handlers and filter boxes must be sealed. Joints and seams shall comply with Section 603.9 of the IMC.

503.2.7.1 Duct construction

Ductwork must be constructed in accordance with the IMC.

The 2009 IECC has specific requirements for low, medium and high pressure duct systems.

503.2.8 Piping insulation

All piping serving part of a heating or cooling system shall be installed in accordance with Table 503.2.8 listed below.

Minimum pipe insulation (thickness in inches)

TABLE 503.2.8 – Nominal Pipe Diameter		
Fluid	Equal to or less than 1.5 in.	Greater than 1.5 in.
Steam	1.5	3
Hot water	1.5	2
Chilled water, brine or refrigerant	1.5	1.5

Exceptions:

1. Factory installed piping within HVAC equipment tested and rated in accordance with 2009 IECC listed procedure;
2. Factory installed piping within room fan-coils and unit ventilators tested and rated according to AHRI 440 (except sampling and variation provisions of Section 6.5 do not apply) and 840, respectively;
3. Piping conveying fluids that have design operating temperature range between 55F and 105F;
4. Piping conveying fluids that are not heated or cooled with fossil fuel or electric power;
5. Runout piping not exceeding 4 feet and 1 inch diameter between the control valve and HVAC coil.

503.2.9 HVAC system completion

Prior to issuing a certificate of occupancy, the design professional must provide evidence of system completion in accordance with Sections 503.2.9.1 – 503.2.9.3

503.2.9.1 Air system balancing

Each supply outlet and zone terminal device shall be equipped with a way for air balancing in accordance with the requirements of Chapter 6 of the IMC. Discharge dampers are not allowed on constant volume fans and variable volume fans with 10 hp or larger motors.

503.2.9.2 Hydronic system balancing

Individual hydronic heating and cooling coils must have a means for balancing and pressure test connections.

503.2.9.3 Manuals

The construction documents shall require that an operating and maintenance manual be provided to the building owner by the mechanical contractor. It must include at least:

1. Equipment capacity (input and output) and required maintenance actions;
2. Equipment operational and maintenance manuals;
3. HVAC system control maintenance calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined set points shall be permanently recorded on control drawings, at control devices or, for digital control systems, in programming comments;
4. Complete written narrative of how each system is intended to operate.

503.2.10 Air system design and control

Each HVAC system with a total fan system motor nameplate horsepower (hp) over 5 hp must meet provisions of Sections 503.2.10.1 – 503.2.10.2

503.2.10.1 Allowable fan floor horsepower

Each HVAC system at fan design conditions shall not exceed the allowable fan system motor nameplate hp (Option 1) or fan system fan brake horsepower (bhp) (Option 2) as listed in Table 503.2.10.1(1). This includes supply fans, return /relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability.

**TABLE 503.2.10(1)
FAN POWER LIMITATION**

	LIMIT	CONSTANT VOLUME	VARIABLE VOLUME
Option 1: Fan system motor nameplate hp	Allowable nameplate motor hp	$hp \leq CFM_s * 0.0011$	$hp \leq CFM_s * 0.0015$
Option 2: Fan system help	Allowable fan system bhp	$bhp \leq CFM_s * 0.00094 + A$	$bhp \leq CFM_s * 0.0013 + A$

Where:

DFM_s = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute.

hp = The maximum combined motor nameplate horsepower.

Bhp = The maximum combined fan brake horsepower.

A = Sum of $[PD \times CFM_D / 4131]$.

Where:

PD = Each applicable pressure drop adjustment from Table 503.2.10(2) in. w.c.

Exceptions:

1. Hospital and laboratory systems that use flow control devices on exhaust and/or return to maintain space pressure relationships necessary for health and safety reasons or environmental control are permitted to use variable volume fan power limitation.
2. Individual exhaust fans with motor nameplate hp of 1 hp or less.
3. Fans exhausting air from fume hoods (with other notations).

503.2.10.2 Motor nameplate horsepower

For each fan, the motor shall be no larger than the first available motor size greater than the bhp. The bhp must be listed on the design documents for verification by code official.

Exceptions:

1. For fans less than 6 bhp where the first available motor larger than the bhp has a nameplate rating within 50% of the bhp, selection of the next larger nameplate motor size is allowed.
2. Fans 6 bhp and larger, where the available motor larger than the bhp has a nameplate rating within 30% of the bhp, selection of the next larger nameplate motor size is allowed.

503.2.11 Heating outside a building

Systems providing heat outside a building must be a radiant system, controlled by an occupancy sensor or timer, so that the system shuts off when no one is present.

503.3 Simple HVAC systems and equipment (Prescriptive)

This section applies to buildings served by unitary or packaged HVAC equipment listed in Table 503.2.3(1) through 503.2.3(5) each serving one zone and controlled by a single thermostat in that zone. It also applies to two pipe heating systems serving one or more zones, where no cooling system is installed. This section does not apply to systems covered in Section 503.4.

503.3.1 Economizers

Supply air economizers must be provided on each cooling system equal to or larger than 54,000 Btu/h. The total capacity of all systems without economizers must not exceed 480,000 Btu/h per building, or 20 percent of its air economizer capacity, whichever is greater. Economizers shall be capable of providing 100 percent outside air, even if additional mechanical cooling is required to meet the cooling load of the building. Systems must provide a way to relieve excess outdoor air during economizer operation to prevent over pressurization of the building. The relief air outlet should prevent recirculation of air back into the building.

Exception:

1. Systems with air or evaporatively cooled condensers that serve spaces with open case refrigeration or that require filtration equipment in order to meet the minimum ventilation requirements of Chapter 4 of the IMC.

503.4 Complex HVAC systems and equipment

Applies to systems not covered in Section 503.3

503.4.1 Economizers

Supply air economizers shall be provided on each cooling system with equal to or greater than 54,000 Btu/h. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per building, or 20 percent of its air economizer capacity whichever is greater. Economizers shall be capable of operating at 100 percent outside air, even if additional mechanical cooling is required to meet the cooling load of the building. Exceptions apply.

503.4.2 Variable air volume (VAV) fan control

Individual VAV fans with motors of 10 hp or greater must be driven by mechanical or electrical variable speed drive or the fan motor shall have controls that will result in fan motor demand of no more than 30 percent of their design wattage at 50 percent of the design airflow when static pressure set point equals 1/3 of the total design static pressure, based on manufacturers data.

For systems with direct digital control of individual zone boxes reporting to the central control panel, the static pressure set point shall be reset based on the zone requiring the most pressure. i.e., the set point is reset lower until one zone damper is nearly wide open.

503.4.3 Hydronic systems controls

Hydronic heating systems comprised of multi-packaged boilers and designed to deliver conditioned water or steam into a common distribution system must include automatic controls capable of sequencing operation of boilers. Hydronic heating systems of single boilers greater than 500,000 Btu/h input capacity must have a multistage or modulating burner.

503.4.3.1 Three-pipe system

Hydronic systems that use a common return for both hot and chilled water are not allowed.

503.4.3.2 Two-pipe changeover system

Systems that use a common distribution system for both heated and chilled water must be designed to allow a dead band between changeover from one mode to the other of at least 15F outside air temperatures; be designed to and provided with controls that will allow operation in one mode for at least 4 hours before changing over to the other mode: and be provided with controls that allow heating and cooling supply temperatures at the change-over point to be no more than 30F apart.

503.4.3.3 & 503.4.3.3.1 Hydronic (water loop) heat pump systems and temperature dead band

Hydronic heat pumps connected to a common heat pump loop with central devices for heat rejection and heat addition must have controls that are capable of providing a heat pump water supply temperature dead band of at least 20F between initiation of heat rejection and heat addition by the central devices.

Exception: Where a system loop temperature optimization controller is installed and can determine the most efficient operating temperature based on realtime conditions of demand and capacity, dead bands of less than 20F shall be permitted.

503.4.3.3.2 Heat rejection

If an open or closed circuit cooling tower is used, than a separate heat exchanger shall be required to isolate the cooling tower from the heat pump loop, and heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop and providing an automatic valve to stop the flow of fluid.

503.4.3.3.3 Two position valve

Each hydronic heat pump on the hydronic system with a total pump power exceeding 10 hp must have a two position valve.

503.4.3.4 Part load controls

Hydronic systems greater than or equal to 300,000 Btu/h in design output capacity supplying heated or chilled water to comfort conditioning systems shall include controls that have ability to:

1. Automatically reset the supply water temperature using zone-return water temperature, building return water temperature, or outside air temperature as an indicator of building heating or cooling demand. The temperature shall be capable of being reset by at least 25 percent of the design supply to return water temperature difference, or

2. Reduce system pump flow by at least 50 percent of design flow rate using adjustable speed drive(s) or pump(s), or multiple-staged pumps where at least one-half of the total pump horsepower is capable of being automatically turned off or control valves designed to modulate or step down, and close, as a function of load, or other approved means.

503.4.3.5 Pump isolation

One or more chilled water plants must have the ability to automatically reduce flow through the chiller plant when the chiller is shut down. Chillers piped in series for increased temperature differential are considered one chiller. One or more boiler plants must have the ability to automatically reduce flow through the boiler plant when a boiler is shut down.

503.4.4 Heat rejection equipment and fan speed control

Each fan motor 7.5 hp or larger must have the capability to operate at 2/3 of full speed or less and must have controls that automatically change the fan speed to control the existing fluid temperature or condensing temperature/pressure of the heat rejection device.

Exception: Factory installed heat rejection devices within HVAC equipment tested and rated in accordance with IECC tables 503.2.3(6) and (7).

503.4.5 Requirements for complex mechanical systems serving multiple zones

Supply air systems serving multiple zones shall be VAV systems which during period of occupancy are designed and capable of being controlled to reduce primary air supply to each zone to one of the following before reheating, recooling or mixing takes place:

1. 30 percent of the maximum supply air to each zone.
2. 300 cfm or less where the maximum flow rate is less than 10 percent of the total fan supply airflow rate.
3. The minimum ventilation requirements of Chapter 4 of the IMC.

Exceptions apply.

503.4.5.1 Single duct variable air volume (VAV) system, terminal devices

Single duct VAV systems shall use terminal devices capable of reducing primary supply air before reheating or recooling takes place.

503.4.5.2 Dual duct and mixing VAV system, terminal devices

Systems that have one warm air duct and one cool air duct must use terminal devices which are able to reduce the flow from one duct to a minimum before mixing of air from the other duct takes place.

503.4.5.3 Single fan dual duct and mixing VAV systems, economizers

Individual dual duct or mixing heating and cooling systems with a single fan and with total capacities greater than 90,000 Btu/h must not have air economizers.

503.4.5.4 Supply-air temperature reset controls

Multiple zone HVAC systems must have controls that automatically reset the supply-air temperature in response to representative building loads or to outdoor temperature. The controls shall be capable of resetting the supply air temperature at least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

Exceptions:

1. System that prevents reheating, recooling or mixing of heated and cooled air supply.
2. 75 percent of the energy for reheating is from site-recovery or site solar energy sources.
3. Zones with peak supply air quantities of 300 cfm or less.

503.4.6 Heat recovery for service water heating

Condenser heat recovery must be installed for heating or reheating of service hot water provided the facility operates 24 hours a day, total installed heat capacity of water-cooled systems exceeds 6 million Btu/h of heat rejection and the design service water heating load exceeds 1 million Btu/h. The system must have the capacity to provide the smaller of:

1. 60 percent of the peak heat rejection load at design conditions; or
2. The preheating required to raise the peak service hot water draw to 85F.

Exceptions:

1. Facilities that employ condenser heat recovery for space heating or reheating purposes with a heat recovery design exceeding 30 percent of the peak water-cooled condenser load at design conditions.
2. Facilities that provide 60 percent of their service water heating from site solar or site recovered energy or from other sources.

SECTION 504 – SERVICE WATER HEATING

504 Service Water Heating (Mandatory)

504.2 Service water-heating equipment performance efficiency

Water heating equipment and hot water storage tanks shall meet the requirements of Table 504.2. The efficiency must be verified through the data furnished by the manufacturer or through certification under an approved certification program.

504.3 Temperature Controls

Service water heating equipment must have controls that allow a set point of 110F for equipment serving dwelling units and 90F for equipment serving other occupancies. The outlet temperature of lavatories in public facility rest rooms shall be limited to 110F.

504.4 Heat traps

Water heating equipment without internal heat traps and serving non-circulating systems must be provided with heat traps on both supply and discharge piping associated with the equipment.

504.5 Pipe insulation

Automatic-circulating hot water systems piping must be insulated to at least 1 inch (R-3.7).

Non-circulation systems served by equipment without integral heat traps must be insulated with at least ½ inch (R-1.85) for the first 8 feet of piping.

504.6 Hot water system controls

Automatic-circulation hot water system pumps or heat trace (heat tape) must turn off automatically or manually when the hot water system is not operating.

504.7.1 Pool heater

All pool heaters must be equipped with a readily accessible on-off switch allowing shut off of the heater without adjusting the thermostat setting. Pool heaters using natural gas or LPG must not have continuously burning pilot lights.

504.7.2 Time switches

Time switches that can automatically turn off and on heaters and pumps according to a preset schedule must be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24 hour pump operation.
2. Where pumps are required to operate solar and waste heat recovery pool heating systems.

504.7.3 Pool covers

Heated pools must be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to above 90F must have a pool cover with at least R-12 value.

Exception: Pools receiving over 60 percent of the energy for heating from site-recovered energy or solar energy source.

SECTION 505 – ELECTRICAL POWER AND LIGHTING SYSTEMS

Section 505 – Electrical Power and Lighting Systems Lighting (Mandatory)

Lighting and power requirements apply to the original lighting system in new buildings and additions or tenant build outs.

505.1 General (Mandatory)

This section covers lighting system controls, connection of ballasts, maximum lighting power for interior applications and minimum acceptable lighting equipment for exterior applications.

Exception: Lighting within dwelling units where 50 percent or more of the permanent interior light fixtures have high-efficacy lamps.

505.2.1 Interior Lighting Controls

Each area enclosed by walls or floor-to-ceiling partitions shall have at least one manual control for lights in that area. The control shall be in the area with the lights or be a remote switch that indicates the status of lights served. Exceptions are areas designated as security or emergency areas that must be continuously lighted and lighting in stairways or corridors that are elements of means of egress. Other exceptions are areas that have only one light and areas controlled by an occupant sensor or in corridors, storerooms, restrooms or public lobbies.

505.2.2.1 Light Reduction Controls

Each area that is required to have a manual control shall allow the occupant to reduce the lights in a reasonable pattern by at least 50 percent by one of the following or other approved method:

1. Controlling all lights;
2. Dual switching of alternate rows of lights or alternate lights;
3. Switch the middle lamp independent of outer lamp or switching each lamp;
4. Switching each luminaire or each lamp.

Light reduction controls are not required if the area has only one luminaire, is controlled by an occupant-sensing device, is in a corridor, storeroom, restroom, public lobby, guest room sleeping unit or spaces that use less than .6 watt per square feet.

505.2.2.2 Automatic Lighting Shutoff

Buildings larger than 5,000 square feet shall be equipped with an automatic control device designed to shut off lighting in those areas. This automatic device shall function on either:

1. A scheduled basis, using time of day, with an independent program schedule that controls the interior lighting in areas that are less than 25,000 square feet and not more than one floor; or
2. An occupant sensor that shall turn lights off within 30 minutes of an occupant leaving a space; or
3. A signal from another control or alarm system that indicates the area is unoccupied.

Exceptions where an automatic control device is not required: sleeping units, lighting in spaces where patient care is provided, spaces where an automatic shutoff would endanger occupant safety or security.

505.2.2.2.1 Occupant Override Requirement

Where an automatic time switch is installed, it shall incorporate an override switching device that is readily accessible, located so that the person using the device can see the lights or is aware of the lights status, is manually operated, turns lights off within 2 hours when an override is initiated and controls an area less than 5,000 sq. ft.

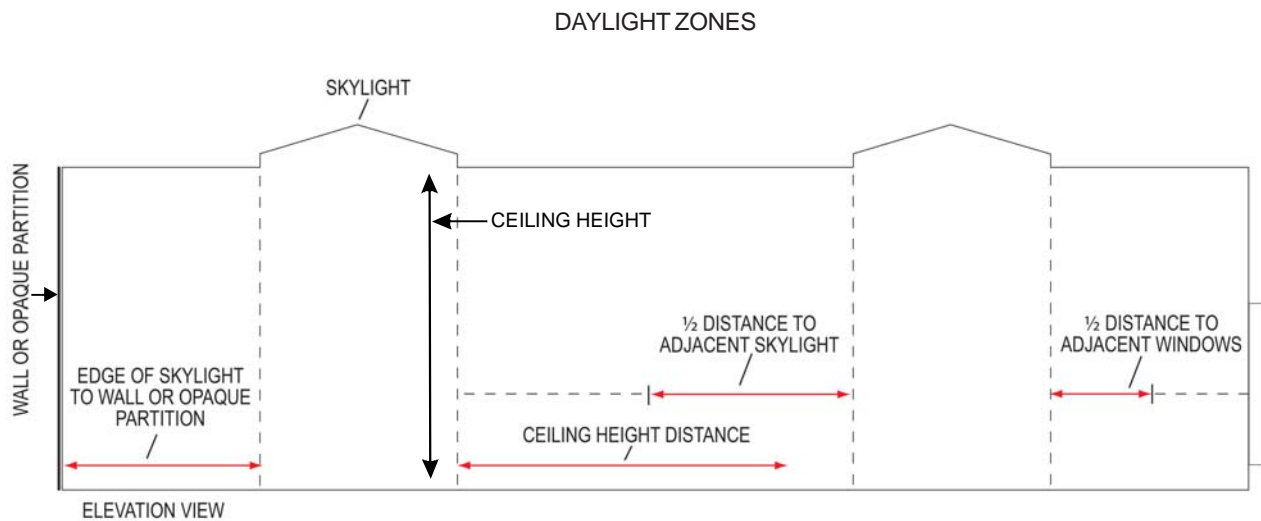
Exceptions are malls and arcades, auditoriums, single tenant retail spaces, industrial facilities and arenas. Where a captive key override is used, time may exceed 2 hours. In all of these areas, with exception of an area where a captive key override is used, the area controlled may not exceed 20,000 square feet.

505.2.2.3 Daylight Zone Control

Daylight zones shall be provided with **individual controls** that control the lights independent of general area lighting. Controls can be manual or automatic.

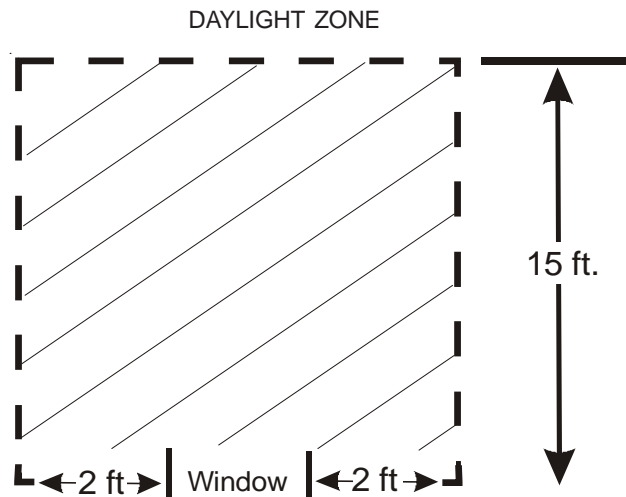
1. Under skylights

The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus the floor-to-ceiling height or the dimension to the ceiling height opaque partition, or one-half the distance to the adjacent skylight or vertical fenestration, whichever is least.



2. Adjacent to vertical fenestration (windows).

The daylight zone depth is assumed to be 15 feet into the space or to the nearest ceiling height opaque (non transparent) partition, whichever is less. The daylight zone width is assumed to be the width of the window plus 2 feet on each side, or the window width plus distance to opaque partition, or the window width plus one-half the distance to the adjacent skylight or vertical fenestration, whichever is least.



Connected daylight zones next to windows can be controlled by a single switch if the zone doesn't include areas facing more than two adjacent orientations (i.e. north, east, south, and west).

505.2.2.3 Holiday scheduling

If an automatic time switch control device is installed, it shall have an automatic holiday scheduling feature that turns off all lights for at least 24 hours and then resumes normal operation. Exceptions are retail stores and malls, restaurants, grocery stores, places of religious worship, and theaters.

505.2.3 Sleeping unit controls

At least one master switch is required at the entry of sleeping units in hotels, motels, boarding houses or similar buildings that controls all permanently wired lights and switched receptacles, except those in bathrooms.

505.3 Tandem Wiring

Fluorescent lights with one or any odd numbered lamp configuration that are recessed-mounted within 10 feet (center-to-center) of each other or are pendant or surface mounted within 1 foot (edge-to-edge) of each other shall be tandem wired. Exceptions are lights on emergency circuits or where electronic high-frequency ballasts are used or lights are not available in pairs in the same area.

505.4 Exit Signs

Internally illuminated exit signs shall not exceed 5 watts per side.

505.5.1 Interior Lighting Power (ILP) limits

The amount of lighting allowed in watts per square foot depends on the building area type. The interior power (in watts) is the value from Table 505.5.2 for the building type times the conditioned floor area of the entire building. An area is the contiguous space that accommodates, or is associated with a single building area as listed in Table 505.5.2. The interior lighting power is the conditioned floor area for each area type times the value from Table 505.5.2. When this method is used to calculate the total interior lighting power for an entire building, each building area shall be treated as a separate area.

**Table 505.5.2 – Interior Lighting Power Allowances
LIGHTING POWER DENSITY**

Building Area Type*	w/ft²
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Healthcare – clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theater	1.2
Multifamily	0.7
Museum	1.1
Office	1.0
Parking Garage	0.3
Penitentiary	1.0
Performing Arts Theater	1.6
Police/Fire Station	1.0
Post Office	1.1
Religious Building	1.3
Retail	1.5
School/University	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

See Table Footnotes on following page.

COMCHECK™ will perform this analysis and is available at www.energycodes.gov.

Table 505.5.2 – Footnotes for Lighting Power Density

- a. In cases with both a general building area type and a more specific building area type are listed, the more specific area type must apply.
- b. Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for the merchandise, or additional lighting power as determined below shall be added to the interior lighting power determined in accordance with this line item.

Calculate the additional lighting power as follows:

Additional Interior Lighting Power Allowance = 1000 watts plus

- (Retail Area 1 x 0.6 W/ft²) +
- (Retail Area 2 x 0.6 W/ft²) +
- (Retail Area 3 x 1.4 W/ft²) +
- (Retail Area 4 x 2.5 W/ft²),

Where:

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

Exception: Other merchandise categories may be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is approved by the authority having jurisdiction.

- This must include all lighting that is part of the design for the space including:
 - Overhead lighting
 - Task lighting
 - Decorative lighting

Note: Wattage must be calculated based on actual power draw, not just nominal lamp rating.

505.5.1.1. and 2, 3, 4 Proposed Lighting Calculation: Rules

The following wattages must be used in the lighting power calculation:

- Screw lamp holders: maximum labeled wattage of the luminaire
- Low voltage lighting: transformer wattage
- Line voltage track:
 1. specified wattage with minimum of 30 W/linear ft, **OR**
 2. wattage limit of system's circuit breaker, **OR**
 3. wattage limit of other permanent current limiting devices
- Other: manufacturer's rated wattage of lamp and associated ballast

505.5.1 Exemptions to Proposed Lighting Power Calculation

- Connected power for the following is not included in calculations:
 - Professional sports arena playing field
 - Sleeping unit lighting
 - Emergency lighting automatically off during normal building operation

Exemptions to Proposed Lighting Power Calculation – *continued*

- Lighting in spaces specifically designed for use by occupants with special lighting needs including visual impairment and other medical and age related issues
 - Lighting in interior spaces specifically designated as a registered interior historic landmark
 - Casino gaming areas
- Lighting equipment used for the following is exempt if it is in addition to general lighting and controlled by an independent control device:
 - Task lighting for medical and dental procedures
 - Display lighting for exhibits in galleries, museums and monuments
 - Theatrical, stage, film, and video production
 - Used for photographic processes
 - Integral to equipment or instrumentation installed by manufacturer
 - Plant growth or maintenance
 - Advertising or directional signage
 - Food warming and food prep equipment (in restaurant buildings and areas)
 - Lighting equipment that is for sale
 - Lighting demonstration equipment in lighting education facilities
 - Approved because of safety or emergency considerations, exclusive of exit lights
 - Integral to both open and glass-enclosed refrigerator and freezer cases
 - In retail display windows when the display is enclosed by ceiling-height partitions
 - Furniture-mounted supplemental task lighting controlled by automatic shutoff

505.2.4 Exterior Lighting Control Requirements

Lighting not designated for dusk-to-dawn operation must be controlled by either a combination of a photo sensor and a time switch, or an astronomical time switch. Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photo sensor. All time switches shall be capable of retaining programming and the setting during loss of power for a period of at least 10 hours.

505.6 Exterior lighting

The total allowed connected lighting power (number of lights) for all exterior lighting applications is the total of the base for the applicable zones plus the individual allowances for the applicable zones.

505.6.1 Exterior Efficiency Requirement (505.6.1)

Building grounds lighting luminaires over 100 watts must have source efficacy of at least 60 lumens per watt.

Exceptions: Low voltage landscape lighting and lighting in areas approved for historical, safety, signage or emergency considerations.

Lights greater than 100 watts must have a minimum efficacy of 60 lumens per watt unless controlled by a motion sensor or other exception under Section 505.6.2

505.6.2 Exterior building lighting power

The total exterior lighting power allowance is the sum of the base site allowance plus the allowances for areas that are permitted in Table 505.6.2(2) for certain zones. Some trade-offs are allowed. Lighting zones are determined by Table 505.6.2(1) listed below.

TABLE 505.6.2(2)

Lighting Zone	Description
1	Developed areas of national and state parks, forest land, and rural areas.
2	Areas mainly consisting of residential zoning, neighborhood business districts, light industrial and with limited night time use and residential mixed use areas.
3	All other areas.
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority.

Exceptions: The following lighting applications are exempt when controlled separately.

1. Specialized signal, directional and transportation related marker lighting;
2. Advertising or directional signage;
3. Integral to equipment or instrumentation installed by manufacturer;
4. Theatrical purposes, stage film and video production;
5. Athletic playing areas;
6. Temporary lighting;
7. Industrial production, material handling, transportation sites and associated storage areas;
8. Theme elements in theme/amusement parks.
9. Used to highlight features of public monuments and registered historic landmark structures or buildings.

Table 505.6.2(2)
Individual Lighting Power Allowances for Building Exteriors

	Zone 1	Zone 2	Zone 3	Zone 4	
Base Site Allowance	500 W	600 W	750 W	1300 W	
Tradable Surfaces	Uncovered Parking Areas				
	Parking areas and drives	0.04 W/ft ²	0.06 W/ft ²	0.10 W/ft ²	0.13 W/ft ²
	Building Grounds				
	Walkways less than 10 feet wide	0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot
	Walkways 10 feet wide or greater				
	Plaza areas				
	Special feature areas	0.14 W/ft ²	0.14 W/ft ²	0.16 W/ft ²	0.2 W/ft ²
	Stairways	0.75 W/ft ²	1.0 W/ft ²	1.0 W/ft ²	1.0 W/ft ²
	Pedestrian tunnels	0.15 W/ft ²	0.15 W/ft ²	0.2 W/ft ²	0.3 W/ft ²
	Building Entrances and Exits				
	Main entries	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
	Other doors	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
	Entry canopies	0.25 W/ft ²	0.25 W/ft ²	0.4 W/ft ²	0.4 W/ft ²
	Sales Canopies				
	Free standing and attached	0.6 W/ft ²	0.6 W/ft ²	0.8 W/ft ²	1.0 W/ft ²
Outdoor Sales					
Open areas (including vehicle sales lots)	0.25 W/ft ²	0.25 W/ft ²	0.5 W/ft ²	0.7 W/ft ²	
Street frontage for vehicle sales lots in addition to "open area" allowance	No allowance	10 W/linear foot	10 W/linear foot	10 W/linear foot	
Non-tradable Surfaces	Building facades	No allowance	0.1 W/ft ² for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length	0.15 W/ft ² for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length	0.2 W/ft ² for each illuminated wall or surface of 5.0 W/linear foot for each illuminated wall or surface length
	Automated teller machines and night depositories	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location
	Entrances and gatehouse inspection stations at guarded fac.	0.75 W/ft ² of covered and uncovered area	0.75 W/ft ² of covered and uncovered area	0.75 W/ft ² of covered and uncovered area	0.75 W/ft ² of covered and uncovered area
	Loading areas for law enforcement, fire, ambulance, and other emergency service vehicles	0.5 W/ft ² of covered and uncovered area	0.5 W/ft ² of covered and uncovered area	0.5 W/ft ² of covered and uncovered area	0.5 W/ft ² of covered and uncovered area
	Drive-up windows/doors	400 W per drive-through	400 W per drive-through	400 W per drive-through	400 W per drive-through
	Parking near 24-hr retail entrances	800 W per main entry	800 W per main entry	800 W per main entry	800 W per main entry

505.7 Electrical energy consumption

Individual dwelling units must be provided with individual meters to determine the electrical energy consumed by each unit.