

# **150150.0 Res Mandatory Features**

## **SUBCHAPTER 7**

### **LOW-RISE RESIDENTIAL BUILDINGS – MANDATORY FEATURES AND DEVICES**

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#### **SECTION 150150.0 – MANDATORY FEATURES AND DEVICES**

Any newly ~~construction-constructed~~ ~~in a~~ low-rise residential building shall meet the requirements of this Section.

(a) **Ceiling Insulation.** The opaque portions of ceilings separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of either Item 1 or 2 below:

1. Ceilings shall be insulated between wood-framing members with insulation resulting in an installed thermal resistance of R-~~30+9~~ or greater for the insulation alone.

**ALTERNATIVE to Section 150150.0(a)1:** Insulation which is not penetrated by framing members may meet an R-value equivalent to installing R-~~30+9~~ insulation between wood-framing members and accounting for the thermal effects of framing members.

2. The weighted average U-factor of ceilings shall not exceed the U-factor that would result from installing R-~~30+9~~ insulation between wood-framing members in the entire ceiling and accounting for the effects of framing members.

(b) **Loose-fill Insulation.** When loose-fill insulation is installed, the minimum installed weight per square foot shall conform with the insulation manufacturer's installed design weight per square foot at the manufacturer's labeled R-value.

(c) **Wall Insulation.** The opaque portions of frame walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of either Item 1 or 2 below:

1. Wood-framed walls shall be insulated between framing members with insulation having an installed thermal resistance of R-~~15+3~~ or greater. Framed foundation walls of heated basements or heated crawl spaces shall be insulated above the adjacent outside ground line with insulation having an installed thermal resistance of at least R-~~15+3~~.

**ALTERNATIVE to Section 150150.0(c)1:** Insulation which is not penetrated by framing members may meet an R-value equivalent to installing R-~~15+3~~ insulation between wood-framing members and accounting for the thermal effects of framing members.

2. The weighted average U-factor of walls shall not exceed the U-factor that would result from installing R-~~15+3~~ insulation between wood-framing members and accounting for the effects of framing members.

3. Bay Window roofs and floors shall be insulated to meet the wall insulation requirements of Package D.

(d) **Raised-floor Insulation.** Raised floors separating conditioned space from unconditioned space shall meet the requirements of either Item 1 or 2 below:

1. Floors shall be insulated between wood-framing members with insulation having an installed thermal resistance of R-~~19+3~~ or greater.

2. The weighted average U-factor of floor assemblies shall not exceed the U-factor that would result from installing R-~~19+3~~ insulation between wood-framing members and accounting for the effects of framing members.

**ALTERNATIVE to Section 150150.0(d)1 and 2:** Raised floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in [TABLE 151-B](#) and [TABLE 151-C](#), [TABLE 151-D](#), [TABLE 150.1-C](#) and a [Class I or Class II](#) vapor ~~retarder~~[barrier](#) is placed over the entire floor of the crawl space, and vents are fitted with automatically operated louvers that are temperature actuated.

(e) **Installation of Fireplaces, Decorative Gas Appliances and Gas Logs**

1. If a masonry or factory-built fireplace is installed, it shall have the following:

- A. Closeable metal or glass doors covering the entire opening of the firebox;
- B. A combustion air intake to draw air from the outside of the building, which is at least 6 square inches in area and is equipped with a readily accessible, operable, and tight-fitting damper or combustion-air control device; and

**EXCEPTION to Section 150150.0(e)1B:** An outside combustion-air intake is not required if the fireplace will be installed over concrete slab flooring and the fireplace will not be located on an exterior wall.

- C. A flue damper with a readily accessible control.

**EXCEPTION to Section 150150.0(e)1C:** When a gas log, log lighter, or decorative gas appliance is installed in a fireplace, the flue damper shall be blocked open if required by the CMC or the manufacturer's installation instructions .

2. Continuous burning pilot lights and the use of indoor air for cooling a firebox jacket, when that indoor air is vented to the outside of the building, are prohibited.

(f) **Air Barrier.** A continuous air barrier meeting the requirements of Section 110.7 shall be installed to the building envelope.

**Retarding Wrap.** If an air retarding wrap is installed to meet the compliance credit under performance approach, it shall be tested and labeled by the manufacturer to comply with ASTM E1677-95, Standard Specification for an Air Retarder (AR) Material or system for Low-Rise Framed Building Walls, and have a minimum perm rating of 10. The air retarding wrap shall be installed per the manufacturer's specifications that shall be provided to comply with ASTM E1677-95 (2000).

(g) **Vapor Barriers Retarder.** In Climate Zones 14 and 16 shown in FIGURE 101-A, a Class II vapor barrier-retarder shall be installed on the conditioned space side of all insulation in all exterior walls, vented attics, and unvented attics with air-impermeable insulation, and in Climate Zones 1-16 unvented crawl spaces the earth floor of the crawl space shall be covered with a Class I or Class II vapor retarder to protect insulation from condensation.

If a building has a control ventilation crawl space, a Class I or Class II vapor barrier-retarder shall be placed over the earth floor of the crawl space to reduce moisture entry and protect insulation from condensation, as specified in the alternative to Section 150150.0(d).

(h) **Space-Conditioning Equipment.**

1. **Building Cooling and Heating Loads.**

Building heating and cooling loads shall be determined using a method based on any one of the following:

- A. The ASHRAE Handbook, Equipment Volume, Applications Volume, and Fundamentals Volume, or
- B. The SMACNA Residential Comfort System Installation Standards Manual, or
- C. The ACCA Manual J.

The cooling and heating loads are two of the criteria that shall be used for equipment sizing and selection.

NOTE: Heating systems are required to have a minimum heating capacity adequate to meet the minimum requirements of the CBC. The furnace output capacity and other specifications are published in the Commission's directory of certified equipment or other directories approved by the Commission.

2. Design conditions.

For the purpose of sizing the space-conditioning (HVAC) system, the indoor design temperatures shall be 70°F for heating and 75°F for cooling. Outdoor design conditions shall be selected from Reference Joint Appendix JA2, which is based on data from the ASHRAE Climatic Data for Region X. The outdoor design temperatures for heating shall be no lower than the Heating Winter Median of Extremes values. The outdoor design temperatures for cooling shall be no greater than the 1.0 percent Cooling Dry Bulb and Mean Coincident Wet Bulb values.

- (i) **Thermostats**— Heating systems shall be equipped with thermostats that meet the setback thermostat requirements of Section 110.2(c).
- (j) **Water System Piping and Insulation for Piping, and Tanks, Insulation and Cooling Systems Lines Insulation.**

1. **Storage tank insulation.**

- A. Storage gas water heaters with an energy factor equal to or less than the federal minimum standards shall be externally wrapped with insulation having an installed thermal resistance of R-12 or greater.
- B. Unfired hot water tanks, such as storage tanks and backup storage tanks for solar water-heating systems, shall be externally wrapped with insulation having an installed thermal resistance of R-12 or greater or have internal insulation of at least R-16 and a label on the exterior of the tank showing the insulation R-value.

2. **Water piping and cooling system line insulation thickness and conductivity.** Piping, whether buried or unburied, for recirculating sections of domestic hot water systems; piping from the heating source to the storage tank for an indirect-fired domestic water-heating system; the first 5 feet (1.5 m) of hot and cold water pipes from the storage tank for nonrecirculating systems; all nonrecirculating hot water piping of nominal diameter 3/4 inch (19 mm) or larger; and cooling system lines shall be thermally insulated as specified in subsection A or B. Piping for steam and hydronic heating systems or hot water systems with pressure above 15 psig shall meet the requirements in TABLE 123-A.

- A. For insulation with conductivity in the range shown in TABLE 150-A-TABLE 150.0-A for the applicable fluid temperature range, the insulation shall have the applicable thickness shown in TABLE 150-B-TABLE 150.0-B.
- B. For insulating with an alternate material with conductivity outside the range shown in TABLE 150-A-TABLE 150.0-A for the applicable fluid temperature range, the insulation shall have a minimum thickness as calculated by EQUATION 150.0-A-EQUATION 150 A.

*EQUATION ~~150~~150.0-A — INSULATION THICKNESS*

$$T = PR \left[ \left( 1 + \frac{t}{PR} \right)^{\frac{K}{k}} - 1 \right]$$

WHERE:

- T* = Minimum insulation thickness for alternate material with conductivity K, inches.
- PR* = Pipe actual outside radius, inches.
- t* = Insulation thickness from TABLE ~~450~~150.0-B, inches.
- K* = Conductivity of alternate material at the mean rating temperature indicated in TABLE ~~450~~150.0-A for the applicable fluid temperature range, in Btu-inch per hour per square foot per °F.
- k* = The lower value of the conductivity range listed in TABLE ~~450~~150.0-A for the applicable fluid temperature range, Btu-inch per hour per square foot per °F.

**EXCEPTION 1 to Section ~~450~~150.0(j)2:** Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

**EXCEPTION 2 to Section ~~450~~150.0(j)2:** Piping that serves process loads, gas piping, cold domestic water piping, condensate drains, roof drains, vents, or waste piping.

**EXCEPTION 3 to Section ~~450~~150.0(j)2:** Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing. Insulation shall butt securely against all framing members.

**EXCEPTION 4 to Section 150150.0(j)2:** Piping installed in interior or exterior walls shall not be required to have pipe insulation if all of the requirements are met for compliance with the Insulation Installation Quality compliance option as specified by the Residential ACM Manual.

**EXCEPTION 5 to Section 150150.0(j)2:** Piping installed in attics with a minimum of 4 inches (10 cm) of attic insulation on top of the piping shall not be required to have pipe insulation.

**NOTE:** Where the Executive Director approves a water heater calculation method for a particular water heating recirculation system, piping insulation requirements are those specified in the approved calculation method.

3. **Insulation Protection.** Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind including but not limited to the following:
  - A. Insulation exposed to weather shall be suitable for outdoor service; e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
  - B. Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall ~~have a~~ include a Class I or Class II vapor retarding facingant located outside the insulation, or the insulation shall be installed at the thickness that meets a Class I or Class II ~~has a vapor barrierretarder-rated (unless the insulation is inherently vapor retardant), and all penetrations and joints of which shall be sealed.~~

~~4. Solar water heating systems and/or collectors shall be certified by the Solar Rating and Certification Corporation.~~

~~54. The maximum length of 1 inch (25 mm) piping in a non-recirculating domestic hot water distribution system shall be limited to a total length of 150 feet (4.5 m).~~

~~**EXCEPTION 1 to Section 150150.0(j)5:** A dedicated 1 inch (25 mm) line feeding a high flow tub fixture (or tub fixtures) can be installed provided all other fixtures meet the requirement of 150150.0(j)5.~~

~~56. Solar domestic water-heating systems and/or collectors shall be certified and rated by the Solar Rating and Certification Corporation (SRCC).~~

(k) **Residential Lighting.**

1. **High Efficacy Luminaire Requirements**

~~A. **Luminaire Efficacy:** Installed luminaires shall be classified as high-efficacy or low-efficacy for compliance with Section 150150.0(k) according in accordance with to Tables 150150.0-C or Table and 150150.0-D, as applicable~~

~~B. **Hybrid Luminaires:** When a high efficacy and low efficacy lighting system are combined together in a single luminaire, the high efficacy and low efficacy lighting systems shall separately comply with the applicable provisions of Section 150150.0(k)~~

~~A high efficacy luminaire or LED Light Engine with Integral Heat Sink has an efficacy that is no lower than the efficacies contained in TABLE 150-C and is not a low efficacy luminaire as specified by Section 150(k)2.~~

~~**EXCEPTION 1 to Section 150(k)1:** To qualify as high efficacy, a luminaire rated only for use with a high intensity discharge reflector lamp shall have a minimum lamp efficacy within 2 lumens per watt of the minimum lamp efficacies in TABLE 150-C.~~

~~**EXCEPTION 2 to Section 150(k)1:** When a high efficacy LED Light Engine with Integral Heat Sink is combined with a low efficacy lighting system in a Hybrid LED Luminaire as defined in Section 101, the high efficacy and low efficacy lighting systems shall separately comply with the applicable provisions of Section 150(k).~~

~~2. **Low Efficacy Luminaires.** A low efficacy luminaire is any luminaire that does not qualify as high efficacy as specified by Section 150(k)1, or any of the following regardless of the efficacy:~~

~~A. Contains a medium screw base socket (E24/E26) or other line voltage socket or a line voltage lamp holder;  
or~~

~~**EXCEPTION 1 to Section 150(k)2A:** High intensity discharge (HID) luminaires containing factory installed ballasts and HID rated medium screw base sockets shall be considered high efficacy luminaires provided they meet the efficacies contained in TABLE 150 C.~~

~~**EXCEPTION 2 to Section 150(k)2A:** A Luminaire with a factory installed GU 24 lamp holder may be classified as high efficacy provided that it meets all of the following requirements:~~

- ~~i.—Is not a recessed downlight that is rated to be used with compact fluorescent lamps; and~~
- ~~ii.—Does not contain any other type of line voltage socket or lamp holder; and~~
- ~~iii.—The manufacturer does not make available adaptors or modular components for the luminaire which convert the GU 24 lamp holder to any other type of socket or lamp holder; and~~
- ~~iv.—Is rated, as specified by UL 1598, for use only with high efficacy lamps or high efficacy LED Light Engine with Integral Heat Sink meeting the requirements contained in TABLE 150 C, as listed on a permanent, pre-printed, factory installed label on the luminaire housing.~~

~~B.—Low voltage incandescent lighting; or~~

~~C.—Track lighting or other lighting systems which allow the addition or relocation of luminaires without altering the wiring of the system; or~~

~~D.—Lighting systems which have modular components that allow conversion between screw based and pin-based sockets without changing the luminaires' housing or wiring; or~~

~~E.—Electrical boxes finished with a blank cover or where no electrical equipment has been installed, and where the electrical box can be used for a luminaire or a surface mounted ceiling fan.~~

~~**3C. Luminaire Wattage.** The wattage of permanently installed luminaires in residential kitchens shall be determined as specified by in accordance with Section 130.0(d~~c~~). In residential kitchens, the wattage of electrical boxes finished with a blank cover or where no electrical equipment has been installed, and where the electrical box can be used for a luminaire or a surface mounted ceiling fan, shall be calculated as 180 watts of low efficacy lighting per electrical box.~~

~~**4D. Electronic Ballasts.** Ballasts for fluorescent lamps rated 13 watts or greater shall be electronic and shall have an output frequency no less than 20 kHz.~~

~~**5E. Night Lights.** A pPermanently installed night lights and night lights integral to a permanently installed luminaire or exhaust fan shall meet one of the following conditions:~~

~~A.—Shall contain only high efficacy lamps meeting the minimum efficacies contained in TABLE 150 C and shall not contain a line voltage socket or line voltage lamp holder; or~~

~~B.—Shall be rated to consume no more than 5 watts of power as determined by in accordance with Section 130.0(d~~c~~), and shall not contain a medium screw base socket.~~

~~EXCEPTION to Section 150.0(k)1E. Lighting installed by the manufacturer in kitchen exhaust hoods.~~

~~**NOTE:** Indicator lights that are integral to lighting controls shall comply with Section 119(b).~~

~~**6.—Lighting Integral to Exhaust Fans.** Lighting integral to exhaust fans, in rooms other than kitchens, shall meet the applicable requirements of Section 150(k). F. **Lighting Integral to Exhaust Fans.** Lighting integral to exhaust fans shall meet the applicable requirements of Section 150.0(k).~~

~~EXCEPTION to Section 150.0(k)1F. Lighting installed by the manufacturer in kitchen exhaust hoods.~~

## ~~72. Switching Devices and Controls.~~

~~A. All permanently installed hHigh efficacy luminaires shall be switched separately from low efficacy luminaires.~~

~~B. All eExhaust fans shall be switched separately from lighting system(s).~~

EXCEPTION to Section 150(k)72B: Lighting integral to an exhaust fan may be on the same switch as the fan. An exhaust fan with an integral lighting system provided where the lighting system can be manually turned on and off switched OFF in accordance with the applicable provisions in Section 150(k)2 while allowing the fan to continue to operate for an extended period of time.

- C. All permanently installed luminaires shall be switched with readily accessible controls that permit the luminaires to be manually switched on ON and off OFF.
  - D. All lighting controls and equipment shall be installed in accordance with the manufacturer's instructions.
  - E. No controls shall bypass a dimmer or vacancy sensor function. A lighting circuit controlled by more than one switch where that a dimmer or manual on occupant vacancy sensor has been installed to comply with Section 150.0(k) shall meet the following conditions:
    - i. No controls shall bypass the dimmer or manual on occupant sensor function.
    - ii. The dimmer or manual on occupant sensor shall comply with the applicable requirements of Section 119.
  - F. Manual on occupant sensors, motion sensors, and dimmers Lighting controls installed to comply with Section 150(k) shall comply with the applicable requirements of Section 110.9.
  - G. An Energy Management Control System (EMCS) may be used to comply with dimmer requirements in Section 150150.0(k) if at a minimum it provides the functionality of a dimmer in accordance with Section 110.9, meets the acceptance test requirements in Section 130.4, the EMCS requirements in Section 130.5, and complies with all of the applicable requirements in Section 150150.0(k)2.
  - H. An Energy Management Control System may be used to comply with vacancy sensor requirements in Section 150150.0(k) if at a minimum it provides the functionality of a vacancy sensor in accordance with Section 110.9, meets the acceptance test requirements in Section 130.4, the EMCS requirements in Section 130.5, and complies with all of the applicable requirements in Section 150150.0(k)2.
  - I. A multi-scene programmable controller may be used to comply with dimmer requirements in Section 150150.0(k) if at a minimum it provides the functionality of a dimmer in accordance with Section 110.9, and complies with all of the applicable requirements in Section 150150.0(k)2.
83. **Lighting in Kitchens.** A minimum of 50 percent of the total rated wattage of permanently installed lighting in kitchens shall be high efficacy.

EXCEPTION to Section 150150.0(k)387A: Up to 50 watts for dwelling units less than or equal to 2,500 ft<sup>2</sup> or 100 watts for dwelling units larger than 2,500 ft<sup>2</sup> may be exempt from the 50 percent high efficacy requirement when the following conditions are met:

- A. All low efficacy luminaires lighting in the kitchen is controlled in accordance with the applicable provisions in Section 150150.0(k)2, and is also controlled by a manual on occupant vacancy sensors, or dimmers, energy management control system (EMCS), or a multi-scene programmable control system; and
- B. All permanently installed luminaires in garages, laundry rooms, closets greater than 70 square feet, and utility rooms are high efficacy and are controlled by a manual on occupant sensor.

**NOTE:** For the purpose of this requirement compliance with Section 150150.0(k), kitchen lighting includes all permanently installed lighting in the kitchen except for lighting that is internal to cabinets for the purpose of illuminating only the inside of the cabinets. Lighting in areas adjacent to the kitchen, including but not limited to dining and nook areas, are considered kitchen lighting if they are not separately switched from kitchen lighting.

94. **Lighting Internal to eCabinets.** Permanently installed lighting that is internal to cabinets shall use no more than 20 watts of power per linear foot of illuminated cabinet. The length of an illuminated cabinet shall be determined using one of the following measurements, regardless of the number of shelves or the number of doors per cabinet section:
- A. One horizontal length of illuminated cabinet, or
  - B. One vertical length, per illuminated cabinet section, or
  - C. No more than one vertical length per every 40 horizontal inches of illuminated cabinet.

5. Lighting in Bathrooms. Lighting installed in bathrooms shall meet the following requirements:

- A. A minimum of one high efficacy luminaire shall be installed in each bathroom; and
- B. All other lighting installed in each bathroom shall be high efficacy or controlled by vacancy sensors.

~~106~~ Lighting in Bathrooms, Garages, Laundry Rooms, Closets, and Utility Rooms. Permanently Lighting installed luminaires in bathrooms, attached and detached garages, laundry rooms, closets and utility rooms shall be high efficacy luminaires and shall be controlled by a vacancy sensors. Vacancy sensors in garages shall use ultrasonic, dual technology, or other methods for occupant detection which do not rely solely on line of sight.

~~EXCEPTION 1 to Section 150(k)10:~~ Permanently installed low efficacy luminaires shall be allowed provided that they are controlled by a manual on-occupant sensor certified to comply with the applicable requirements of Section 119.

~~EXCEPTION 2 to Section 150(k)10:~~ Permanently installed low efficacy luminaires in closets less than 70 square feet are not required to be controlled by a manual on-occupant sensor.

~~117~~ Lighting other than in Kitchens, Bathrooms, Garages, Laundry Rooms, Closets, and Utility Rooms. Permanently Lighting installed luminaires located in rooms or areas other than in kitchens, bathrooms, garages, laundry rooms, closets, and utility rooms shall be high efficacy luminaires, or shall be controlled by either dimmers or vacancy sensors.

~~EXCEPTION 1 to Section 150(k)7:~~ Luminaires in closets less than 70 square feet.

~~EXCEPTION 1 to Section 150(k)11:~~ Permanently installed low efficacy luminaires shall be allowed provided they are controlled by either a dimmer switch that complies with the applicable requirements of Section 119, or by a manual on-occupant vacancy sensor that complies with the applicable requirements of Section 119.

~~EXCEPTION 2 to Section 150(k)11:~~ Lighting in detached storage buildings less than 1000 square feet located on a residential site ~~is not required to comply with Section 150(k)11.~~

~~8132~~ Recessed Luminaires in Insulated Ceilings. Luminaires recessed into insulated ceilings shall meet all of the following ~~conditions~~ requirements:

- A. Be listed, as defined in Section 100.1, for zero clearance insulation contact (IC) by Underwriters Laboratories or other nationally recognized testing/rating laboratories; and
- B. Have a label that certifies that the luminaire is airtight with air leakage less than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283. An exhaust fan housing shall not be required to be certified airtight; and

~~EXCEPTION to Section 150(k)123B:~~ An exhaust fan housing shall not be required to be certified airtight.

- C. Be sealed with a gasket or caulk between the luminaire housing and ceiling, and shall have all air leak paths between conditioned and unconditioned spaces sealed with a gasket or caulk; and

~~Note: An exhaust fan shall be sealed with a gasket or caulk between the exhaust fan housing and ceiling.~~

- D. For recessed compact fluorescent luminaires with ballasts to qualify as high efficacy for compliance with Section ~~150150.0(k)~~, the ballasts shall be certified to the Commission to comply with the applicable requirements in Section 110.9(a); and

- E. Allow ballast maintenance and replacement to be readily accessible to building occupants from below the ceiling without requiring the cutting of holes in the ceiling.

~~139~~ Residential Outdoor Lighting. Luminaires providing residential outdoor lighting shall meet the following requirements, as applicable; ~~including outdoor lighting for private patios on low-rise residential buildings with four or more dwelling units, entrances, balconies, and porches, and which are permanently mounted to a residential building or to other buildings on the same lot shall be high efficacy luminaires.~~

- A. For single-family residential buildings, outdoor lighting permanently mounted to a residential building or other buildings on the same lot shall be high efficacy, or may be low efficacy if it ~~EXCEPTION 1 to Section 150(k)134:~~ Permanently installed outdoor low efficacy luminaires shall meets all of the following requirements:

- ~~i. be allowed provided that they are e~~Controlled by a manual ~~on/off~~ON and OFF switch; and
- ~~ii. Controlled by~~ a motion sensor not having an override or bypass switch that disables the motion sensor, ~~or controlled by a motion sensor having a temporary override switch which temporarily bypasses the motion sensing function and automatically reactivates the motion sensor within 6 hours;~~ and
- ~~iii. Controlled by~~ one of the following methods:

- ~~aA.~~ Photocontrol not having an override or bypass switch that disables the photocontrol; or
- ~~bB.~~ Astronomical time clock not having an override or bypass switch that disables the astronomical time clock, ~~and which is programmed to automatically turn the outdoor lighting OFF during daylight hours;~~ or
- ~~cC.~~ Energy management control system (EMCS) ~~which meets all of the following requirements: At a minimum provides the functionality of an astronomical time clock in accordance with Section 110.9; meets the acceptance test requirements in Section 130.4; meets the requirements for an EMCS in Section 130.5; does not have~~ing an override or bypass switch that allows the luminaire to be always ~~on~~ON; and, ~~is programmed to automatically turn the outdoor lighting OFF during daylight hours.~~

~~**EXCEPTION 2 to Section 150(k)13:** Outdoor luminaires used to comply with Exception 1 to Section 150(k)13 may be controlled by a temporary override switch which bypasses the motion sensing function provided that the motion sensor is automatically reactivated within 6 hours.~~

- ~~B. For low-rise multi-family residential buildings, outdoor lighting for private patios, entrances, balconies, and porches; and outdoor lighting for residential parking lots and residential carports with less than eight vehicles per site shall comply with one of the following requirements:~~

- ~~i. Shall comply with Section 150150.0(k)9A; or~~
- ~~shall be high efficacy.~~

- ~~ii. Shall comply with the applicable requirements in Sections 110.9, 130.0, 130.2, 130.4, 140.7, and 140.9.~~

- ~~C. For low-rise residential buildings with four or more dwelling units, outdoor lighting not regulated by Section 150150.0(k)9B installed for use other than private patios, entrances, balconies, and porches, or Section 150150.0(k)9D shall comply with the applicable requirements in Sections 110.9, 130.0, 130.2, 130.4, 140.7, and 140.9.~~

~~**EXCEPTION 3 to Section 150(k)13:** Permanently installed luminaires in or around swimming pools, water features, or other locations subject to Article 680 of the California Electric Code need not be high efficacy luminaires.~~

- ~~D. Outdoor lighting for residential parking lots and residential carports with a total of eight or more vehicles per site shall comply with the applicable requirements in Sections 110.9, 130.0, 130.2, 140.7, and 140.9.~~

~~414~~10. **Internally illuminated address signs.** Internally illuminated address signs shall:

- A. Comply with Section 140.8; or
- B. ~~Shall Not contain a screw base socket, and~~ consume no more than 5 watts of power as determined according to Section 130.0(~~dc~~).

~~156~~11. **Parking Lots and Residential Garages for Eight or More Vehicles.** Lighting ~~for parking lots and carports with a total of eight or more vehicles per site shall comply with the applicable requirements in Sections 130, 132, 134, and 147. Lighting for residential parking garages for eight or more vehicles shall comply with the applicable requirements in Sections 110.9, 130.0, 130.1, 130.4, and 140.6, and 140.9.~~

~~167~~12. **Interior Common Areas of Low-rise Multi-Family Residential Buildings.** Permanently installed lighting in the enclosed, non-dwelling spaces of low rise residential buildings with four or more dwelling units shall be high efficacy luminaires.

~~EXCEPTION to Section 150(k)167:~~ Permanently installed low efficacy luminaires shall be allowed provided that they are controlled by an occupant sensor(s) certified to comply with the applicable requirements of Section 119. A. In a low-rise multi-family residential building where the total interior common area in a single building equals 20 percent or less of the floor area, permanently installed lighting for the interior common areas in that building shall be high efficacy luminaires or controlled by an occupant sensor.

B. In a low-rise multi-family residential building where the total interior common area in a single building equals more than 20 percent of the floor area, permanently installed lighting in that building shall:

- i. Shall comply with the applicable requirements in Sections 110.9, 130.0, 130.1, 140.6, and 140.9; and
- ii. Lighting installed in corridors and stairwells shall be controlled by occupant sensors that reduce the lighting power in each space by at least 50 percent. The occupant sensors shall be capable of turning the light fully on from all designed paths of egress.

(l) **Slab Edge Insulation.** Material used for slab edge insulation shall meet the following minimum specifications:

1. Water absorption rate for the insulation material alone without facings no greater than 0.3 percent when tested in accordance with Test Method A – 24-Hour-Immersion of ASTM C272.
2. Water vapor permeance no greater than 2.0 perm/inch when tested in accordance with ASTM E96.
3. Concrete slab perimeter insulation shall be protected from physical damage and ultraviolet light deterioration.

(m) **Air-~~d~~Distribution and Ventilation System Ducts, Plenums, and Fans.**

1. **CMC ~~e~~Compliance.** All air-distribution system ducts and plenums, including, but not limited to, mechanical closets and air-handler boxes, shall be installed, sealed and insulated to meet the requirements of the CMC Sections 601, 602, 603, 604, 605 and Standard 6-5, incorporated herein by reference. Portions of supply-air and return-air ducts and plenums shall either be insulated to a minimum installed level of R-~~4.26.0~~ (or any higher level required by CMC Section 605) or be enclosed entirely in directly conditioned space. Connections of metal ducts and the inner core of flexible ducts shall be mechanically fastened. Openings shall be sealed with mastic, tape, or other duct-closure system that meets the applicable requirements of UL 181, UL 181A or UL 181B or aerosol sealant that meets the requirements of UL 723. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used.

Building cavities, support platforms for air handlers, and plenums defined or constructed with materials other than sealed sheet metal, duct board or flexible duct shall not be used for conveying conditioned air. Building cavities and support platforms may contain ducts. Ducts installed in cavities and support platforms shall not be compressed to cause reductions in the cross-sectional area of the ducts.

**EXCEPTION to Section ~~150~~150.0(m)1:** The requirements do not apply to ducts and fans integral to a wood heater or fireplace.

2. **Factory-~~f~~Fabricated ~~d~~Duct ~~s~~Systems.**

- A. All factory-fabricated duct systems shall comply with UL 181 for ducts and closure systems, including collars, connections, and splices, and be labeled as complying with UL 181. UL 181 testing may be performed by UL laboratories or a laboratory approved by the Executive Director.
- B. All pressure-sensitive tapes, heat-activated tapes, and mastics used in the manufacture of rigid fiberglass ducts shall comply with UL 181 and UL 181A.
- C. All pressure-sensitive tapes and mastics used with flexible ducts shall comply with UL 181 and UL 181B.
- D. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.

3. **Field-~~f~~Fabricated ~~d~~Duct ~~s~~Systems.**

- A. Factory-made rigid fiberglass and flexible ducts for field-fabricated duct systems shall comply with UL 181. All pressure-sensitive tapes, mastics, aerosol sealants, or other closure systems used for installing field-fabricated duct systems shall meet the applicable requirements of UL 181, UL 181A, and UL 181B.

- B. Mastic sealants and mesh.
    - i. Sealants shall comply with the applicable requirements of UL 181, UL 181A, and UL 181B, and be nontoxic and water resistant.
    - ii. Sealants for interior applications shall be tested in accordance with ASTM C731 and D2202, incorporated herein by reference.
    - iii. Sealants for exterior applications shall be tested in accordance with ASTM C731, C732, and D2202, incorporated herein by reference.
    - iv. Sealants and meshes shall be rated for exterior use.
  - C. Pressure-sensitive tape. Pressure-sensitive tapes shall comply with the applicable requirements of UL 181, UL 181A, and UL 181B.
  - D. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.
  - E. Drawbands used with flexible duct.
    - i. Drawbands shall be either stainless-steel worm-drive hose clamps or UV-resistant nylon duct ties.
    - ii. Drawbands shall have a minimum tensile strength rating of 150 pounds.
    - iii. Drawbands shall be tightened as recommended by the manufacturer with an adjustable tensioning tool.
  - F. Aerosol-sealant closures.
    - i. Aerosol sealants shall meet the requirements of UL 723 and be applied according to manufacturer specifications.
    - ii. Tapes or mastics used in combination with aerosol sealing shall meet the requirements of this section.
4. **Duct Insulation R-value Ratings.** All duct insulation product R-values shall be based on insulation only (excluding air films, vapor ~~barriers~~retarder, or other duct components) and tested C-values at 75°F mean temperature at the installed thickness, in accordance with ASTM C518 or ASTM C177, incorporated herein by reference, and certified pursuant to Section 110.8.
  5. **Duct Insulation Thickness.** The installed thickness of duct insulation used to determine its R-value shall be determined as follows:
    - A. For duct board, duct liner, and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
    - B. For duct wrap, installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
    - C. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.
  6. **Duct Labeling.** Insulated flexible duct products installed to meet this requirement shall include labels, in maximum intervals of 3 feet, showing the thermal performance R-value for the duct insulation itself (excluding air films, vapor ~~barriers~~retarder, or other duct components), based on the tests in Section ~~150~~150.0(m)4 and the installed thickness determined by Section ~~150~~150.0(m)5C.
  7. **Backdraft Dampers.** All fan systems, regardless of volumetric capacity, that exhaust air from the building to the outside shall be provided with backdraft or automatic dampers to prevent air leakage.
  8. **Gravity Ventilation Dampers.** All gravity ventilating systems that serve conditioned space shall be provided with either automatic or readily accessible, manually operated dampers in all openings to the outside except combustion inlet and outlet air openings and elevator shaft vents.
  9. **Protection of Insulation.** Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind but not limited to the following: Insulation exposed to weather shall be suitable for outdoor service e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular

foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

10. **Porous Inner Core Flex Duct.** Flexible ducts having porous inner cores shall not be used.

11. **Duct System Leakage.** When space conditioning systems utilize forced air duct systems to supply conditioned air to an occupiable space, the ducts shall be sealed, as confirmed through field verification and diagnostic testing, in accordance with all applicable procedures specified in Reference Residential Appendix RA3.1 and leakage compliance criteria specified in Reference Residential Appendix Table RA3.1-2.

12. **Air Filtration.**

A. **System Configuration.** Mechanical systems that supply air to an occupiable space through ductwork exceeding 10 ft (3 m) in length and through a thermal conditioning component, except evaporative coolers, shall be configured to ensure that all recirculated air and all outdoor air supplied to the occupiable space is filtered before passing through the system's thermal conditioning components. All system air filter devices shall be located and installed in such a manner as to facilitate access and regular service by the owner. The air filter device locations shall be labeled with the applicable design airflow rate and the maximum allowable clean-filter pressure drop. The labels shall conform to a format approved by the Energy Commission, be readily legible, and shall be visible to a person replacing the air filter.

B. **Efficiency.** All systems that are required to meet the specifications given in Section 150.0(m)12A shall be provided with air filters having a minimum efficiency rating of MERV 6 as determined in accordance with ASHRAE Standard 52.2, or a minimum particle size efficiency of 50% in the 3.0–10 µm range as determined in accordance with AHRI Standard 680.

C. **Pressure Drop.** All systems that are required to meet the specifications given in Section 150.0(m)12A shall be provided with air filters that perform at a maximum clean filter pressure drop of 25 Pa (0.1 inches water), as rated using AHRI Standard 680, for the applicable system design airflow.

D. **Air Filter Product Labeling.** Air filter products shall be labeled by the manufacturer to disclose the AHRI Standard 680 performance ratings for airflow rate, initial and final resistance (pressure drop), dust holding capacity, and particle size efficiency for three particle size ranges: 0.30 µm to 1.0 µm, 1.0 µm to 3.0 µm, and 3.0 µm to 10 µm.

13. **Duct System Sizing and Air Filter Grille Sizing.** For space conditioning systems that utilize forced air ducts to supply conditioned air to an occupiable space, all such duct systems shall have return ducts and return air filter grills that conform to the requirements in Section 150.0(m)13A, otherwise the forced air duct systems shall demonstrate compliance with the fan watt draw and airflow verification requirements given in Section 150.0(m)13B. The requirements of sections 150.0(m)13A and 150.0(m)13B do not apply to heating-only systems.

A. Return duct sizing and return air filter grille sizing shall conform to the applicable requirements in Tables 150.0-A and 150.0-B.

Table 150.0-A: Return Duct Sizing for Single Return Duct Systems (not applicable to systems with nominal cooling capacity greater than 2.5 ton).		
System Nominal Cooling Capacity (Ton)	Minimum Return Duct Diameter (inch)	Minimum Total Return Grill Gross Area ( inch <sup>2</sup> )
1.5	16	500

<u>2</u>	<u>18</u>	<u>600</u>
<u>2.5</u>	<u>20</u>	<u>800</u>

<u>Table 150.0-B: Return Duct Sizing for Multiple Return Duct Systems</u>			
<u>System Nominal Cooling Capacity (Ton)</u>	<u>Return Duct 1 Minimum Diameter (inch)</u>	<u>Return Duct 2 Minimum Diameter (inch)</u>	<u>Minimum Total Return Grill Gross Area ( inch<sup>2</sup>)</u>
<u>1.5</u>	<u>12</u>	<u>10</u>	<u>500</u>
<u>2</u>	<u>14</u>	<u>12</u>	<u>600</u>
<u>2.5</u>	<u>14</u>	<u>14</u>	<u>800</u>
<u>3</u>	<u>16</u>	<u>14</u>	<u>900</u>
<u>3.5</u>	<u>16</u>	<u>16</u>	<u>1000</u>
<u>4</u>	<u>18</u>	<u>18</u>	<u>1200</u>
<u>5</u>	<u>20</u>	<u>20</u>	<u>1500</u>

B Fan Watt draw and airflow verification procedures shall be performed in accordance with the requirements of subsections i through ii below.

- i. Forced air system fans shall demonstrate, in every zonal control mode, an airflow greater than 350 CFM per ton of nominal cooling capacity, and a fan watt draw less than 0.58 W/CFM when tested in accordance with the procedures given in Reference Residential Appendix RA3.3; and
- ii. Have a hole for the placement of a static pressure probe (HSPP) or a permanently installed static pressure probe (PSPP) in the supply plenum downstream of the air conditioning evaporator coil. The size, location, and labeling shall conform to the requirements specified in Reference Residential Appendix RA3.3.

14. **HVAC System Bypass Duct.** Bypass ducts that do not deliver conditioned supply air to a dwelling unit's occupiable space, but deliver conditioned supply air directly to the space conditioning system return duct airflow shall not be used.

15. **Zonally Controlled Central Forced Air System.** Central forced air systems shall simultaneously demonstrate, in every zonal control mode, an airflow from the residence and through the circulation blower greater than 350

CFM per ton of nominal cooling capacity and a blower Watt draw of less than 0.58 W/CFM as determined utilizing the methods specified in Reference Residential Appendix RA3.3.

(n) **Water Heating System.**

1. Systems using gas or propane water heaters to serve individual dwelling units shall include the following components:

A. A 120V electrical receptacle within 3 feet from the water heater. This electrical receptacle shall be accessible to the water heater with no obstructions; ~~without partition walls in~~  
~~between; and~~

B. A Category III or IV vent;

**EXCEPTION to 150.0(n)1B:** The building plan includes a vent retrofit plan for future upgrade to a Category III or IV vent. The plan shall include a vent path less than 12 ft without any interior walls along the path and a side-wall vent location in compliance with the National Fuel Gas Code. ~~and~~

C. A condensate drain that meets local jurisdiction requirements; and, ~~and~~

D. A gas supply line with a capacity of at least 200,000 Btu/hr.

~~**Exception to 150.0(n)1B:** The building plan includes a vent retrofit plan for future upgrade to a~~  
~~Category III or IV vent. The plan shall include a vent path less than 12 Ft without any interior~~  
~~walls along the path and a side wall vent location in compliance with the National Fuel Gas~~  
~~Code.~~

2. ~~Water Heating Recirculation Loops Serving Multiple Dwelling Units.~~ Water heating recirculation loops serving multiple dwelling units shall meet the requirements of Section 110.3(c)5.

(o) **Ventilation for Indoor Air Quality.** All dwelling units shall meet the requirements of ~~ANSI~~ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings. Window operation is not a permissible method of providing the Whole-Building Ventilation required in Section 4 of ~~that~~ASHRAE Standard 62.2. Installation and performance criteria for whole-building ventilation systems and local ventilation exhaust systems required by ASHRAE Standard 62.2 shall be confirmed through field verification and diagnostic testing, in accordance with all applicable procedures specified in Reference Residential Appendix RA3.7. Continuous operation of central forced air system fans used in central fan integrated ventilation systems is not a permissible method of providing the whole-building ventilation required in Section 4 of ASHRAE Standard 62.2.

(p) **Pool Systems and Equipment Installation.** Any residential pool system or equipment installed shall comply with the applicable requirements of Section 110.4, as well as the requirements listed in this section.

1. **Pump sizing and flow rate.**

A. All pumps and pump motors installed shall be listed in the Commission's directory of certified equipment and shall comply with the Appliance Efficiency Regulations.

B. All pump flow rates shall be calculated using the following system equation:

$$H = C \times F^2$$

WHERE:

H is the total system head in feet of water.

F is the flow rate in gallons per minute (gpm).

C is a coefficient based on the volume of the pool:

0.0167 for pools less than or equal to 17,000 gallons.

0.0082 for pools greater than 17,000 gallons.

and;

- C. Filtration pumps shall be sized, or if programmable, shall be programmed, so that the filtration flow rate is not greater than the rate needed to turn over the pool water volume in 6 hours or 36 gpm, whichever is greater; and
- D. Pump motors used for filtration with a capacity of 1 hp or more shall be multi-speed; and
- E. Each auxiliary pool load shall be served by either separate pumps or the system shall be served by a multi-speed pump; and

**EXCEPTION to Section 150.0(p)1E:** Pumps if less than 1 hp may be single speed.

- F. Multi-speed pumps shall have controls which default to the filtration flow rate when no auxiliary pool loads are operating; and
- G. For multi-speed pumps, the controls shall default to the filtration flow rate setting within 24 hours and shall have an override capability for servicing.

2. **System piping.**

- A. A length of straight pipe that is greater than or equal to at least 4 pipe diameters shall be installed before the pump; and
- B. Pool piping shall be sized so that the velocity of the water at maximum flow for auxiliary pool loads does not exceed 8 feet per second in the return line and 6 feet per second in the suction line; and
- C. All elbows shall be sweep elbows or elbow-type that have a pressure drop of less than the pressure drop of straight pipe with a length of 30 pipe diameters.

3. **Filters.** Filters shall be at least the size specified in NSF/ANSI 50 for public pool intended applications.

4. **Valves.** Minimum diameter of backwash valves shall be 2 inches or the diameter of the return pipe, whichever is greater.

(q) Fenestration Products separating conditioned space from unconditioned space shall meet the requirements of either Item 1 or 2 below:

1. Fenestration products must have a maximum U-factor of 0.57.

2. The weighted average U-factor of all fenestration products shall not exceed the U-factor that would result from installing 0.57 U-factor fenestration products throughout the conditioned space of the building.

**EXCEPTION to Section 150.0(qg)1:** Up to eight square feet of fenestration area.

(r) Solar Ready. Buildings shall meet the requirements of Section 110.10 applicable to the building project.

**TABLE 150.0-A PIPE INSULATION CONDUCTIVITY RANGE**

FLUID TEMPERATURE RANGE (°F)	INSULATION MEAN RATING TEMPERATURE (°F)	CONDUCTIVITY RANGE (Btu-inch per hour per square foot per °F) <sup>1</sup>
201 – 250	150	0.27 – 0.30
105 – 201	100	0.24 – 0.28
Below 105	75	0.23 – 0.27

<sup>1</sup> Insulation conductivity shall be determined in accordance with ASTM C 335 at the mean temperature listed in TABLE 150.0-A, and shall be rounded to the nearest 1/100 Btu-inch per hour per square foot per °F.

**TABLE 150.0-B PIPE INSULATION MINIMUM THICKNESS REQUIREMENTS**

SYSTEM	PIPE DIAMETER	
	Less than or Equal to 2 inches	Greater than 2 inches
	INSULATION THICKNESS REQUIRED (in inches)	
Domestic hot water (above 105°F)	1.0	1.5
Hydronic heating supply lines (above 200°F to 250°F) <sup>1</sup>	1.0	2.0
Hydronic heating supply lines (105°F to 200°F)	1.0	1.5
Cooling system refrigerant suction, chilled water and brine lines	0.75	1.0

<sup>1</sup> Steam hydronic heating systems or hot water systems with pressure above 15 psi shall meet the requirements of TABLE 123-A.

**TABLE 150-C HIGH EFFICACY LUMINAIRE REQUIREMENTS**

<b>Lamp Power Rating for Non-LED Lighting (see Note 1), or System Power Rating for LED Lighting (see Notes 2, 3, and 4)</b>	<b>Minimum Lamp Efficacy for Non-LED Lighting, or Minimum System Efficacy for LED Lighting</b>
5-watts or less	30 lumens per watt
over 5-watts to 15-watts	40 lumens per watt
over 15-watts to 40-watts	50 lumens per watt
over 40-watts	60 lumens per watt

**Notes:**

- Determine minimum lamp efficacy category for lighting systems which are not LED using the initial rated lumens divided by the rated watts of the lamp (not including the ballast).
- To qualify as high efficacy, an LED luminaire shall meet the minimum system efficacy requirements in Table 150-C when determined according to Reference Joint Appendix JA8, and be certified to comply with Section 119(m), and input power shall be determined according to Section 130(d)5.
- For a Hybrid LED Luminaire to qualify as a high efficacy luminaire, all lighting systems in the luminaire shall qualify as high efficacy according to Section 150(k)1, and the LED Light Engine with Integral Heat Sink shall comply with Note 4, below.
- To qualify as high efficacy, an LED Light Engine with Integral Heat Sink shall meet the minimum system efficacy requirements in Table 150-C when determined according to Reference Joint Appendix JA8, shall be certified to comply with Section 119(m), and input power shall be determined according to Section 130(d)5.

**TABLE 450150.0-C CLASSIFICATION OF HIGH EFFICACY AND LOW EFFICACY LIGHT SOURCES**

<u>High Efficacy Light Sources</u>	<u>Low Efficacy Light Sources</u>
<p><u>Luminaires manufactured, designed and rated for use with only lighting technologies in this column shall be classified as high efficacy:</u></p>	<p><u>Luminaires manufactured, designed or rated for use with any of the lighting technologies in this column shall be classified as low efficacy.</u></p>
<p>1. <u>Pin-based fluorescent lamps.</u>                  2. <u>Pulse-start metal halide lamps.</u>                  3. <u>High pressure sodium lamps.</u>                  4. <u>GU-24 sockets rated for LED lamps.</u>                  5. <u>GU-24 sockets rated for compact fluorescent lamps, and which are not recessed luminaires.</u>                  6. <u>Luminaires using LED light sources which have been certified to the Energy Commission as high efficacy in accordance with Joint Appendix JA-8.</u>                  7. <u>Luminaire housings rated by the manufacturer for use with only LED light engines.</u>                  8. <u>Induction lamps.</u>                  Note: <u>Adaptors which convert an incandescent lamp holder to a high-efficacy luminaire shall not be used to classify a luminaire as high efficacy.</u></p>	<p>1. <u>Line-voltage lamp holders (sockets) capable of operating incandescent lamps of any type.</u>                  2. <u>Low-voltage lamp holders capable of operating incandescent lamps of any type.</u>                  3. <u>High efficacy lamps installed in low-efficacy luminaires, including screw base compact fluorescent and screw base LED lamps.</u>                  3. <u>Mercury vapor lamps.</u>                  4. <u>Track lighting or other flexible lighting system which allows the addition or relocation of luminaires without altering the wiring of the system.</u>                  6. <u>Luminaires using LED light sources which have not been certified to the Energy Commission as high efficacy.</u>                  7. <u>Lighting systems which have modular components that allow conversion between high-efficacy and low-efficacy lighting without changing the luminaires' housing or wiring.</u>                  8. <u>Electrical boxes finished with a blank cover or where no electrical equipment has been installed, and where the electrical box can be used for a luminaire or a surface mounted ceiling fan.</u></p>

**TABLE 450150.0-D MINIMUM REQUIREMENTS FOR OTHER LIGHT SOURCES TO QUALIFY AS HIGH EFFICACY**

<p><u>Use this table to determine luminaire efficacy only for lighting systems not listed in Table 450150.0-C</u></p>	
<u>Luminaire Power Rating</u>	<u>Minimum Luminaire Efficacy to Qualify and High Efficacy</u>
5 watts or less	30 lumens per watt
over 5 watts to 15 watts	45 lumens per watt
over 15 watts to 40 watts	60 lumens per watt
over 40 watts	90 lumens per watt
<p>Note: <u>Determine minimum luminaire efficacy using the system initial rated lumens divided by the luminaire total rated system input power.</u></p>	

