B. Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall have a Class I or Class II vapor retarder~~ing facing, or the insulation shall be installed at the thickness that qualifies as a Class I or Class II vapor retarder.~~

(k) **Residential Lighting.**

1. Residential **Luminaire Requirements**

A. **Luminaire Efficacy:** ~~Installed~~ All installed luminaires shall be ~~classified as~~ high-efficacy ~~or low-efficacy for compliance with Section 150.0(k)~~ in accordance with TABLE 150.0-A ~~or TABLE 150.0-B, as applicable~~.

Provide definition of "Blank Electrical Box"

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 150.0(k)~~**Blank Electrical Boxes.** The number of electrical boxes that are more than 5 feet above the finished floor and do not contain a luminaire or other device shall be no greater than the number of bedrooms. These electrical boxes must be served by a dimmer, ~~or~~ vacancy sensor control, or fan speed control.

A studio or efficiency apartment has no bedrooms per se.

C. ~~**Luminaire Wattage and Classification.** The Wattage and Classification of permanently installed luminaires in residential kitchens shall be determined in accordance with Section 130.0(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.~~**Recessed Downlight Luminaires in Ceilings.** Luminaires recessed into ceilings shall meet all of the following requirements:

i. Be listed, as defined in Section 100.1, for zero clearance insulation contact (IC) by Underwriters Laboratories or other nationally recognized testing/rating laboratory; and

ii. Have a label that certifies 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

iii. 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

iv. For luminaires with hardwired ballasts or drivers, allow ballast or driver maintenance and replacement to be readily accessible to building occupants from below the ceiling without requiring the cutting of holes in the ceiling; and

v. Shall not contain screw base~~d lamps~~sockets; and

vi. Shall contain light sources that comply with References Joint Appendix JA8, including the elevated temperature requirements, and that are marked "JA8-2016-E" as specified in Reference Joint Appendix JA8~~of JA8.104.8 and shall not contain light sources that are labeled "not for use in enclosed fixtures" or "not for use in recessed fixtures."~~

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D. **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.

Clarify if there is a limit to the quantity of night lights per room, or the rooms that are allowed to have night lights.

E. **Night Lights.** Permanently installed night lights and night lights integral to installed luminaires or exhaust fans shall be rated to consume no more than five watts of power per luminaire or exhaust fan as determined in accordance with Section 130.0(c). Night lights shall not be required to be controlled by vacancy sensors.

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.

G. **Screw based luminaires.** Screw based luminaires shall meet all of the following requirements:

i. The luminaires shall not be recessed downlight luminaires in ceilings; and

ii. The luminaires shall contain lamps that comply with Reference Joint Appendix JA8; and

iii. The installed lamps shall be ~~labeled~~ marked with "JA8-2016" or "JA8-2016-E" as ~~compliant with~~ specified in Reference Joint Appendix JA8.

EXCEPTION to Section 150.0~~1~~(k)1G: Luminaires with hard-wired ballasts for high intensity discharge lamps.

H. **Enclosed Luminaires.** Light sources that are not marked "JA8-2016-E" shall not be installed in enclosed luminaires.

Residential

2. **Interior Lighting Switching Devices and Controls.**

A. ~~High efficacy luminaires shall be switched separately from low efficacy luminaires~~All ~~leading-edge~~forward phase cut dimmers used with LED light sources shall comply with NEMA SSL 7A.

B. Exhaust fans shall be switched separately from lighting systems.

EXCEPTION to Section 150.0(k)2B: Lighting integral to an exhaust fan may be on the same switch as the fan provided the lighting can be switched OFF in accordance with the applicable provisions in Section 150.0(k)2 while allowing the fan to continue to operate for an extended period of time.

C. Luminaires shall be switched with readily accessible controls that permit the luminaires to be manually switched ON and OFF.

D. 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 where that dimmer or vacancy sensor has been installed to comply with Section 150.0(k).

F. Lighting controls 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 150.0(k) if at a minimum it provides the functionality of a dimmer in accordance with Section 110.9, meets the installation certificate requirements in Section 130.4, the EMCS requirements in Section 130.5(f), and complies with all other applicable requirements in Section 150.0(k)2.

H. An Energy Management Control System (EMCS) may be used to comply with vacancy sensor requirements in Section 150.0(k) if at a minimum it provides the functionality of a vacancy sensor in accordance with Section 110.9, meets the installation certificate requirements in Section 130.4, the EMCS requirements in Section 130.5(f), and complies with all other applicable requirements in Section 150.0(k)2.

I. A multiscene programmable controller may be used to comply with dimmer requirements in Section 150.0(k) if at a minimum it provides the functionality of a dimmer in accordance with Section 110.9, and it complies with all other applicable requirements in Section 150.0(k)2.

J. In ~~B~~bathrooms, ~~G~~garages, ~~L~~laundry ~~R~~rooms, and ~~U~~utility ~~R~~rooms, at least one luminaire in each of these spaces shall be controlled by a vacancy sensor.

K. Dimmers or vacancy sensors shall control all luminaires required to have light sources compliant with Reference Joint Appendix JA8.

EXCEPTION 1 to Section 150.0(k)2K: Luminaires in closets less than 70 square feet.

EXCEPTION 2 to Section 150.0(k)2K: Luminaires in hallways.

L. Undercabinet lighting shall be switched separately from other lighting systems.

Please clarify whether ~~an~~ undercabinet lighting controlled by a separate control channel of an EMCS would be compliant.

~~3. **Lighting in Kitchens.**~~

~~A. A minimum of 50 percent of the total rated wattage of permanently installed lighting in kitchens shall be high efficacy.~~

~~B. For the purpose of compliance with Section 150.0(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~~

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~~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.~~

~~**EXCEPTION to Section 150.0(k)3:** Up to 50 watts for dwelling units less than or equal to 2,500 ft² or 100 watts for dwelling units larger than 2,500 ft² may be exempt from the 50 percent high efficacy requirement when all lighting in the kitchen is controlled in accordance with the applicable provisions in Section 150.0(k)2, and is also controlled by vacancy sensors or dimmers.~~

~~4. **Lighting Internal to Cabinets.** 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.~~

~~6. **Lighting in Garages, Laundry Rooms, and Utility Rooms.** Lighting installed in attached and detached garages, laundry rooms, and utility rooms shall be high efficacy luminaires and controlled by vacancy sensors.~~

~~7. **Lighting other than in Kitchens, Bathrooms, Garages, Laundry Rooms, and Utility Rooms.** Lighting installed in rooms or areas other than in kitchens, bathrooms, garages, laundry rooms, and utility rooms shall be high efficacy, or shall be controlled by either dimmers or vacancy sensors.~~

~~**EXCEPTION 1 to Section 150.0(k)7:** Luminaires in closets less than 70 square feet.~~

~~**EXCEPTION 2 to Section 150.0(k)7:** Lighting in detached storage buildings less than 1,000 square feet located on a residential site.~~

~~8. **Recessed Luminaires in Ceilings.** Luminaires recessed into ceilings shall meet all of the following 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 laboratory; 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~~

~~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~~

~~D. For recessed compact fluorescent luminaires with ballasts to qualify as high efficacy for compliance with Section 150.0(k), the ballasts shall be certified to the Commission to comply with the applicable requirements in Section 110.9; 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.~~

~~9.~~ 3. **Residential Outdoor Lighting.** In addition to meeting the requirements of Section 150.0(k)1A. ~~Luminaires~~ luminaires providing residential outdoor lighting shall meet the following requirements, as applicable:

A. For single-family residential buildings, outdoor lighting permanently mounted to a residential building, or to other buildings on the same lot, shall ~~be high efficacy, or may be low efficacy if it~~ meets ~~all of~~ the ~~following~~ requirements in item i and the requirements in ~~either~~ item ii ~~or item iii:~~

i. Controlled by a manual ON and OFF switch that does not override to ON the automatic actions of Items ii ~~or iii~~ below; and

~~ii.~~ Controlled by ~~a~~ photocell and motion sensor. Controls that override to ON shall not be allowed unless the override ~~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; or

ii ~~iii.~~ Controlled by one of the following methods:

a. b. ~~a.~~ ~~Photocontrol not having an override or bypass switch that disables the photocontrol~~Photocontrol and automatic time switch control. Controls that override to ON shall not be allowed unless the override shall automatically return the photocontrol and automatic time switch control to its normal operation within 6 hours.; or

c. ~~b.~~ Astronomical time clock, ~~not having an override or bypass switch that disables the astronomical time clock, and~~ Controls that override to ON shall not be allowed unless the override shall automatically return the astronomical clock to its normal operation within 6 hours and which is programmed to automatically turn the outdoor lighting OFF during daylight hours; or

d. ~~c.~~ Energy management control system 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 Installation Certification requirements in Section 130.4; ~~meets the requirements for an EMCS in Section 130.5;~~ does not have an override or bypass switch that allows the luminaire to be always ON; and, is programmed to automatically turn the outdoor lighting OFF during daylight hours.

B. For low-rise multifamily 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 150.0(k)~~9A~~3A; or

ii. Shall comply with the applicable requirements in Sections 110.9, 130.0, 130.2, 130.4, 140.7 and 141.0. } Non Res.

C. For low-rise residential buildings with four or more dwelling units, outdoor lighting not regulated by Section 150.0(k)~~9B~~ 3B or 150.0(k)~~9D~~ 3D shall comply with the applicable requirements in Sections 110.9, 130.0, 130.2, 130.4, 140.7 and 141.0.

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, 130.4, 140.7 and 141.0.

~~10~~4. **Internally illuminated address signs.** Internally illuminated address signs shall:

A. Comply with Section 140.8; or

B. Shall consume no more than 5 watts of power as determined according to Section 130.0(c).

~~11~~5. **Residential Parking Garages for Eight or More Vehicles.** Lighting for residential parking garages for eight or more vehicles shall comply with the applicable requirements for nonresidential garages in Sections 110.9, 130.0, 130.1, 130.4, 140.6, and 141.0.

~~12~~6. **Interior Common Areas of Low-rise Multi-Family Residential Buildings.**

A. In a low-rise multifamily 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~~ and controlled by an occupant sensor.

B. In a low-rise multifamily 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. Comply with the applicable requirements in Sections 110.9, 130.0, 130.1, 140.6 and 141.0; and

Residential Parking Garage for Seven or Less Vehicles. - - - -

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when the space is vacant.

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~~on ~~and Off~~ from all designed paths of ingress and egress. when the space becomes occupied.

(l) RESERVED~~**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.~~

~~4. Insulation for a heated slab floor shall meet the requirements of Section 110.8(g).~~

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

1. **CMC 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 601.0, 602.0, 603.0, 604.0, 605.0 and ANSI/SMACNA-006-2006 HVAC Duct Construction Standards Metal and Flexible 3rd Edition, incorporated herein by reference. Portions of supply-air and return-air ducts and plenums of a space heating or cooling system shall either be insulated to a minimum installed level of R-6.0 (or any higher level required by CMC Section 605.0) or a minimum installed level of R-4.2 when ~~be enclosed~~ entirely in ~~directly~~ conditioned space as confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix RA3.1.4.3.8. 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~~ designed 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 150.0(m)1: Ducts and fans integral to a wood heater or fireplace.

2. **Factory-Fabricated Duct 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-Fabricated Duct 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.

TABLE 150.0-A CLASSIFICATION OF HIGH EFFICACY ~~AND LOW EFFICACY~~ LIGHT SOURCES

High Efficacy Light Sources Luminaires installed with only the lighting technologies in this table shall be classified as high efficacy	
~~**High Efficacy Light Sources**~~ ~~Luminaires manufactured, designed and rated for use with only lighting technologies in this column shall be classified as high efficacy.~~Light sources in this column other than those installed in ceiling recessed ~~luminaries~~ downlight luminaires are classified as high efficacy and are **not** required to comply with Reference Joint Appendix JA8	~~**Low Efficacy Light Sources**~~ ~~Luminaires manufactured, designed or rated for use with any of the lighting technologies in this column shall be classified as low efficacy.~~Light sources in this column shall be certified to the Commission as High Efficacy Light Sources in accordance with Reference Joint Appendix JA8 and be marked as meeting JA8.
1. Pin-based ~~linear or compact~~ linear or compact fluorescent ~~lamps~~ light sources ~~with~~ using electronic ballasts. ~~Compact fluorescent lamps ≥ 13 watts shall have 4 pins for compliance with the electronic ballast requirements in Section 150.0(k)1D.~~ 2. Pulse-start metal halide ~~lamps~~. 3. High pressure sodium ~~lamps~~. 4. GU-24 sockets ~~rated for LED lamps~~containing light sources other than LEDs.[a,b] 5. ~~GU-24 sockets rated for compact fluorescent lamps~~Luminaires with hardwired high frequency generator and induction lamp. 6. Inseparable SSL luminaires that are installed outdoors. 7. Inseparable SSL luminaires containing colored light sources that are installed to provide decorative lighting. ~~6. Luminaires using LED light sources which have been certified to the Commission as high efficacy in accordance with Reference Joint Appendix JA8.~~ ~~7. Luminaire housings rated by the manufacturer for use with only LED light engines.~~ ~~8. Induction lamps.~~ ~~**Note:** Adaptors which convert an incandescent lamp holder to a high efficacy luminaire shall not be used to classify a luminaire as high efficacy.~~	~~1. Line-voltage lamp holders (sockets) capable of operating incandescent lamps of any type~~ ~~2~~68. All ~~Low-voltage lamp holders capable of operating incandescent lamps of any type~~light sources in ceiling recessed downlight luminaires. Note that ceiling recessed downlight luminaires shall not have screw bases regardless of lamp type as described in Section 150.0(k)1C. ~~7~~9. GU-24 sockets containing LED light sources. ~~38~~1310. ~~High efficacy lamps installed in low efficacy luminaires, including screw base compact fluorescent and screw base LED lamps~~Any light source not otherwise listed in this table and certified to the Commission as complying with Joint Appendix ~~8~~ JA8. ~~3. Mercury vapor lamps.~~ ~~4. Track lighting or other flexible lighting system which allows the addition or relocation of luminaires without altering the wiring of the system.~~ ~~6. Luminaires using LED light sources which have not been certified to the Commission as high efficacy.~~ ~~7. Lighting systems that have modular components that allow conversion between high efficacy and low-efficacy lighting without changing the luminaires' housing or wiring.~~ ~~8. 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.~~	

Notes:

a. GU-24 sockets containing light sources such as compact fluorescent lamps and induction lamps.

b. California Title 20 Section 1605(k)3 does not allow incandescent sources to have a GU-24 base.