

Commercial Electrification Readiness

Code Language:

Add new text as follows:

C103.2.2 Electrification system. The construction documents shall provide details for additional electric infrastructure, including branch circuits, conduit, or pre-wiring, panel capacity, and electrical service capacity in compliance with the provisions of this code.

Revise text as follows:

C105.2.5 Electrical system. Inspection shall verify lighting system controls, components, ~~and~~ meters, and additional electric infrastructure as required by the code, approved plans and specifications.

Add new definitions as follows:

ALL-ELECTRIC BUILDING. A building that contains no combustion equipment, or plumbing for combustion equipment, installed within the building or building site.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, service water heating, cooking, clothes drying and/or lighting that uses fuel gas or fuel oil.

COMMERCIAL COOKING APPLIANCES. Appliances used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such appliances include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries, and similar appliances. For the purpose of this definition, a food service establishment shall include any building or a portion thereof used for the preparation and serving of food.

FUEL GAS. A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).

MIXED-FUEL BUILDING. A building that contains combustion equipment or includes piping for such equipment.

Revise text as follows:

C405.5.3 Gas lighting. Gas-fired lighting appliances shall not be ~~equipped with continuously burning pilot ignition systems~~ permitted.

Add new text as follows:

C405.10 Additional electric infrastructure. Buildings that contain *combustion equipment* and end-uses shall be required to install electric infrastructure in accordance with this section.

C405.10.1 Combustion space heating. Spaces containing *combustion equipment* for space heating shall comply with this section.

C405.10.1.1 Low-capacity heating. Spaces containing warm-air furnaces with a capacity less than 225,000 Btu/h and gas- and oil-fired boilers with a capacity less than 400,000 Btu/h shall be provided with a designated exterior location(s) that complies with the following:

1. Natural drainage for condensate from cooling equipment operation or a condensate drain located within 3 feet (914 mm) of the location of the space heating equipment, and
2. A dedicated branch circuit in compliance with NFPA70 Section 424.4 based on heat pump space heating equipment sized in accordance with the requirements of Section C403.1.1 and terminating within 3 feet (914 mm) of the location of the space heating equipment with no obstructions. Both ends of the branch circuit shall be labeled "For Future Heat Pump Space Heater."

Exception: Where an electrical circuit in compliance with NFPA70 Sections 440.4(B) and 440.35 exists for space cooling equipment.

C405.10.1.2 High-capacity heating. Spaces containing all other space heating *equipment* shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the *equipment* and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric *equipment* with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, "For Future Electric Space Heating Equipment".

C405.10.2 Combustion water heating. Spaces containing *combustion equipment* for water heating shall comply with either C405.10.2.1 or C405.10.2.2

C405.10.2.1 Low-capacity water heating. Spaces containing water heaters with a capacity less than 300,000 Btu/h (88 kW) shall comply with the following:

1. A dedicated 208/240-volt branch circuit with a minimum capacity of 30 amps terminating within 3 feet (914 mm) from the water heater shall be provided and be accessible to the water heater with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Heat Pump Water Heater" and be electrically isolated,
2. A condensate drain that is no more than 2 inches (51 mm) higher than the base of the installed water heater and allows natural draining without pump assistance shall be installed within 3 feet (914 mm) of the water heater,
3. The space shall meet minimum dimensions of 3 feet (914 mm) by 3 feet (914 mm) by 7 feet (2134 mm) high, and

4. The space shall meet a minimum volume of 700 cubic feet (20,000 L) or the equivalent of one 16-inch (406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203 mm) duct of no more than 10 feet (3048 mm) in length for cool exhaust air.

Exception: Where items 1 and 2 are be provided at an exterior location capable of serving an outdoor compressor for a split-system heat pump water heater and a chase that is sized to accommodate refrigerant lines is provided between the outdoor location and the space required in item 3.

C405.10.2.2 High-capacity water heating. Spaces containing water heaters with a capacity greater than or equal to 300,000 Btu/h (88 kW) shall comply with the following:

1. Conduit that is continuous between a junction box located within 3 feet (914 mm) of the *equipment* and an electrical panel shall be provided. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric *equipment* with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, “For Future Electric Water Heating Equipment”, and
2. A condensate drain that is no more than 2 inches (51 mm) higher than the base of the installed water heater and allows natural draining without pump assistance shall be installed within 3 feet (914 mm) of the water heater,

C405.10.3 Combustion cooking. Spaces containing combustion equipment for cooking shall comply with either C405.10.3.1 or C405.10.3.2

C405.10.3.1 Commercial cooking. Spaces containing *commercial cooking appliances* shall be provided with a dedicated branch circuit with a minimum capacity of 80 kVA per 1 kBtu of appliance input capacity. The branch circuit shall terminate within 3 feet (914 mm) of the appliance with no obstructions. Both ends of the branch circuit shall be labeled with the words “For Future Electric Cooking Equipment” and be electrically isolated.

C405.10.3.2 Light and medium duty cooking. Spaces containing light- and medium duty cooking *equipment* not designated as *commercial cooking appliances* shall be provided with a dedicated branch circuit in compliance with NFPA 70 Section 422.10. The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be accessible with no obstructions. Both ends of the branch circuit shall be labeled with the words “For Future Electric Cooking Equipment” and be electrically isolated.

C405.10.4 Combustion clothes drying. Spaces containing combustion equipment for clothes drying shall comply with either C405.10.4.1 or C405.10.4.2

C405.10.4.1 Commercial drying. Spaces containing clothes drying *equipment*, and end-uses for commercial laundry applications shall be provided with conduit that is

continuous between a junction box located within 3 feet (914 mm) of the *equipment* and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric *equipment* with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, “For Future Electric Clothes Drying Equipment”, and

C405.10.4.2 Residential drying. Spaces containing clothes drying *equipment*, *appliances*, and end-uses serving multiple *dwelling units* or sleeping areas with a capacity less than or equal to 9.2 cubic feet shall be provided with a dedicated 240-volt branch circuit with a minimum capacity of 30 amps shall terminate within 6 feet (1829 mm) of fossil fuel clothes dryers and shall be accessible with no obstructions. Both ends of the branch circuit shall be labeled with the words “For Future Electric Clothes Drying Equipment” and be electrically isolated.

C406.1 Additional energy efficiency credit requirements. New *all-electric buildings* shall achieve a total of 10 credits and new *mixed-fuel buildings* shall achieve a total of 15 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

EVSE Infrastructure Requirements

Code Language:

Add new definitions as follows:

AUTOMOBILE PARKING SPACE. A space within a building or private or public parking lot, exclusive of driveways, ramps, columns, office and work areas, for the parking of an automobile.

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). Equipment for plug-in power transfer including the ungrounded, grounded and equipment grounding conductors, and the *electric vehicle* connectors, attachment plugs, personal protection system and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the *electric vehicle*.

ELECTRIC VEHICLE SUPPLY EQUIPMENT INSTALLED SPACE (EVSE space). An *automobile parking space* that is provided with a dedicated *EVSE* connection.

ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE). A designated *automobile parking space* that is provided with electrical infrastructure, such as, but not limited to, raceways, cables, electrical capacity, and panelboard or other electrical distribution equipment space, necessary for the future installation of an *EVSE*.

ELECTRIC VEHICLE READY SPACE (EV READY SPACE). An *automobile parking space* that is provided with a branch circuit and either an outlet, junction box or receptacle, that will support an installed *EVSE*.

Add new sections as follows:

C405.11 Electric Vehicle Power Transfer Infrastructure. New parking facilities shall be provided with *electric vehicle* power transfer infrastructure in accordance with Sections C405.11.1 through C405.11.6.

Exception: Parking facilities, serving occupancies other than R2 with fewer than 10 *automobile parking spaces*.

C405.11.1 Quantity. The number of required *EV spaces*, *EV capable spaces* and *EV ready spaces* shall be determined in accordance with this Section and Table C405.13.1 based on the total number of *automobile parking spaces* and shall be rounded up to the nearest whole number. For R- 2 buildings, the Table requirements shall be based on the total number of dwelling units or the total number of *automobile parking spaces*, whichever is less.

1. Where more than one parking facility is provided on a building site, the number of required *automobile parking spaces* required to have *EV* power transfer infrastructure shall be calculated separately for each parking facility.
2. Where one shared parking facility serves multiple building occupancies, the required number of spaces shall be determined proportionally based on the floor area of each building occupancy.

3. Installed EVSE spaces that exceed the minimum requirements of this section may be used to meet minimum requirements for EV ready spaces and EV capable spaces.
4. Installed EV ready spaces that exceed the minimum requirements of this section may be used to meet minimum requirements for EV capable spaces.
5. Where the number of EV ready spaces allocated for R-2 occupancies is equal to the number of dwelling units or to the number of automobile parking spaces allocated to R-2 occupancies, whichever is less, requirements for EVSE spaces for R-2 occupancies shall not apply.
6. Requirements for a Group S-2 parking garage shall be determined by the occupancies served by that parking garage. Where new automobile spaces do not serve specific occupancies, the values for Group S-2 parking garage in Table C405.11.1 shall be used.

Table C405.11.1
REQUIRED EV POWER TRANSFER INFRASTRUCTURE

<u>OCCUPANCY</u>	<u>EVSE SPACES</u>	<u>EV READY SPACES</u>	<u>EV CAPABLE SPACES</u>
<u>GROUP A</u>	8%	0	10%
<u>GROUP B</u>	5%	0	15%
<u>GROUP E</u>	1%	0	2%
<u>GROUP F</u>	1%	0	2%
<u>GROUP H</u>	1%	0	0%
<u>GROUP I</u>	1%	0	2%
<u>GROUP M</u>	10%	0	10%
<u>R-1</u>	7%	5%	50%
<u>R-2</u>	7%	5%	50%
<u>R-3 AND R-4</u>	1%	0	2%
<u>GROUP S exclusive of parking garages</u>	1%	0	0%
<u>S-2 parking garages</u>	8%	0	10%

C405.11.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section C405.11.1 shall comply with all of the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 6 feet (1828 mm) of the EV capable space and a suitable panelboard or other onsite electrical distribution equipment.
2. Installed raceway or cable assembly and onsite electrical distribution equipment to which they connect shall be sized and rated to supply a minimum circuit capacity in accordance with C405.11.5
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space for a 2-pole circuit breaker or set of fuses.
4. The electrical enclosure or outlet and the electrical distribution equipment directory shall be marked: "For future electric vehicle supply equipment (EVSE)."

C405.11.3 EV Ready Spaces. Each branch circuit serving *EV ready spaces* used to meet the requirements of Section C405.11.1 shall comply with all of the following:

1. Terminate at an outlet or enclosure, located within 6 feet (1828 mm) of each *EV ready space* it serves.
2. Have a minimum electrical distribution system and circuit capacity in accordance with C405.11.5.
3. The panelboard or other electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

C405.11.4 EVSE Spaces. An installed *EVSE* with multiple output connections shall be permitted to serve multiple *EVSE spaces*. Each *EVSE* installed to meet the requirements of Section C405.11.1, serving either a single *EVSE space* or multiple *EVSE spaces*, shall comply with all of the following:

1. Be served by an electrical distribution system in accordance with C405.11.5.
2. Have a minimum nameplate charging capacity of 6.2 kVA (or 30A at 208/240V). Where an *EVSE* with multiple connections serves three or more *EVSE spaces* and is controlled by an energy management system in accordance with Section C405.11.5.1, the nameplate charging capacity shall be not less than 2.1 kVA per *EVSE space* served.
3. Be located within 6 feet (1828 mm) of each *EVSE space* it serves.

C405.11.4.1 EVSE Installation. *EVSE* shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. *EVSE* shall be accessible in accordance with International Building Code Section 1107.

C405.11.5 Electrical distribution system capacity. The electrical infrastructure serving each *EV capable space*, *EV ready space*, and *EVSE space* used to comply with Section C405.11.1 shall comply with one of the following:

1. Sized for a calculated EV charging load of not less than 6.2 kVA for each *EV ready space* or *EVSE space* and 3.3 kVA for each *EV capable space* it serves.
2. The requirements of C405.11.5.1.

C405.11.5.1 Capacity Management for EV loads. The capacity of the electrical distribution system and each branch circuit serving multiple *EVSE spaces*, *EV ready spaces* or *EV capable spaces* designed to be controlled by an energy management system providing load management shall comply with NFPA 70 and one of the following:

1. Be sized for a minimum calculated load of 3.3 kVA per *EVSE*, *EV ready* or *EV capable space*.
2. Where all (100%) of the automobile spaces are *EVSE* or *EV ready spaces*, be sized for a minimum calculated load of 2.1 kVA per *EVSE* or *EV ready space*.

Where an energy management system is used to control *EV* charging loads for the purposes of this section, it shall not be configured to turn off electrical power to *EVSE* or *EV ready spaces* used to comply with Section C405.11.1.

Add new standard(s) as follows:

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

UL 2202-2009 Electric Vehicle (EV) Charging System- with revisions through February 2018

UL 2594-2016 Standard for Electric Vehicle Supply Equipment

Energy Monitoring

Code Language

Add new section as follows:

C405.12 Energy monitoring. New buildings with a gross conditioned floor area of 25,000 square feet (2322 m²) or larger shall be equipped to measure, monitor, record and report energy consumption data in compliance with Sections C405.12.1 through C405.12.5.

Exception: R-2 occupancies and individual tenant spaces are not required to comply with this section provided that the space has its own utility services and meters and has less than 5,000 square feet (464.5 m²) of conditioned floor area.

C405.12.1 Electrical energy metering. For all electrical energy supplied to the building and its associated site, including but not limited to site lighting, parking, recreational facilities and other areas that serve the building and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C405.12.2.

C405.12.2 End-use metering categories. Meters or other approved measurement devices shall be provided to collect energy use data for each end-use category indicated in Table C405.12.2. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories indicated in Table C405.12.2 shall be permitted to be from a load that is not within that category.

Exceptions:

1. HVAC and water heating equipment serving only an individual dwelling unit shall not require end-use metering.
2. End-use metering shall not be required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.
3. End-use metering shall not be required for an individual tenant space having a floor area not greater than 2,500 square feet (232 m²) where a dedicated source meter complying with Section C405.12.3 is provided.

TABLE C405.12.2 ENERGY USE CATEGORIES

<u>LOAD CATEGORY</u>	<u>DESCRIPTION OF ENERGY USE</u>
<u>Total HVAC system</u>	<u>Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120-volt equipment, or by 208/120-volt equipment that is located in a building where the main service is 480/277-volt power, is permitted to be excluded from total HVAC system energy use.</u>
<u>Interior lighting</u>	<u>Lighting systems located within the building.</u>
<u>Exterior lighting</u>	<u>Lighting systems located on the building site but not within the building.</u>
<u>Plug loads</u>	<u>Devices, appliances and equipment connected to convenience receptacle outlets.</u>
<u>Process load</u>	<u>Any single load that is not included in an HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment and commercial kitchens.</u>
<u>Building operations and other miscellaneous loads</u>	<u>The remaining loads not included elsewhere in this table, including but not limited to vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas and snow-melt systems.</u>

C405.12.3 Meters. Meters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section C405.12.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC or other building systems that can monitor their energy consumption shall be permitted instead of meters. Current sensors shall be permitted, provided that they have a tested accuracy of ± 2 percent. Required metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with Sections C405.12.4 and C405.12.5.

C405.12.4 Data acquisition system. A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for a minimum of 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly and yearly logged data for each end-use category required by Section C405.12.2.

C405.12.5 Graphical energy report. A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C405.12.2 at least every hour, day, month and year for the previous 36 months.

Envelope Testing

Code Language

Add new definition as follows:

TESTING UNIT ENCLOSURE AREA. The area sum of all the boundary surfaces that define the dwelling unit, sleeping unit, or occupiable conditioned space including top/ceiling, bottom/floor, and all side walls. This does not include interior partition walls within the dwelling unit, sleeping unit, or occupiable conditioned space. Wall height shall be measured from the finished floor of the conditioned space to the finished floor or roof/ceiling air barrier above.

Revise as follows:

C402.5 Air leakage—thermal envelope (Mandatory). The building thermal envelope of buildings shall comply with Sections C402.5.1 through C402.5.11.18, or the building thermal envelope shall be tested in accordance with Section C402.5.2 or Section C402.5.3 ~~ASTM E 779~~ at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft (2.0 L/s • m). Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The continuous air barriers shall be permitted to be located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

Exception: Air barriers are not required in buildings located in Climate Zone 2B.

C402.5.1.1 Air barrier construction. The continuous air barrier shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.

4. Recessed lighting fixtures shall comply with Section C402.5.8. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

C402.5.1.2 Air barrier compliance options. A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings including Group R and Group I occupancy shall meet the provisions of Section C402.5.2.
Exception: Buildings in Climate Zones 2B, 3C, and 5C.
2. Buildings or portions of buildings including Group R and Group I occupancy shall meet the provisions of Section C402.5.3

Exceptions:

1. Buildings in Climate Zones 2B, 3B, 3C and 5C.
2. Buildings larger than 5,000 square feet (464.5 m²) floor area in Climate Zones 0B, 1, 2A, 4B and 4C.
3. Buildings between 5,000 square feet (464.5 m²) and 50,000 square feet (4645 m²) floor area in Climate Zones 0A, 3A and 5B.
4. Buildings or portions of buildings that do not complete air barrier testing shall meet the provisions of Section C402.5.1.3 or C402.5.1.4 in addition to Section C402.5.1.5.

C402.5.1.3 Materials. Materials with an air permeability not greater than 0.004 cfm/ft (0.02 L/s • m) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

1. Plywood with a thickness of not less than / inch (10 mm).
2. Oriented strand board having a thickness of not less than / inch (10 mm).
3. Extruded polystyrene insulation board having a thickness of not less than / inch (12.7 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than / inch (12.7 mm).
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m) and having a thickness of not less than 1 / inches (38 mm).
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m) and having a thickness of not less than 4.5 inches (113mm).
7. Exterior or interior gypsum board having a thickness of not less than / inch (12.7 mm).
8. Cement board having a thickness of not less than / inch (12.7 mm).
9. Built-up roofing membrane.
10. Modified bituminous roof membrane.
11. ~~Fully adhered~~ Single-ply roof membrane.
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than / inch (15.9 mm).
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.
16. Solid or hollow masonry constructed of clay or shale masonry units.

C402.5.1.4 Assemblies. Assemblies of materials and components with an average air leakage not greater than 0.04 cfm/ft² (0.2 L/s × m²) under a pressure differential of 0.3 inch of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E2357, ASTM E1677, ASTM D8052 or ASTM E283 shall comply with this section. Assemblies listed in Items 1 through 3 shall be deemed to comply, provided that joints are sealed and the requirements of Section C402.5.1.1 are met.

1. Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.
2. Masonry walls constructed of clay or shale masonry units with a nominal width of 4 inches (102 mm) or more.
3. A Portland cement/sand parge, stucco or plaster not less than 1/2 inch (12.7 mm) in thickness.

Add new text as follows:

C402.5.2 Dwelling and sleeping unit enclosure testing. The building thermal envelope shall be tested in accordance with ASTM E 779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.30 cfm/ft (1.5 L/s m) of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units the greater of seven units or 20 percent of the testing units in the building shall be tested including a top floor unit, a ground floor unit, and a unit with the largest testing unit enclosure area. For each tested unit that exceeds the maximum air leakage rate, an additional 2 units shall be tested, including a mixture of testing unit types and locations.

C402.5.3 Building thermal envelope testing. The building thermal envelope shall be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E3158 or ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.40 cfm/ft² (2.0 L/s × m²) of the building thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof.
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade.
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.

HVAC Controls Fault Detection and Diagnostic

Code Language

Add new definition as follows:

FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM. A software platform that utilizes building analytic algorithms to convert data provided by sensors and devices to automatically identify faults in building systems and provide a prioritized list of actionable resolutions to those faults based on cost or energy avoidance, comfort and maintenance impact.

Revise as follows:

C403.2 System design (Mandatory). Mechanical systems shall be designed to comply with Sections C403.2.1 ~~and C403.2.2.~~ through C403.2.3. Where elements of a building's mechanical systems are addressed in Sections C403.3 through C403.12, such elements shall comply with the applicable provisions of those sections.

Add new text as follows:

C403.2.3 Fault Detection and Diagnostics (Mandatory). New buildings with an HVAC system serving a gross conditioned floor area of 100,000 square feet (9290 square meters) or larger shall include a fault detection and diagnostics (FDD) system to monitor the HVAC system's performance and automatically identify faults. The FDD system shall:

1. Include permanently installed sensors and devices to monitor the HVAC system's performance;
2. Sample the HVAC system's performance at least once per 15 minutes;
3. Automatically identify and report HVAC system faults;
4. Automatically notify authorized personnel of identified HVAC system faults;
5. Automatically provide prioritized recommendations for repair of identified faults based on analysis of data collected from the sampling of HVAC system performance; and
6. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

Exception: R1 and R-2 occupancies.

Demand Controlled Ventilation Requirement

Code Language

Revise as follows:

C403.7.1 Demand control ventilation (Mandatory). Demand control ventilation (DCV) shall be provided for all single-zone systems required to comply with Sections C403.5 through 403.5.3 and spaces larger than 500 square feet (46.5 m²) and with an average occupant load of ~~25~~ 15 people or greater per 1,000 square feet (93 m²) of floor area, as established in Table 403.3.1.1 of the International Mechanical Code, and served by systems with one or more of the following:

1. An air-side economizer.
2. Automatic modulating control of the outdoor air damper.
3. A design outdoor airflow greater than 3,000 cfm (1416 L/s).

Exceptions:

1. Systems with energy recovery complying with Section C403.7.4.
2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3. ~~Systems~~ Multiple-zone systems with a design outdoor airflow less than ~~1,200~~ 750 cfm (~~566~~ 354 L/s).
4. ~~Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (566 L/s).~~ Spaces where greater than 75 percent of the space design outdoor airflow is required for makeup air that is exhausted from the space or transfer air that is required for makeup air that is exhausted from other spaces.
5. ~~Ventilation provided only for process loads.~~ Spaces with one of the following occupancy classifications as defined in Table 403.3.1.1 of the *International Mechanical Code*: correctional cells, education laboratories, barber, beauty and nail salons, and bowling alley seating areas.

Energy Recovery Ventilation Requirements

Code Language

Add new definition as follows:

ENTHALPY RECOVERY RATIO. Change in the enthalpy of the outdoor air supply divided by the difference between the outdoor air and entering exhaust air enthalpy, expressed as a percentage.

Add new text as follows:

C403.7.4 Energy Recovery Systems. Energy recovery ventilation systems shall be provided as specified in either Section 403.7.4.1 or 403.7.4.2, as applicable.

C403.7.4.1 Nontransient dwelling units (Prescriptive). Nontransient dwelling units shall be provided with outdoor air energy recovery ventilation systems with an enthalpy recovery ratio of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.

Exceptions:

1. Nontransient dwelling units in Climate Zone 3C.
2. Nontransient dwelling units with no more than 500 square feet (46 m of conditioned floor area in Climate Zones 0, 1, 2, 3, 4C, and 5C.
3. Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1, and 2.
4. Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 4, 5, 6, 7, and 8.

Revise as follows:

C403.7.4 C403.7.4.2 Energy recovery ventilation systems Spaces other than nontransient dwelling units (Mandatory). Where the supply airflow rate of a fan system serving a space other than a nontransient dwelling unit exceeds the values specified in Tables C403.7.4(1) and C403.7.4(2), the system shall include an energy recovery system. The energy recovery system shall be configured to provide a change in the enthalpy of the outdoor air supply of provide an enthalpy recovery ratio of not less than 50 percent of the difference between the outdoor air and return air enthalpies, at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass or controls that permit operation of the economizer as required by Section C403.5.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the International Mechanical Code .
2. Laboratory fume hood systems that include not fewer than one of the following features:
 - 2.1. Variable-air-volume hood exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values.

- 2.2. Direct makeup (auxiliary) air supply equal to or greater than 75 percent of the exhaust rate, heated not warmer than 2°F (1.1°C) above room setpoint, cooled to not cooler than 3°F (1.7°C) below room setpoint, with no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that are heated to less than 60°F (15.5°C) and that are not cooled.
 4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site-solar energy.
 5. Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1 and 2.
 6. Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 3C, 4C, 5B, 5C, 6B, 7 and 8.
 7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
 8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design outdoor air flow rate.
 9. Systems expected to operate less than 20 hours per week at the outdoor air percentage covered by Table C403.7.4(1).
 10. Systems exhausting toxic, flammable, paint or corrosive fumes or dust.
 11. Commercial kitchen hoods used for collecting and removing grease vapors and smoke.

Small Fan Efficacy Requirement

Code Language

Add new text as follows:

C403.8.5 Low-capacity ventilation fans (Mandatory). Mechanical ventilation system fans with motors less than 1/12 horsepower in capacity shall meet the efficacy requirements of Table C403.8.5 at one or more rating points.

Exceptions:

1. Where ventilation fans are a component of a listed heating or cooling appliance.
2. Dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans that operate intermittently.

TABLE C403.8.5 LOW-CAPACITY VENTILATION FAN EFFICACY

<u>FAN LOCATION</u>	<u>AIR FLOW RATE MINIMUM (CFM)</u>	<u>MINIMUM EFFICACY (CFM/WATT)</u>	<u>AIR FLOW RATE MAXIMUM(CFM)</u>
	<u>(CFM)</u>	<u>(CFM/WATT)</u>	<u>(CFM)</u>
<u>HRV or ERV</u>	<u>Any</u>	<u>1.2 cfm/watt</u>	<u>Any</u>
<u>In-line fan</u>	<u>Any</u>	<u>3.8 cfm/watt</u>	<u>Any</u>
<u>Bathroom, utility room</u>	<u>10</u>		<u>< 90</u>
<u>Bathroom, utility room</u>	<u>90</u>		<u>Any</u>

a. Air flow shall be tested in accordance with HVI Standard 916 and listed. Efficacy shall be listed, or shall be derived from listed power and air flow. Fan efficacy for fully ducted HRV, ERV, balanced, and in-line fans shall be determined at a static pressure not less than 0.2 in. w.c. Fan efficacy for ducted range hoods, bathroom, and utility room fans shall be determined at a static pressure not less than 0.1 in. w.c.

High Capacity Water Heaters

Code Language

Revise text as follows:

C404.2.1 High input service water-heating systems. Gas-fired water-heating equipment installed in new buildings shall be in compliance with this section. Where a singular piece of water-heating equipment serves the entire building and the input rating of the equipment is 1,000,000 Btu/h (293 kW) or greater, such equipment shall have a thermal efficiency, E_t , of not less than ~~90~~ 92 percent. Where multiple pieces of water-heating equipment serve the building and the combined input rating of the water-heating equipment is 1,000,000 Btu/h (293 kW) or greater, the combined input-capacity-weighted-average thermal efficiency, E_t , shall be not less than 90 percent.

Exceptions:

1. Where not less than 25 percent of the annual service water-heating requirement is provided by on-site renewable energy or site recovered energy, the minimum thermal efficiency requirements of this section shall not apply.
2. The input rating of water heaters installed in individual dwelling units shall not be required to be included in the total input rating of service water-heating equipment for a building.
3. The input rating of water heaters with an input rating of not greater than 100,000 Btu/h (29.3 kW) shall not be required to be included in the total input rating of service water-heating equipment for a building.

Lighting Control Requirements

Code Language

Revise text as follows:

C405.2.1 Occupant sensor controls. Occupant sensor controls shall be installed to control lights in the following space types:

1. Classrooms/lecture/training rooms.
2. Conference/meeting/multipurpose rooms.
3. Copy/print rooms.
4. Lounges/breakrooms.
5. Enclosed offices.
6. Open plan office areas.
7. Restrooms.
8. Storage rooms.
9. Locker rooms.
10. Corridors
11. Warehouse storage areas
12. Other spaces 300 square feet (28 m) or less that are enclosed by floor-to-ceiling height partitions.

Exception: Luminaires that are required to have specific application controls in accordance with Section C405.2.5.

C405.2.1.1 Occupant sensor control function. Occupant sensor controls in warehouses shall comply with Section C405.2.1.2. Occupant sensor controls in open plan office areas shall comply with Section C405.2.1.3. Occupant sensor controls in corridors shall comply with Section C405.2.1.4. Occupant sensor controls for all other spaces specified in Section C405.2.1 shall comply with the following:

1. They shall automatically turn off lights within 20 minutes after all occupants have left the space.
2. They shall be manual on or controlled to automatically turn on the lighting to not more than 50-percent power.
3. They shall incorporate a manual control to allow occupants to turn off lights.

Exception: Full automatic-on controls with no manual control shall be permitted ~~to control lighting in public corridors , interior parking areas, stairways, restrooms, primary building entrance areas and lobbies , locker rooms, lobbies, library stacks, and areas where manual-on manual operation would endanger the safety or security of the room or building occupants.~~ 3. They shall incorporate a manual control to allow occupants to turn off lights. occupant safety or security.

C405.2.1.2 Occupant sensor control function in warehouses. warehouse storage areas. Lighting in warehouse storage areas shall be controlled as follows:

1. Lighting in each aisleway shall be controlled independently of lighting in all other aisleways and open areas.
2. Occupant sensors shall automatically reduce lighting power within each controlled area to an unoccupied setpoint of not more ~~by not less than~~ 50

percent of full power within 20 minutes after all occupants have left the controlled area.

3. Lights which are not turned off by occupant sensors shall be turned off by time-switch control complying with Section C405.2.2.1. control lighting in each aisleway independently and shall not control lighting beyond the aisleway being controlled by the sensor.
4. A manual control shall be provided to allow occupants to turn off lights in the space.

C405.2.1.3 Occupant sensor control function in open plan office areas. Occupant sensor controls in open plan office spaces less than 300 square feet (28 m²) in area shall comply with Section C405.2.1.1. Occupant sensor controls in all other open plan office spaces shall comply with all of the following:

1. The controls shall be configured so that general lighting can be controlled separately in control zones with floor areas not greater than 600 square feet (55 m²) within the open plan office space.
2. General lighting in each control zone shall be permitted to automatically turn on upon occupancy within the control zone. General lighting in other unoccupied zones within the open plan office space shall be permitted to turn on to not more than 20 percent of full power or remain unaffected.
3. The controls shall automatically turn off general lighting in all control zones within 20 minutes after all occupants have left the open plan office space.

Exception: Where general lighting is turned off by time-switch control complying with Section C405.2.2.1

- ~~4. The controls shall be configured so that g~~General lighting power in each control zone is reduced by not less than 80 percent of the full zone general lighting power in a reasonably shall turn off or uniformly reduce lighting power to an unoccupied setpoint of not more than 20 percent of full power illumination pattern within 20 minutes of after all occupants leaving that control zone. Control functions that switch control zone lights completely off when the zone is vacant meet this requirement.
- ~~5. The controls shall be configured such that any daylight responsive control will activate open plan office space general lighting or control zone general lighting only when occupancy for the same area is detected.~~

Add new text as follows:

C405.2.1.4 Occupant sensor control function in corridors. Occupant sensor controls in corridors shall uniformly reduce lighting power to not more than 50 percent of full power within 20 minutes after all occupants have left the space.

Exception: Corridors provided with less than two foot-candles of illumination on the floor at the darkest point with all lights on.

Revise text as follows:

C405.2.6.3 Lighting setback. Lighting that is not controlled in accordance with Section C405.2.6.2 shall be comply with the following:

1. Be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:

- ~~1.~~ 1.1. From not later than midnight to not earlier than 6 a.m.
- ~~2.~~ 1.2. From not later than one hour after business closing to not earlier than one hour before business opening.
- ~~3.~~ 1.3. During any time where activity has not been detected for 15 minutes or more.

2. Luminaires serving outdoor parking areas and having a rated input wattage of greater than 78 W and a mounting height of 24 feet or less above the ground shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent during any time where activity has not been detected for 15 minutes or more. No more than 1500 W of lighting power shall be controlled together.

LPD Allowances

Code Language

Revise as follows:

TABLE C405.3.2(1) INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD

BUILDING AREA TYPE	LPD (w/ft ²)	
Automotive facility	0.71	<u>0.75</u>
Convention center	0.76	<u>0.64</u>
Courthouse	0.9	<u>0.79</u>
Dining: bar lounge/leisure	0.9	<u>0.8</u>
Dining: cafeteria/fast food	0.79	<u>0.76</u>
Dining: family	0.78	<u>0.71</u>
Dormitory ^a , b	0.61	<u>0.53</u>
Exercise center	0.65	<u>0.72</u>
Fire station ^a	0.53	<u>0.56</u>
Gymnasium	0.68	<u>0.76</u>
Health care clinic	0.82	<u>0.81</u>
Hospital ^a	1.05	<u>0.96</u>
Hotel/Motel ^{a, b}	0.75	<u>0.56</u>
Library	0.78	<u>0.83</u>
Manufacturing facility	0.9	<u>0.82</u>
Motion picture theater	0.83	<u>0.44</u>
Multifamily ^c	0.68	<u>0.45</u>
Museum	1.06	<u>0.55</u>
Office	0.79	<u>0.64</u>
Parking garage	0.15	<u>0.18</u>
Penitentiary	0.75	<u>0.69</u>
Performing arts theater	1.18	<u>0.84</u>
Police station	0.8	<u>0.66</u>
Post office	0.67	<u>0.65</u>
Religious building	0.94	<u>0.67</u>
Retail	1.06	<u>0.84</u>
School/university	0.81	<u>0.72</u>
Sports arena	0.87	<u>0.76</u>
Town hall	0.8	<u>0.69</u>
Transportation	0.61	<u>0.5</u>
Warehouse	0.48	<u>0.45</u>
Workshop	0.9	<u>0.91</u>

a. Where sleeping units are excluded from lighting power calculations by application of Section R405.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.

- b. Where dwelling units are excluded from lighting power calculations by application of Section R405.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.
- c. Dwelling units are excluded. Neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.

Revise as follows:

TABLE C405.3.2(2) INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

COMMON SPACE TYPES ^a	LPD (watts/sq.ft)
Atrium	
Less than 40 feet in height	0.03 per foot in total height 0.48
Greater than 40 feet in height	0.40 + 0.02 per foot in total height 0.6
Audience seating area	
In an auditorium	0.63 0.61
In a gymnasium	0.65 0.23
In a motion picture theater	1.14 0.27
In a penitentiary	0.28 0.67
In a performing arts theater	2.03 1.16
In a religious building	1.53 0.72
In a sports arena	0.43 0.33
Otherwise	0.43 0.33
Banking activity area	0.86 0.61
Breakroom (See Lounge/breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	1.34 0.89
Otherwise	0.96 0.71
Computer room	1.33 0.94
Conference/meeting/multipurpose room	1.07 0.97
Copy/print room	0.56 0.31
Corridor	
In a facility for the visually impaired (and not used primarily by the staff) ^b	0.92 0.71
In a hospital	0.92 0.71
In a manufacturing facility	0.29
Otherwise	0.66 0.41
Courtroom	1.39 1.2
Dining area	
In bar/lounge or leisure dining	0.93 0.86
In cafeteria or fast food dining	0.63 0.4
In a facility for the visually impaired (and not used primarily by the staff) ^b	2 1.27
In family dining	0.71 0.6
In a penitentiary	0.96 0.42

Otherwise	0.63 <u>0.43</u>
Electrical/mechanical room	0.43 <u>0.43</u>
Emergency vehicle garage	0.41 <u>0.52</u>
Food preparation area	1.06 <u>1.09</u>
Guestroom ^{c, d}	0.77 <u>0.41</u>
Laboratory_	
In or as a classroom	1.2 <u>1.11</u>
Otherwise	1.45 <u>1.33</u>
Laundry/washing area	0.43 <u>0.53</u>
Loading dock, interior	0.58 <u>0.88</u>
Lobby_	
For an elevator	0.68 <u>0.65</u>
In a facility for the visually impaired (and not used primarily by the staff) ^b	2.03 <u>1.69</u>
In a hotel	1.06 <u>0.51</u>
In a motion picture theater	0.45 <u>0.23</u>
In a performing arts theater	1.7 <u>1.25</u>
Otherwise	1 <u>0.84</u>
Locker room	0.48 <u>0.52</u>
Lounge/breakroom_	
In a healthcare facility	0.78 <u>0.42</u>
Otherwise	0.62 <u>0.59</u>
Office_	
Enclosed	0.93 <u>0.74</u>
Open plan	0.81 <u>0.61</u>
Parking area, interior	0.14 <u>0.15</u>
Pharmacy area	1.34 <u>1.66</u>
Restroom_	
In a facility for the visually impaired (and not used primarily by the staff) ^b	0.96 <u>1.26</u>
Otherwise	0.85 <u>0.63</u>
Sales area	1.22 <u>1.05</u>
Seating area, general	0.42 <u>0.23</u>
Stairway (see Space containing stairway)	-
Stairwell	0.58 <u>0.49</u>
Storage room	0.46 <u>0.38</u>
Vehicular maintenance area	0.56 <u>0.6</u>
Workshop	1.14 <u>1.26</u>
BUILDING TYPE SPECIFIC SPACE TYPES^a	LPD (watts/ ft²)
Automotive (see Vehicular maintenance area)_	
Convention Center—exhibit space	0.88 <u>0.61</u>
Dormitory—living quarters ^{c, d}	0.54 <u>0.5</u>
Facility for the visually impaired ^b _	

In a chapel (and not used primarily by the staff)	1.06	<u>0.7</u>
In a recreation room (and not used primarily by the staff)	1.8	<u>1.77</u>
Fire Station—sleeping quarters ^c	0.2	<u>0.23</u>
Gymnasium/fitness center ₂		
In an exercise area	0.5	<u>0.9</u>
In a playing area	0.82	<u>0.85</u>
Healthcare facility ₂		
In an exam/treatment room	1.68	<u>1.4</u>
In an imaging room	1.06	<u>0.94</u>
In a medical supply room	0.54	<u>0.62</u>
In a nursery	1	<u>0.92</u>
In a nurse's station	0.81	<u>1.17</u>
In an operating room	2.17	<u>2.26</u>
In a patient room ^c	0.62	<u>0.68</u>
In a physical therapy room	0.84	<u>0.91</u>
In a recovery room	1.03	<u>1.25</u>
Library ₂		
In a reading area	0.82	<u>0.96</u>
In the stacks	1.2	<u>1.18</u>
Manufacturing facility ₂		
In a detailed manufacturing area	0.93	<u>0.8</u>
In an equipment room	0.65	<u>0.76</u>
In an extra-high-bay area (greater than 50' floor-to-ceiling height)	1.05	<u>1.42</u>
In a high-bay area (25-50' floor-to-ceiling height)	0.75	<u>1.24</u>
In a low-bay area (less than 25' floor-to-ceiling height)	0.96	<u>0.86</u>
Museum ₂		
In a general exhibition area	1.05	<u>0.31</u>
In a restoration room	0.85	<u>1.1</u>
Performing arts theater—dressing room	0.36	<u>0.41</u>
Post office—sorting area	0.68	<u>0.76</u>
Religious buildings		
In a fellowship hall	0.55	<u>0.54</u>
In a worship/pulpit/choir area	1.53	<u>0.85</u>
Retail facilities ₂		
In a dressing/fitting room	0.5	<u>0.51</u>
In a mall concourse	0.9	<u>0.82</u>
Sports arena—playing area ₂		
For a Class I facility ^e	2.47	<u>2.94</u>
For a Class II facility ^f	1.96	<u>2.01</u>
For a Class III facility ^g	1.7	<u>1.3</u>
For a Class IV facility ^h	1.13	<u>0.86</u>

Transportation facility_	
In a baggage/carousel area	0.45 <u>0.51</u>
In an airport concourse	0.31 <u>0.39</u>
At a terminal ticket counter	0.62 <u>0.25</u>
Warehouse—storage area_	
For medium to bulky, palletized items	0.35 <u>0.33</u>
For smaller, hand-carried items	0.69

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

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

c. Where sleeping units are excluded from lighting power calculations by application of Section R405.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.

d. Where dwelling units are excluded from lighting power calculations by application of Section R405.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.

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

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

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

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

Lighting for Plant Growth

Code Language

Add new text as follows:

C405.10 Lighting for plant growth and maintenance (Mandatory). Not less than 95 percent of the permanently installed luminaires used for plant growth and maintenance shall have a photon efficiency of not less than 1.6 $\mu\text{mol}/\text{J}$ as defined in accordance with ANSI/ASABE S640.

Add new standard(s) as follows:

<u>ASABE</u>	<u>ASABE</u> <u>2950 Niles Road</u> <u>St. Joseph, MI 49085</u> <u>US</u>
<u>S640-2017</u>	<u>Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms)</u>

C406 Credits Approach

Code Language:

Revise as follows:

SECTION C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS REQUIREMENTS

C406.1 Requirements. ~~Additional energy efficiency credit requirements.~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5). Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Buildings Credits from the tables or calculation shall be achieved where a building complies shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Where not required by Section C405.12, include an energy monitoring system in accordance with Section C406.10.
10. Where not required by Section C403.2.3, include a fault detection and diagnostics (FDD) system in accordance with Section C406.11.
11. Efficient kitchen equipment in accordance with Section C406.12.

Add new text as follows:

Table C406.1(1) Additional Energy Efficiency Credits f or Group B Occupants

<u>Climate Zone:</u>	<u>3B</u>
<u>C406.2.1: 5% heating efficiency improvement</u>	<u>NA</u>
<u>C406.2.2: 5% cooling efficiency improvement</u>	<u>4</u>
<u>C406.2.3: 10% heating efficiency improvement</u>	<u>NA</u>
<u>C406.2.4: 10% cooling efficiency improvement</u>	<u>7</u>
<u>C406.3.1: Reduced lighting power</u>	<u>9</u>
<u>C406.4: Enhanced digital lighting controls</u>	<u>2</u>
<u>C406.5: On-site renewable energy</u>	<u>9</u>
<u>C406.6: Dedicated outdoor air</u>	<u>3</u>
<u>C406.7.1: Recovered or renewable water heating</u>	<u>NA</u>
<u>C406.7.2: Efficient fossil fuel water heater</u>	<u>NA</u>
<u>C406.7.4: Heat pump water heater</u>	<u>NA</u>
<u>C406.8: Enhanced envelope performance</u>	<u>3</u>
<u>C406.9: Reduced air infiltration</u>	<u>1</u>
<u>C406.10: Energy monitoring</u>	<u>3</u>

C406.11: Fault detection and diagnostics system	<u>1</u>
---	----------

Table C406.1(2) Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	<u>3B</u>
C406.2.1: 5% heating efficiency improvement	<u>NA</u>
C406.2.2: 5% cooling efficiency improvement	<u>1</u>
C406.2.3: 10% heating efficiency improvement	<u>NA</u>
C406.2.4: 10% cooling efficiency improvement	<u>3</u>
C406.3.1: Reduced lighting power	<u>2</u>
C406.4: Enhanced digital lighting controls	<u>NA</u>
C406.5: On-site renewable energy	<u>8</u>
C406.6: Dedicated outdoor air	<u>2</u>
C406.7.1: Recovered or renewable water heating	<u>12</u>
C406.7.2: Efficient fossil fuel water heater	<u>7</u>
C406.7.4: Heat pump water heater	<u>5</u>
C406.8: Enhanced envelope performance	<u>4</u>
C406.9: Reduced air infiltration	<u>4</u>
C406.10: Energy monitoring	<u>1</u>
C406.11: Fault detection and diagnostics system	<u>1</u>

Table C406.1(3) Additional Energy Efficiency Credits for Group E Occupancies

Climate Zone:	<u>3B</u>
C406.2.1: 5% heating efficiency improvement	<u>1</u>
C406.2.2: 5% cooling efficiency improvement	<u>2</u>
C406.2.3: 10% heating efficiency improvement	<u>1</u>
C406.2.4: 10% cooling efficiency improvement	<u>4</u>
C406.3.1: Reduced lighting power	<u>9</u>
C406.4: Enhanced digital lighting controls	<u>2</u>
C406.5: On-site renewable energy	<u>6</u>
C406.6: Dedicated outdoor air	<u>NA</u>
C406.7.1: Recovered or renewable water heating	<u>1</u>
C406.7.2: Efficient fossil fuel water heater	<u>1</u>
C406.7.4: Heat pump water heater	<u>NA</u>
C406.8: Enhanced envelope performance	<u>4</u>
C406.9: Reduced air infiltration	<u>NA</u>
C406.10: Energy monitoring	<u>3</u>
C406.11: Fault detection and diagnostics system	<u>1</u>

* for schools with full-service kitchens or showers

Table C406.1(4) Additional Energy Efficiency Credits for Group M Occupancies

Climate Zone:	<u>3B</u>
C406.2.1: 5% heating efficiency improvement	<u>1</u>

C406.2.2: 5% cooling efficiency improvement	<u>3</u>
C406.2.3: 10% heating efficiency improvement	<u>1</u>
C406.2.4: 10% cooling efficiency improvement	<u>6</u>
C406.3.1: Reduced lighting power	<u>14</u>
C406.4: Enhanced digital lighting controls	<u>NA</u>
C406.5: On-site renewable energy	<u>8</u>
C406.6: Dedicated outdoor air	<u>3</u>
C406.7.1: Recovered or renewable water heating	<u>NA</u>
C406.7.2: Efficient fossil fuel water heater	<u>NA</u>
C406.7.4: Heat pump water heater	<u>NA</u>
C406.8: Enhanced envelope performance	<u>3</u>
C406.9: Reduced air infiltration	<u>1</u>
C406.10: Energy monitoring	<u>4</u>
C406.11: Fault detection and diagnostics system	<u>1</u>

Table C406.1(5) Additional Energy Efficiency Credits for Other* Occupancies

<u>Climate Zone:</u>	<u>3B</u>
C406.2.1: 5% heating efficiency improvement	<u>1</u>
C406.2.2: 5% cooling efficiency improvement	<u>3</u>
C406.2.3: 10% heating efficiency improvement	<u>1</u>
C406.2.4: 10% cooling efficiency improvement	<u>5</u>
C406.3.1: Reduced lighting power	<u>9</u>
C406.4: Enhanced digital lighting controls	<u>2</u>
C406.5: On-site renewable energy	<u>8</u>
C406.6: Dedicated outdoor air	<u>3</u>
C406.7.1: Recovered or renewable water heating	<u>12</u>
C406.7.2: Efficient fossil fuel water heater	<u>7</u>
C406.7.4: Heat pump water heater	<u>5</u>
C406.8: Enhanced envelope performance	<u>4</u>
C406.9: Reduced air infiltration	<u>2</u>
C406.10: Energy monitoring	<u>3</u>
C406.11: Fault detection and diagnostics system	<u>1</u>

- a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M.
- b. For occupancy groups listed in C406.7.1

Revise as follows:

C406.1.1 Tenant spaces. Tenant spaces shall comply with sufficient options from Tables C406.1(1) through C406.1(5) to achieve a minimum number of 5 credits, where credits are selected from Section C406.2, C406.3, C406.4, C406.6 or C406.7, or C406.10. Alternatively Where the entire building complies using credits from Section C406.5, C406.8 or C406.9, tenant spaces shall be deemed to comply with Section C406.5 where the entire building is in compliance. ~~this section.~~

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. 9) and *Variable refrigerant flow systems* shall exceed listed in the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by 10 percent, in accordance with Sections C406.2.1, C406.2, C406.2.3 or C406.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from C406.2.2, C406.2.4, or C40.2.6.5. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through C403.3.2(7)9) and *Variable refrigerant flow systems* not listed in the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 shall be limited to 10 percent of the total building system capacity. capacity for heating equipment where selecting C406.2.1 or C406.2.3 and cooling equipment where selecting C406.2.2, C406.2.4 or C406.2.5.

C406.2.1 Five-percent heating efficiency improvement. Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five-percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten-percent heating efficiency improvement. Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten-percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.5 More than 10-percent cooling efficiency improvement. Where equipment exceeds the minimum annual cooling and heat rejection efficiency requirements by more than 10 percent, energy efficiency credits for cooling may be determined using Equation 4-12, rounded to the nearest whole number. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER and IPLV.

$EECHEC = EEC10 [1 + ((CEI - 10 \text{ percent}) \div 10 \text{ percent})]$ (Equation 4-12)

where:

EECHEC = Energy efficiency credits for cooling efficiency improvement.

EEC10 = Section C406.2.4 credits from Tables C406.1(1) through C406.1(5).

CEI = The lesser of: the improvement above minimum cooling and heat rejection efficiency requirements or 15 percent.

C406.3 Reduced lighting power. Buildings shall comply with Section C406.3.1 or C406.3.2, and dwelling units and sleeping units within the building shall comply with Section C406.3.3.

C406.3.1 Reduced lighting power 10 percent. The total connected interior lighting power calculated in accordance with Section C405.3.1 shall be less than 90 percent of the total lighting power allowance calculated in accordance with Section C405.3.2.

C406.3.2 Reduced lighting power more than 15 percent . Where the total connected interior lighting power calculated in accordance with Section C405.3.1 is less than 85 percent of the total lighting power allowance calculated in accordance with Section C405.3.2, additional energy efficiency credits shall be determined based on Equation 4-12, rounded to the nearest whole number.

$$AEEC_{LPA} = AEEC_{10} \times 10 \times (LPA - LPD) / LPA \text{ (Equation 4-12)}$$

Where:

$AEEC_{LPA}$ = C406.3.2 additional energy efficiency credits

LPD = total connected interior lighting power calculated in accordance with Section C405.3.1

LPA = total lighting power allowance calculated in accordance with Section C405.3.2

$AEEC_{10}$ = C406.3.1 credits from Tables C406.1(1) through C406.1(5)

C406.3.3 Lamp efficacy. Not less than 95 percent of the permanently installed lighting, excluding kitchen appliance light fixtures, serving dwelling units and sleeping units shall be provided by lamps with an efficacy of not less than 65 lumens per watt or luminaires with an efficacy of not less than 45 lumens per watt.

C406.5 On-site renewable energy. Buildings shall comply with Section C406.5.1 or C406.5.2.

C406.5.1 Basic Renewable Credits. The total minimum ratings of on-site renewable energy systems shall be one of the following:

1. Not less than ~~4.74~~ 0.86 Btu/h per square foot (~~5.4~~ 2.7 W/m²) or ~~0.50~~ 0.25 watts per square foot (~~5.4~~ 2.7 W/m²) of conditioned floor area.
2. Not less than 2 percent of the annual energy used within the building for building mechanical and service water heating equipment and lighting regulated in ~~Chapter 4~~ Section C405.

C406.5.2 Enhanced Renewable Credits. Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406.5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$AEEC_{RRa} = AEEC_{2.5} \times RRa / RRl$ (Equation 4-13) Where: $AEEC_{RRa}$ = C406.5.2 additional energy efficiency credits

RRa = actual total minimum ratings of on-site renewable energy systems in Btu/h, watts per square foot or W/m²)

RRl = minimum ratings of on-site renewable energy systems required by C406.5.1(1) in Btu/h, watts per square foot or W/m²) $AEEC_{2.5}$ = C406.5.1 credits from Tables C406.1(1) through C406.1(5)

C406.7 Reduced energy use in service water heating. Buildings shall comply with Sections C406.7.1 and either C406.7.2, C406.7.3 or C406.7.4.

C406.7.1 Building type. To qualify for this credit, the building shall contain one of shall be of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following use groups. types to use this compliance method:

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

3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.
4. Group F: Laundries.
5. *Group R-2.*
6. Group A-3: Health clubs and spas.
7. Group E: Schools with full-service kitchens or locker rooms with showers
8. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

C406.7.2 ~~Load fraction. Recovered or renewable water heating~~ The building service water-heating system shall have one or more of the following that are sized to provide not less than ~~60~~ 30 percent of the building's annual hot water requirements, or sized to provide ~~100~~ 70 percent of the building's annual hot water requirements if the building ~~shall otherwise~~ is required to comply with Section C403.9.5:

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. On-site renewable energy water-heating systems.

C406.7.3 Efficient fossil fuel water heater. The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95% Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater. Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0. Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

C406.10 Energy monitoring. Buildings shall be equipped to measure, monitor, record and report energy consumption data in compliance with Sections C406.10.1 through C406.10.5.

C406.10.1 Electrical energy metering. For all electrical energy supplied to the building and its associated site, including but not limited to site lighting, parking, recreational facilities, and other areas that serve the building and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C406.10.2.

C406.10.2 End-use metering categories. Meters or other *approved* measurement devices shall be provided to collect energy use data for each end-use category listed in Table 406.10.2. These meters shall have the capability to collect energy consumption data for the whole building or for each separately metered portion of the building. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories listed in Table 406.10.2 is permitted to be from a load not within the category.

Exceptions:

1. HVAC and water-heating equipment serving only an individual dwelling unit does not require end-use metering.
2. End-use metering is not required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.

TABLE C406.10.2
ENERGY USE CATEGORIES

<u>LOAD CATEGORY</u>	<u>DESCRIPTION OF ENERGY USE</u>
<u>Total HVAC system</u>	<u>Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120-volt equipment, or by 208/120-volt equipment that is located in a building where the main service is 480/277-volt power, is permitted to be excluded from total HVAC system energy use.</u>
<u>Interior lighting</u>	<u>Lighting systems located within the building.</u>
<u>Exterior lighting</u>	<u>Lighting systems located on the building site but not within the building.</u>
<u>Plug loads</u>	<u>Devices, appliances and equipment connected to convenience receptacle outlets.</u>
<u>Process loads</u>	<u>Any single load that is not included in an HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment and commercial kitchens.</u>
<u>Building operations and other miscellaneous loads</u>	<u>The remaining loads not included elsewhere in this table, including but not limited to vertical transportation systems and automatic doors.</u>

C406.10.3 Meters. Meters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section C406.10.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC or other building systems that can monitor their energy consumption shall be permitted instead of meters. Current sensors shall be permitted, provided that they have a tested accuracy of ± 2 percent. Required metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with Sections C406.10.4 and C406.10.5.

C406.10.4 Data acquisition system. A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for a minimum of 36

to store real-time energy consumption data and provide hourly, daily, monthly and yearly logged data for each end-use category required by Section C406.10.2.

C406.10.5 Graphical energy report. A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C406.10.2 at least every hour, day, month and year for the previous 36 months.

C406.11 Fault detection and diagnostics system. A fault detection and diagnostics system shall be installed to monitor the HVAC system's performance and automatically identify faults. The system shall do all of the following:

1. Include permanently installed sensors and devices to monitor the HVAC system's performance.
2. Sample the HVAC system's performance at least once every 15 minutes.
3. Automatically identify and report HVAC system faults.
4. Automatically notify authorized personnel of identified HVAC system faults.
5. Automatically provide prioritized recommendations for repair of identified faults based on analysis of data collected from the sampling of the HVAC system performance.
6. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

C406.12 Efficient kitchen equipment. For buildings and spaces designated as Group A-2 or facilities that include a commercial kitchen with at least one gas or electric fryer, all fryers, dishwashers, steam cookers and ovens shall comply with all of the following:

1. Achieve performance levels in accordance with the equipment specifications listed in Tables C406.12(1) through C406.12(4) when rated in accordance with the applicable test procedure.
2. Be installed prior to the issuance of the Certificate of Occupancy.
3. Have associated performance levels listed on the construction documents submitted for permitting.

Energy efficiency credits for efficient kitchen equipment shall be independent of climate zone and determined based on Equation 4-15, rounded to the nearest whole number.

$AEECK = 20 \times AreaK/AreaB$ (Equation 4-15)

where:

$AEECK$ = Section C406.12 additional energy efficiency credits.

$AreaK$ = Floor area of full-service kitchen (ft² or m²).

$AreaB$ = Gross floor area of building (ft² or m²).

TABLE C406.12(2)
MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL STEAM COOKERS

<u>FUEL TYPE</u>	<u>PAN CAPACITY</u>	<u>COOKING ENERGY EFFICIENCY^a</u>	<u>IDLE ENERGY RATE</u>	<u>TEST PROCEDURE</u>
<u>Electric steam</u>	<u>3-pan</u>	<u>50%</u>	<u>400 watts</u>	<u>ASTM F1484</u>
	<u>4-pan</u>	<u>50%</u>	<u>530 watts</u>	
	<u>5-pan</u>	<u>50%</u>	<u>670 watts</u>	
	<u>6-pan and larger</u>	<u>50%</u>	<u>800 watts</u>	
<u>Gas steam</u>	<u>3-pan</u>	<u>38%</u>	<u>6,250 Btu/h</u>	
	<u>4-pan</u>	<u>38%</u>	<u>8,350 Btu/h</u>	
	<u>5-pan</u>	<u>38%</u>	<u>10,400 Btu/h</u>	
	<u>6-pan and larger</u>	<u>38%</u>	<u>12,500 Btu/h</u>	

For SI: 1 Btu/h = 0.293/W.

b. Cooking energy efficiency is based on heavy load (potato) cooking capacity.

TABLE C406.12(3)
MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL DISHWASHERS

<u>MACHINE TYPE</u>	<u>HIGH-TEMPERATURE EFFICIENCY REQUIREMENTS</u>		<u>LOW-TEMPERATURE EFFICIENCY REQUIREMENTS</u>		<u>TEST PROCEDURE</u>
	<u>Idle energy rate^a</u>	<u>Water consumption^b</u>	<u>Idle energy rate^a</u>	<u>Water consumption</u>	
<u>Under counter</u>	<u>≤ .50 kW</u>	<u>≤ 0.86 GPR</u>	<u>≤ 0.50 kW</u>	<u>≤ 1.19 GPR</u>	<u>ASTM F1696</u> <u>ASTM F1920</u>
<u>Stationary single-tank door</u>	<u>≤ .70 kW</u>	<u>≤ 0.89 GPR</u>	<u>≤ 0.60 kW</u>	<u>≤ 1.18 GPR</u>	
<u>Pot, pan and utensil</u>	<u>≤ 1.20 kW</u>	<u>≤ 0.58 GPR</u>	<u>≤ 1.00 kW</u>	<u>≤ 0.58 GPSF</u>	
<u>Single-tank conveyor</u>	<u>≤ 1.50 kW</u>	<u>≤ 0.70 GPR</u>	<u>≤ 1.50 kW</u>	<u>≤ 0.79 GPR</u>	
<u>Multiple-tank conveyor</u>	<u>≤ 2.25 kW</u>	<u>≤ 0.54 GPR</u>	<u>≤ 2.00 kW</u>	<u>≤ 0.54 GPR</u>	
<u>Single-tank flight</u>	<u>Reported</u>	<u>GPH ≤ 2.975x + 55.00</u>	<u>Reported</u>	<u>GPH ≤ 2.975x + 55.00</u>	
<u>Multiple-tank flight</u>	<u>Reported</u>	<u>GPH ≤ 4.96x + 17.00</u>	<u>Reported</u>	<u>GPH ≤ 4.96x + 17.00</u>	

a. Idle results shall be measured with the door closed and represent the total idle energy consumed by the machine, including all tank heaters and controls. Booster heater (internal or external) energy consumption shall not be part of this measurement unless it cannot be separately monitored.

b. GPR = gallons per rack, GPSF = gallons per square foot of rack, GPH = gallons per hour, x = maximum conveyor belt speed (feet/minute) × conveyor belt width (feet).

TABLE C406.12(4)
MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL OVENS

<u>FUEL TYPE</u>	<u>CLASSIFICATION</u>	<u>IDLE RATE</u>	<u>COOKING-ENERGY EFFICIENCY, %</u>	<u>TEST PROCEDURE</u>
Convection ovens				
<u>Gas</u>	<u>Full-size</u>	$\leq 12,000 \text{ Btu/h}$	≥ 46	<u>ASTM F1496</u>
<u>Electric</u>	<u>Half-size</u>	$\leq 1.0 \text{ Btu/h}$	≥ 71	
	<u>Full-size</u>	$\leq 1.60 \text{ Btu/h}$		
Combination ovens				
<u>Gas</u>	<u>Steam mode</u>	$\leq 200P^a + 6,511 \text{ Btu/h}$	≥ 41	<u>ASTM F2861</u>
	<u>Convection mode</u>	$\leq 150P^a + 5,425 \text{ Btu/h}$	≥ 56	
<u>Electric</u>	<u>Steam mode</u>	$\leq 0.133P^a + 0.6400 \text{ kW}$	≥ 55	
	<u>Convection mode</u>	$\leq 0.080P^a + 0.4989 \text{ kW}$	≥ 76	
Rack ovens				
<u>Gas</u>	<u>Single</u>	$\leq 25,000 \text{ Btu/h}$	≥ 48	<u>ASTM F2093</u>
	<u>Double</u>	$\leq 30,000 \text{ Btu/h}$	≥ 52	

For SI: 1 Btu/h = 0.293/W.

- a. P = Pan Capacity: the number of steam table pans the combination oven is able to accommodate in accordance with ASTM F1495.
- b.

Reason Statement

This revision to C406 incentivizes energy efficiency measures based on their actual energy cost savings in Las Cruces and offers designers flexibility in choosing the energy efficiency measures that make the most sense for their project. Each point in C406 is worth 0.025% energy cost savings and the requirement for 10 points, results a total of 2.5% energy cost savings. Building designers who choose to build prescriptively must choose among 15 separate energy efficiency measures to achieve a minimum 2.5% energy cost savings.

Existing Building Clarification

Code Language:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Exception: *Additions, alterations, repairs* and changes of occupancy to existing buildings complying with Chapter 5.

Reason Statement:

This amendment clarifies how existing buildings comply with the code. Existing buildings either comply with the code as new construction or comply with the code as directed by Chapter 5. The addition of this exception is how the IECC-2021 addresses the problem. Addressing the issue the same way that the next code revision does will create consistency in the code moving forward.