Introduction
Housekeeping

1. This webinar is being recorded

2. All audio will remain muted.

3. A chat box is available to ask questions during the presentation. Time will be granted at the end of each major section to respond to questions.

4. A copy of this presentation will be emailed to attendees.
Today’s Speaker

Matthew Siska, P.E.
Principal at
GDS Associates

With nearly 20 years of experience in the commercial construction industry, Matt’s career began as a building and fire code consultant. He transitioned into the energy efficiency industry, working with both new construction and existing building retrofits. Matt brings a real-world, practical perspective to the discussion of energy conservation and building science practices.

- Bachelor of Science in Civil Engineering from Worcester Polytechnic Institute
- Master of Science in Fire Protection Engineering from Worcester Polytechnic Institute
- Registered Professional Engineer

GDS Associates, Inc.
ENGINEERS & CONSULTANTS

GDS is a multi-service engineering and consulting firm providing services to a broad range of clients associated with, or affected by, electric, natural gas, water, and wastewater utilities.

Services Include:
- Power Supply Planning
- Wholesale & Retail Rates
- Regulatory & Financial
- Transmission Planning & NERC/CIP Compliance
- Distribution System Planning & Line Design
- DSM & Energy Efficiency
- Utility Distribution Services
- Natural Gas
- Renewable Energy
- Sustainability
- Emerging Smart Infrastructure
- Data Analytics
- Electrification
- DER Integration
IECC 2015 Commercial - Session Outline

• Administration and Enforcement
• Key Definitions
• General Requirements
• Compliance Pathways
• Commercial Provisions
• Existing Buildings
Learning Objectives

- Understand how to apply and interpret commercial energy codes in new construction, major renovations, and existing buildings
- Learn allowable compliance paths and the intersection of IECC and ASHRAE 90.1
- Recognize information required on construction documents
- Appreciate the various topic areas addressed in the IECC and know where to look for more detailed requirements
The following is a suggested outline for permits impacted by the energy code update to be effective July 1, 2021:

- Permits issued/pending prior to 7/1/21 would be completed under the IECC 2009 ed.
- Permits applications received prior to 7/1/21 would be completed under IECC 2009 ed.
- Projects under construction as of 7/1/21 would be completed under 2009 ed.
- Applications received within 30 days of 7/1/21 should be given some local discretion to chose which edition they wish to use- recognizing that some planning/contracts may have occurred when the designer/owner may not have been aware of the change. This would require some local discretion.

* Permit administration is determined at the local level: this guide provides a timeline as a guide only to aid in a reasonable transition to a code change.

Questions regarding this guidance should be directed to the State Fire Marshal’s Office

https://www.main.gov/dps/fmo/building-codes
### International Energy Conservation Code (IECC) Structure

#### 2009 IECC
- Chapter 1: Administration
- Chapter 2: Definitions
- Chapter 3: Climate Zones
- Chapter 4: Residential EE
- Chapter 5: Commercial EE

#### 2015 IECC (Commercial)
- Chapter 1: *Scope* and Administration
- Chapter 2: Definitions
- Chapter 3: General Requirements
- Chapter 4: Commercial EE
- **Chapter 5: Existing Buildings**
- Chapter 6: Referenced Standards

*Beginning in 2012 edition, residential provisions split out from commercial.*
Chapter 1: Scope and Administration
PART 1 – SCOPE AND APPLICATION

Section C101 Scope and General Requirements

C101.3 Intent.

- This code regulates the design and construction of buildings for the use and conservation of energy over the life of each building.

- *The code provides flexibility to permit the use of innovative approaches and techniques to achieve this objective.*

- This code is not intended to abridge safety, health or environmental requirements contained in other applicable code or ordinances.

Section C101 Scope and General Requirements

C101.4 Applicability.

Where, in any specific case, different sections of this code specify different materials, methods of construction, or other requirements, **the most restrictive shall govern.** Where there is a conflict between a general requirement and a specific requirements, **the specific requirement shall govern.**

- C101.4.1 Mixed Occupancy. Where a building contains both residential and commercial occupancies, **each occupancy shall be separately considered and meet the applicable provisions of IECC-Commercial Provisions, or IECC-Residential Provisions.**
Residential vs. Commercial Provisions

- **Residential Building defined (2015 IECC):** For this code, it includes detached one-and-two family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3, and R-4 buildings three stories or less in height above grade plane.
  - R-1 (Hotel, Motel) must comply with commercial provisions.
  - All residential buildings > 3 stories must comply with commercial provisions.
  - R-2, R-3 and R-4 buildings three stories or less comply with IECC residential provisions.
(C103.2) Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to:

1. Insulation materials and their $R$-values.
2. Fenestration $U$-factors and solar heat gain coefficients (SHGCs).
3. Area-weighted $U$-factor and solar heat gain coefficient (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating system and equipment types, sizes and efficiencies.

https://codes.iccsafe.org/content/IECC2015?site_type=public
(C103.2, Cont.) Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to:

7. Equipment and system controls.
8. Fan motor horsepower (hp) and controls.
9. Duct sealing, duct and pipe insulation and location.
10. Lighting fixture schedule with wattage and control narrative.
11. Location of daylight zones on floor plans.
12. Air sealing details.

https://codes.iccsafe.org/content/IECC2015?site_type=public
Envelope Definition Plan Example

TYPICAL EXTERIOR WALL CONSTRUCTION
UL DESIGN RU366 1 HOUR RATED
TOTAL INSULATION R VALUE - 24.3
CLAPBOARD SIDING
1" EPS RIGID INSULATION (R 4.1)
TYVEX BUILDING WRAP
1/2" PLYWOOD SHEATHING OVERLAPPED
AT FLOOR/MALL JOINT AS REQUIRED
2X6 WOOD STUDS SPACED PER STRUCTURAL REGS.
R20.2- 3 1/2" BATT INSULATION (R13) + 2" OPEN
CELL SPRAY FOAM(R12)
VAPOR BARRIER
5/8" GYPSUM BOARD

NOTE:
ALL FRAMING SHALL BE COORDINATED TO REDUCE
THERMAL BRIDGING AS MUCH AS POSSIBLE AT
WINDOWS & DOORS. NO EXTRA CRIPPLES, JACKS
ETC EXCEPT REQUIRED FOR STRUCTURAL
REQUIREMENTS

ADDITIONAL REGS.

PROVIDE 1"(R5) RIGID INSULATION FOAM BOARD FOR THERMAL
BRIDGING THROUGH WALLS DIVIDING
CONDITIONED/UNCONDITIONED SPACE.
CAULK ALL SIDES OF RIGID INSUL. - TYPICAL

NOTE - PROVIDE SPRINKLER SYSTEM IN
CONCEALED COMBUSTIBLE SPACES
CONFORMANCE WITH NFPA 13 AS PER MEP
SPECIFICATION.

SECOND FLOOR
12" - 36"
# Mechanical Schedule Plan Example

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SERVICE</th>
<th>SUPPLY FAN</th>
<th>HOT WATER HEATING 140 °F EXT</th>
<th>DX COOLING (MBH)</th>
<th>AIR-COOLED CONDENSING UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AIRFLOW (CFM)</td>
<td>ESP (IN. WC)</td>
<td>MOTOR (HP)</td>
<td>MBH</td>
</tr>
<tr>
<td>FCU-1</td>
<td>SEE PLANS</td>
<td>760</td>
<td>0.50&quot;</td>
<td>1/2</td>
<td>31.0</td>
</tr>
<tr>
<td>FCU-2</td>
<td>SEE PLANS</td>
<td>900</td>
<td>0.50&quot;</td>
<td>3/4</td>
<td>37.7</td>
</tr>
<tr>
<td>FCU-3</td>
<td>SEE PLANS</td>
<td>900</td>
<td>0.50&quot;</td>
<td>3/4</td>
<td>37.7</td>
</tr>
<tr>
<td>FCU-4</td>
<td>SEE PLANS</td>
<td>1,130</td>
<td>0.50&quot;</td>
<td>3/4</td>
<td>41.7</td>
</tr>
</tbody>
</table>

1. UNITS SHALL BE PROVIDED W/ ALL NECESSARY CONTROLS
2. PROVIDE TWO SETS OF FILTERS
3. PROVIDE 7–DAY PROGRAMMABLE THERMOSTATS. THE THERMOSTATS SHALL BE SIMILAR TO NEST THERMOSTATS.
4. PROVIDE SECONDARY CONDENSATE DRAIN PAN WITH OVERFLOW SWITCH FOR ALL FAN COIL UNITS.
5. PROVIDE COMPLETE CONDENSATE SYSTEM AND RUN TO NEAREST FLOOR DRAIN
6. THE ACCU’S SHALL BE INTERLOCKED TO THE INDOOR UNITS.
7. THE INDOOR UNIT SHALL BE PROVIDED WITH AN INTEGRAL PUMP.
Detailed Sequence of Operation

VARIABLE AIR VOLUME UNIT CONTROLS SEQUENCE OF OPERATION

GENERAL:
1. CONTROL SYSTEM SHALL BE AN OPEN ARCHITECTURE; BACNET MICROPROCESSOR BASED DIRECT DIGITAL CONTROL SYSTEM. THE PROPOSED SYSTEM ARCHITECTURE IS DIAGRAMMATICALLY AND INTENDED TO QUALIFY THE REQUIREMENTS AND FUNCTIONALITY OF THE SYSTEM INCLUDING DATA FLOW, SYSTEM DEVICES, AND COMMUNICATION REQUIREMENTS. IT IS NOT INTENDED TO DEPICT OR LIMIT SYSTEM REQUIREMENTS OR TO QUANTIFY THE NUMBER OF DEVICES AND COMPONENTS.
2. CONTRACTOR TO PROVIDE A FULLY FUNCTIONAL SYSTEM THAT MEETS THE INTENT OF THESE DOCUMENTS INCLUDING BUT NOT LIMITED TO THE COMPONENTS INDICATED.
3. REFER TO THE BUILDING AUTOMATION SECTION OF THE SPECIFICATIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

AIR HANDLING UNIT SHALL BE CONTROLLED BY A DEDICATED, PROGRAMMABLE BAS CUSTOM APPLICATION CONTROLLER. THE BUILDING AUTOMATION SYSTEM (BAS) SHALL SEND THE CUSTOM APPLICATION CONTROLLER SIGNALS FOR OCCUPIED, UNOCCUPIED, OPTIMAL START, NIGHT HEAT/COLD, AND TIMED OVERRIDE COMMANDS. THE BAS SHALL ALSO SEND A DISCHARGE AIR DEWPOINT AND TEMPERATURE SETPOINT, AND A DUCT STATIC PRESSURE SETPOINT. COORDINATE AND INTERFACE WITH THE WITH THE UNIT MANUFACTURES CONTROLS.

FAN CONTROL:
1. SUPPLY FANS AIR FANS - ALL FANS SHALL RUN DURING OCCUPIED AND UNOCCUPIED MODES. WHEN THE OUTSIDE AIR AND EXHAUST AIR DAMPERS ARE APPROXIMATELY 75% OPEN, THE END SWITCHES ON THE DAMPERS SHALL CLOSE AND START THE CORRESPONDING FAN MOTORS. ONCE FAN OPERATION HAS BEEN PROVEN, UNIT OPERATION SHALL PROCEED. THE SUPPLY AIR FAN SHALL OPERATE. THE SUPPLY FAN VFD SHALL MODULATE TO MAINTAIN THE DOWNTOWN DUCT STATIC PRESSURE SETPOINT WITH THE SUPPLY VAV & FPD BOXES.
2. WHEN IN THE OFF MODE ON SAFETY OR MANUAL DISCONNECT AHU SUPPLY FAN SHALL BE OFF WITH ANY ASSOCIATED SUPPLY AND RETURN AIR SMOKE FIRE DAMPERS (IF APPLICABLE) CLOSED. THE OUTSIDE AIR AND EXHAUST DAMPERS SHALL BE CLOSED AND THE RETURN AIR DAMPER SHALL BE OPEN.
3. WHEN THE RTU IS STARTED, ANY ASSOCIATED SMOKE DAMPERS SHALL OPEN, AND THEN AFTER A 30 SECOND DELAY THE AHU SUPPLY FAN SHALL START INITIALLY IN THE RECIRCULATION MODE (100%) RETURN AIR WITH THE VFD LIMITING THE FAN SPEED TO LOW OR MINIMUM SPEED.

SUPPLY AIR TEMPERATURE IN THE PARAGRAPHS BELOW.
5. SUPPLY AIR MOISTURE LEVELS SHALL BE CONTROLLED IN ACCORDANCE WITH THE DEHUMIDIFICATION AND DEHUMIDIFICATION PARAGRAPHS BELOW.

RTU’S 1, 2 & 3

START / STOP SEQUENCE:
1. THE SYSTEM SHALL BE CONTROLLED BY A STAND-ALONE DEDICATED FULLY PROGRAMMABLE DDC CONTROLLER. THE SYSTEM SHALL START THROUGH THE BAS SYSTEM AND OPERATE AS DESCRIBED BELOW. PROVIDE THE SAFETIES HAVE BEEN SATISFIED.
2. WHEN THE RTU IS OFFLINE VIA THE BAS START / STOP COMMAND, VIA THE SERVICE DISCONNECT SWITCHES OR BY ANY OF THE SAFETIES, THE COMPONENTS SHALL GO TO THEIR FAIL SAFE CONDITION. THE OUTSIDE AIR AND EXHAUST DAMPER SHALL BE CLOSED AND THE RETURN AIR DAMPER SHALL BE OPEN.

AHU OPERATION:
1. UNIT IS NORMALLY STARTED AND STOPPED REMOTELY AT THE BAS. THE UNIT SHALL NORMALLY OPERATE IN THE OCCUPIED MODE FOR OCCUPIED HOURS AS SCHEDULED BY THE OPERATOR.
2. IF THE SUPPLY FAN FAILS TO OPERATE IN 3 ATTEMPTS FOR 30 SECONDS [ADJ. THE FANS SHALL BE TURNT OFF, THE OUTSIDE AIR AND EXHAUST AIR DAMPERS AND ALL COOLING/HEATING SHALL BE DISABLED, AND AN ALARM SHALL BE ANNUNCIATED. A MANUAL RESET IS REQUIRED TO RESTART THE FANS.
3. AHU'S SHALL PROVIDE REQUIRED SUPPLY AIR FLOW IN ACCORDANCE WITH THE DUCT CONTROL PARAGRAPHS BELOW.
4. DISCHARGE AIR CONDITIONS SHALL BE CONTROLLED IN ACCORDANCE WITH THE
Section C104 Inspections (2015)

- **C104.2 Required Inspections.** The code official or his or her designated agent, upon notification, shall make the inspections set forth in Sections C104.2.1 through C104.2.6.
  - C104.2.1 Footing and foundation inspection
  - C104.2.2 Framing and rough in inspection
  - C104.2.3 Plumbing rough in inspection
  - C104.2.4 Mechanical rough in inspection
  - C104.2.5 Electrical rough in inspection
  - C104.2.6 Final Inspection

https://codes.iccsafe.org/content/IECC2015?site_type=public
Key Definitions

- **WALL, ABOVE GRADE.** A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building.

- **WALL, BELOW GRADE.** A wall associated with the basement or first story of the building that is part of the *building thermal envelope*, that is not less than 85 percent below grade and is on the exterior of the building.

- **BUILDING THERMAL ENVELOPE:** The basement walls, exterior walls, floor, roof, and any other building elements that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.

[https://codes.iccsafe.org/content/IECC2015?site_type=public](https://codes.iccsafe.org/content/IECC2015?site_type=public)
Key Definitions, Cont.

- **REPAIR.** The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

- **ADDITION.** An extension or increase in the conditioned space floor area or height of a building or structure.
  
  - **CONDITIONED SPACE.** An area, room or space that is enclosed within the building thermal envelope and is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling.

- **ALTERATION.** Any construction, retrofit, or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a building, electrical, gas, mechanical, or plumbing system that involves an extension, additional, or change to the arrangement, type or purpose of the original installation that requires a permit.

https://codes.iccsafe.org/content/IECC2015?site_type=public*
FENESTRATION. Products classified as either vertical fenestration or skylights

- **Skylight.** Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees (1.05 rad) from horizontal

- **Vertical fenestration.** Windows (fixed or moveable), opaque doors, glazed doors, glazed block and combination opaque/glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of at least 60 degrees (1.05 rad) from horizontal

Key Definitions, Cont.

- **ROOF RECOVER.** The process of installing an additional roof covering over an existing roof covering without removing the existing roof covering.

- **ROOF REPAIR.** Reconstruction or renewal of any part of an existing roof for the purpose of its maintenance.

- **ROOF REPLACEMENT.** The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

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https://codes.iccsafe.org/content/IECC2015?site_type=public

https://www.brownroofing.org/commercial-roofing/tpo-roofing.html
http://www.donsroofingandconst.com/services/roof-over.html
Chapter 3:
**General Requirements**
C301: Climate Zones

Aroostook County: Climate Zone 7
All Other ME Counties: Climate Zone 6A

Alaska is Zone 7, except for Bethel, Dillingham, Fairbanks, N. Star, Nome, North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk, which are Zone 8. Hawaii, Guam, Puerto Rico, and the Virgin Islands are Zone 1.
C302: Design Considerations

C302.1 Interior design conditions.
The interior design temperatures used for heating and cooling load calculations shall be a maximum of 72°F (22°C) for heating and minimum of 75°F (24°C) for cooling.

- Maximum heating temperature 72°F
- Minimum cooling temperature 75°F
C303: Materials, Systems, and Equipment

- Insulation materials used in the building thermal envelope must be marked and identified to confirm compliance with the approved plans.
- Ratings must be visible during inspection. All FG Batt > 12” wide, 1 depth gauge every 300 sf of attic surface for blown in.

Unlabeled products are subject to default values →

TABLE C303.1.3(1)
DEFAULT GLAZED FENESTRATION U-FACTORS

<table>
<thead>
<tr>
<th>FRAME TYPE</th>
<th>SINGLE PANE</th>
<th>DOUBLE PANE</th>
<th>SKYLIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Single</td>
</tr>
<tr>
<td>Metal</td>
<td>1.20</td>
<td>0.80</td>
<td>2.00</td>
</tr>
<tr>
<td>Metal with Thermal Break</td>
<td>1.10</td>
<td>0.65</td>
<td>1.90</td>
</tr>
<tr>
<td>Nonmetal or Metal Clad</td>
<td>0.95</td>
<td>0.55</td>
<td>1.75</td>
</tr>
<tr>
<td>Glazed Block</td>
<td></td>
<td>0.60</td>
<td></td>
</tr>
</tbody>
</table>

https://codes.iccsafe.org/content/IECC2015?site_type=public
Chapter 4: Commercial Energy Efficiency
Chapter 4: Commercial Energy Efficiency

- C401: General
- C402: Building Envelope Requirements
- C403: Building Mechanical Systems
- C404: Service Water Heating (Mandatory)
- C405: Electrical Power and Lighting Systems
- C406: Additional Efficiency Package Options
- C407: Total Building Performance
- C408: System Commissioning
Commercial Building Requirements
C401 General
IECC vs. ASHRAE 90.1

- ASHRAE 90.1 is a minimum standard; IECC is a code book
- IECC references ASHRAE 90.1
- States adopt IECC
- Both released on 3-year cycle
IECC Commercial Compliance Pathways

Source: iccsafe.org Annual 2015 IECC Update
IECC Prescriptive Path

Meet Individual Component Requirements from:

- C402 – Envelope
- C403 – Mechanical
- C404 – Service Hot Water
- C405 – Lighting

Must submit plans with building documents to prove compliance

*Tradeoffs are allowed within Prescriptive Framework*
C402.1.5: Component Performance Alternative

Allows various envelope components to be traded off against each other, provided total building heat loss is not greater than a code compliant design.

\[ A + B + C + D + E \leq \text{Zero} \]  
\text{(Equation 4-2)}

- \( A \) = Sum of the (UA dif) values for each distinct assembly, excluding below
- \( B \) = Sum of the (FL dif) values for each distinct slab on grade perimeter
- \( C \) = Sum of the (CA dif) values for each distinct below grade wall assembly
- \( D \) = The additional amount of vertical glazing area in excess of maximum
- \( E \) = The additional amount of skylight area in excess of code maximum

**Considered part of prescriptive path**

https://codes.iccsafe.org/content/IECC2015?site_type=public
C407: Total Building Performance Alternative

Meet Performance Requirements from Sections:

- ✔ C402.5 Air Leakage
- ✔ C403.2 Provisions Applicable to All Mechanical Systems
- ✔ C404 Service Hot Water
- ✔ C405 Lighting
- ✔ C407 Total Building Performance

- ✔ Proposed design building must be shown to have an annual energy cost that is less than or equal to 85% of the standard reference design building.
Figure 11.5.2 HVAC Systems Map ANSI/AHRAE/IESNA Standard 90.1-2013.
### Building Systems

#### Table 11.5.2-1 Budget System Descriptions

<table>
<thead>
<tr>
<th>System No.</th>
<th>System Type</th>
<th>Fan Control</th>
<th>Cooling Type</th>
<th>Heating Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VAV with parallel fan-powered boxes&lt;sup&gt;a&lt;/sup&gt;</td>
<td>VAV&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Chilled water&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Electric resistance</td>
</tr>
<tr>
<td>2</td>
<td>VAV with reheat&lt;sup&gt;b&lt;/sup&gt;</td>
<td>VAV&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Chilled water&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Hot-water fossil fuel boiler&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>3</td>
<td>Packaged VAV with parallel fan-powered boxes&lt;sup&gt;a&lt;/sup&gt;</td>
<td>VAV&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Direct expansion&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Electric resistance</td>
</tr>
<tr>
<td>4</td>
<td>Packaged VAV with reheat&lt;sup&gt;b&lt;/sup&gt;</td>
<td>VAV&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Direct expansion&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Hot-water fossil fuel boiler&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>Two-pipe fan-coil</td>
<td>Single- or two-speed fan&lt;sup&gt;ij&lt;/sup&gt;</td>
<td>Chilled water&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Electric resistance</td>
</tr>
<tr>
<td>6</td>
<td>Water-source heat pump</td>
<td>Single- or two-speed fan&lt;sup&gt;ij&lt;/sup&gt;</td>
<td>Direct expansion&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Electric heat pump and boiler&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>7</td>
<td>Four-pipe fan-coil</td>
<td>Single- or two-speed fan&lt;sup&gt;ij&lt;/sup&gt;</td>
<td>Chilled water&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Hot-water fossil fuel boiler&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>8</td>
<td>Packaged terminal heat pump</td>
<td>Single-speed fan&lt;sup&gt;l&lt;/sup&gt;</td>
<td>Direct expansion&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Electric heat pump&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
<tr>
<td>9</td>
<td>Packaged rooftop heat pump</td>
<td>Single- or two-speed fan&lt;sup&gt;ij&lt;/sup&gt;</td>
<td>Direct expansion&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Electric heat pump&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
<tr>
<td>10</td>
<td>Packaged terminal air conditioner</td>
<td>Single-speed fan&lt;sup&gt;l&lt;/sup&gt;</td>
<td>Direct expansion</td>
<td>Hot-water fossil fuel boiler&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>11</td>
<td>Packaged rooftop air conditioner</td>
<td>Single- or two-speed fan&lt;sup&gt;ij&lt;/sup&gt;</td>
<td>Direct expansion</td>
<td>Fossil fuel furnace</td>
</tr>
</tbody>
</table>

<sup>a</sup> VAV with Parallel Fan-Powered Boxes: Fans in parallel VAV fan-powered boxes shall be sized for 50% of the peak design flow rate and shall be modeled with 0.35 W/cfm fan power. Minimum volume setpoints for fan-powered boxes shall be equal to the minimum rate for the space required for ventilation consistent with Exception 1(b) to Section 6.5.2.1. Supply air temperature setpoint shall be constant at the design condition [see Section 11.5.2(g)].
Commercial Building Requirements

C402 Building Envelope
## Building Envelope: Major Changes in 2015

### TABLE C402.1.3

**Opaque Thermal Envelope Insulation Component Minimum Requirements, R-Value Method**

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 EXCEPT MARINE</th>
<th>5 AND MARINE 4</th>
<th>6</th>
<th>7</th>
<th>8</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>All other</td>
<td>Group R</td>
<td>All other</td>
<td>Group R</td>
<td>All other</td>
<td>Group R</td>
<td>All other</td>
<td>Group R</td>
</tr>
</tbody>
</table>

### Walls, above grade

<table>
<thead>
<tr>
<th>Mass</th>
<th>R-5.7ci&lt;sup&gt;®&lt;/sup&gt;</th>
<th>R-5.7ci&lt;sup&gt;®&lt;/sup&gt;</th>
<th>R-7.6ci</th>
<th>R-7.6ci</th>
<th>R-9.5ci</th>
<th>R-9.5ci</th>
<th>R-11.4ci</th>
<th>R-11.4ci</th>
<th>R-13.3ci</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal building</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-6.5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-6.5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-6.5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-6.5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-6.5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-6.5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-6.5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-6.5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-6.5ci</td>
</tr>
<tr>
<td>Metal framed</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-5ci</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-5ci</td>
</tr>
<tr>
<td>Wood framed and other</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-3.8ci or R-20</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-3.8ci or R-20</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-3.8ci or R-20</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-3.8ci or R-20</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-3.8ci or R-20</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-3.8ci or R-20</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-3.8ci or R-20</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-3.8ci or R-20</td>
<td>R-13&lt;sup&gt;+&lt;/sup&gt; R-3.8ci or R-20</td>
</tr>
</tbody>
</table>

### Walls, below grade

<table>
<thead>
<tr>
<th>Below-grade wall&lt;sup&gt;c&lt;/sup&gt;</th>
<th>NR</th>
<th>NR</th>
<th>NR</th>
<th>NR</th>
<th>NR</th>
<th>R-7.5ci</th>
<th>R-7.5ci</th>
<th>R-7.5ci</th>
<th>R-7.5ci</th>
</tr>
</thead>
</table>

---

<sup>a</sup> See 2015 International Energy Conservation Code, § B402.1.3.

<sup>b</sup> Averages of the vertical composite insulations spaced at least 12 in. on center and the horizontal composite insulations spaced at least 6 in. on center shall be used. Metal buildings shall be considered to have metal framing even when the framing is aluminum. Metal framing shall be free of nonmetallic barriers from the inside to the outside of the building envelope.

<sup>c</sup> See 2015 International Energy Conservation Code, § B402.1.3.5.

https://codes.iccsafe.org/content/IECC2015?site_type=public
### Building Envelope: Major Changes in 2015, Cont.

**TABLE C402.1.3**  
**Opaque Thermal Envelope Insulation Component Minimum Requirements, R-Value Method**

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 EXCEPT MARINE</th>
<th>5 AND MARINE 4</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All other</td>
<td>Group R</td>
<td>All other</td>
<td>Group R</td>
<td>All other</td>
<td>Group R</td>
<td>All other</td>
<td>Group R</td>
</tr>
<tr>
<td>Slab-on-grade floors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unheated slabs</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>R-10 for 24' below</td>
<td>R-10 for 24' below</td>
<td>R-10 for 24' below</td>
</tr>
<tr>
<td>Heated slabs</td>
<td>R-7.5 for 12' below</td>
<td>R-7.5 for 12' below</td>
<td>R-7.5 for 12' below</td>
<td>R-7.5 for 12' below</td>
<td>R-7.5 for 12' below</td>
<td>R-10 for 24' below</td>
<td>R-10 for 24' below</td>
<td>R-10 for 24' below</td>
</tr>
<tr>
<td>Opaque doors</td>
<td>R-4.75</td>
<td>R-4.75</td>
<td>R-4.75</td>
<td>R-4.75</td>
<td>R-4.75</td>
<td>R-4.75</td>
<td>R-4.75</td>
<td>R-4.75</td>
</tr>
</tbody>
</table>

---

https://codes.iccsafe.org/content/IECC2015?site_type=public*
Fenestration Terms

Projection Factor (PF)

\[ PF = \frac{A}{B} \]

Solar Heat Gain Coefficient (SHGC)
<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 EXCEPT MARINE</th>
<th>5 AND MARINE 4</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical fenestration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed fenestration</td>
<td>0.50</td>
<td>0.50</td>
<td>0.46</td>
<td>0.38</td>
<td>0.38</td>
<td>0.36</td>
<td>0.29</td>
</tr>
<tr>
<td>Operable fenestration</td>
<td>0.65</td>
<td>0.65</td>
<td>0.60</td>
<td>0.45</td>
<td>0.45</td>
<td>0.43</td>
<td>0.37</td>
</tr>
<tr>
<td>Entrance doors</td>
<td>1.10</td>
<td>0.83</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
<td>0.77</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Orientation</th>
<th>SEW</th>
<th>N</th>
<th>SEW</th>
<th>N</th>
<th>SEW</th>
<th>N</th>
<th>SEW</th>
<th>N</th>
<th>SEW</th>
<th>N</th>
<th>SEW</th>
<th>N</th>
<th>SEW</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF &lt; 0.2</td>
<td>0.25</td>
<td>0.33</td>
<td>0.25</td>
<td>0.33</td>
<td>0.25</td>
<td>0.33</td>
<td>0.40</td>
<td>0.53</td>
<td>0.40</td>
<td>0.53</td>
<td>0.40</td>
<td>0.53</td>
<td>0.45</td>
<td>NR</td>
</tr>
<tr>
<td>0.2 ≤ PF &lt; 0.5</td>
<td>0.30</td>
<td>0.37</td>
<td>0.30</td>
<td>0.37</td>
<td>0.30</td>
<td>0.37</td>
<td>0.48</td>
<td>0.58</td>
<td>0.48</td>
<td>0.58</td>
<td>0.48</td>
<td>0.58</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>PF ≥ 0.5</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.64</td>
<td>0.64</td>
<td>0.64</td>
<td>0.64</td>
<td>0.64</td>
<td>0.64</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skylight</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>U-factor</td>
<td>0.75</td>
<td>0.65</td>
<td>0.55</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHGC</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SHGC: Ratio of solar heat gain entering through fenestration to incident solar radiation

PF = Projection Factor

https://codes.iccsafe.org/content/IECC2015?site_type=public
New Air Barrier Provisions in 2015 IECC

- Continuous Air Barrier Requirements (C402.5.1) - MANDATORY
  - Allowable Prescriptive Materials (e.g., 1/2” cement board, 3/8” plywood)
  - Treatment of joints, penetrations and material intersections
  - New Provisions for OA Openings, Loading docks, and Vestibules

- Buildings must comply with prescriptive provisions OR be performance tested and demonstrate < 0.40 CFM/ft² leakage at -75 Pa (0.3 in water gauge).
Compliance with Air Barrier Provisions

**Option 1:**
Utilize list of 16 prescriptive materials

<table>
<thead>
<tr>
<th>Air Barrier Material (Prescriptive)</th>
<th>Thickness (Minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plywood</td>
<td>3/8”</td>
</tr>
<tr>
<td>Oriented strand board</td>
<td>3/8”</td>
</tr>
<tr>
<td>Extruded polystyrene insulation board</td>
<td>1/2”</td>
</tr>
<tr>
<td>Foil-faced urethane insulation board</td>
<td>1/2”</td>
</tr>
<tr>
<td>Closed cell spray foam minimum density of 1.5 pcf</td>
<td>1-1/2”</td>
</tr>
<tr>
<td>Open cell spray foam density between 0.4 and 1.5 pcf</td>
<td>4.5”</td>
</tr>
<tr>
<td>Exterior gypsum sheathing or interior gypsum board</td>
<td>1/2”</td>
</tr>
<tr>
<td>Cement board</td>
<td>1/2”</td>
</tr>
<tr>
<td>Built-up roofing membrane</td>
<td>N/A</td>
</tr>
<tr>
<td>Modified bituminous roof membrane</td>
<td>N/A</td>
</tr>
<tr>
<td>Fully adhered single-ply roof membrane</td>
<td>N/A</td>
</tr>
<tr>
<td>A Portland cement/sand parge, stucco, or gypsum plaster</td>
<td>5/8”</td>
</tr>
<tr>
<td>Cast-in-place and precast concrete</td>
<td>N/A</td>
</tr>
<tr>
<td>Sheet metal or aluminum</td>
<td>N/A</td>
</tr>
<tr>
<td>Fully grouted concrete block masonry</td>
<td>N/A</td>
</tr>
<tr>
<td>Solid or hollow masonry constructed of clay or shale masonry units</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Reference: Table 7-1 “Common Building Materials that comply with air leakage requirements”
Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials (C402.5.1.1)
Option 2: Acceptance of assemblies with specified average air leakage rate

Option 3: Building Pressure Testing
**New** Vestibule Requirements

### IECC 2015 – Section C402.5.7

- Building entrances shall be protected with an enclosed vestibule.
- All doors opening into and out of the vestibule shall be equipped with self-closing devices.
- Shall be designed so it is not necessary for the interior and exterior doors to be open at the same time.
- The installation of one or more revolving doors in the building entrances shall NOT eliminate the requirement that a vestibule be required on any doors adjacent to revolving doors.
**Vestibule Exceptions – IECC 2015**

**Exceptions:** Vestibules are not required for the following:

1. Buildings in *Climate Zones* 1 and 2.
2. Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
3. Doors opening directly from a *sleeping unit* or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m²) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
7. Doors that have an air curtain with a velocity of not less than 6.56 feet per second (2 m/s) at the floor that have been tested in accordance with ANSI/AMCA 220 and installed in accordance with the manufacturer’s instructions. Manual or automatic controls shall be provided that will operate the air curtain with the opening and closing of the door. Air curtains and their controls shall comply with Section C408.2.3.

https://codes.iccsafe.org/content/IECC2015?site_type=public

Fire Marshal's Office  
Building Codes Division
Commercial Building Requirements

C403 Building Mechanical Systems
Building Mechanical Systems: Major Changes in 2015

- Minimally impactful increase in equipment efficiencies:
  - Increased pipe insulation requirements
  - *New Provisions* related to kitchen hood controls, walk-in coolers, freezers, refrigerated warehouse coolers and freezers, and display cases
  - Expanded requirements for energy recovery in high outside air systems
  - Expanded requirements for controls and ‘Complex’ HVAC systems

- Economizers
- OA Reset Control
- Staged Cooling
- Boiler Turndown

- Part load hydronic controls
- VAV Reheat Control
- OA Ventilation Optimization and more...
C403.2: Mandatory Provisions

** Applicable to all Mechanical Systems **

C403.2.1 Calculation of Heating and Cooling Loads
C402.2.2 Equipment Sizing
C403.2.3 HVAC Equipment Performance Requirements
C403.2.4 HVAC System Controls
C403.2.5 Hot Water Boiler OA Setback Controls
C403.2.6 Ventilation
C403.2.7 Energy Recovery Ventilation Systems
C403.2.8 Kitchen Exhaust Systems
C403.2: Mandatory Provisions, *Cont.*

** Applicable to all Mechanical Systems **

- C403.2.9  Duct and Plenum Insulation and Sealing
- C402.2.10  Pipe Insulation
- C403.2.11  Commissioning
- C403.2.12  Air System Design and Control
- C403.2.13  Heating Outside a Building
- C403.2.14-18  New Provisions Related to Refrigeration Systems

- Refrigeration equipment performance
- Walk in coolers and freezers
- Refrigerated warehouse coolers and freezers
- Refrigerated display cases
Important Acronyms

Cooling

- **EER**: Energy Efficiency Ratio = $\frac{btu/h}{watt\text{-hour}}$ at design conditions
- **SEER**: Seasonal Energy Efficiency Ratio = $\frac{Total \ Season\ btu\ Cooling}{Total \ Season\ watt\text{-hours}}$
- **IPLV**: Integrated Part Load Value = Single number figure expressing part load efficiency for air conditioning and heat pump equipment on the basis of weighted operation at various load capacities
- **IEER**: Integrated Energy Efficiency Ratio = Similar to IPLV
- **COP**: Coefficient of Performance = $\frac{Useful\ work\ performance}{Work\ Required}$
  
  - COP most often refers to heat pump systems and is often above 1.
  - Heat Pump COP will vary with outside air temperature
**Important Acronyms, Cont.**

**Heating**

- **AFUE**: Annual Fuel Utilization Efficiency
- **HSPF**: Heating Seasonal Performance Factor (air source heat pumps) \[\text{HSPF} = \frac{\text{btu}}{\text{watt-hour}}\]
- **Ec**: Combustion Efficiency: 100% minus flue losses
- **Et**: Thermal Efficiency: Total efficiency including standby and jacket losses
- **EF**: Energy factor (Water Heating) = \[\frac{\text{Thermal energy out}}{\text{Energy Input}}\]
C403.2.7: Energy Recovery Ventilation Systems

**TABLE C403.2.7(1)**

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3B, 3C, 4B, 4C, 5B</td>
<td>≥ 10% and &lt; 20%</td>
</tr>
<tr>
<td>DESIGN SUPPLY FAN AIRFLOW RATE (cfm)</td>
<td>NR</td>
</tr>
<tr>
<td>1B, 2B, 5C</td>
<td>NR</td>
</tr>
<tr>
<td>6B</td>
<td>≥ 28,000</td>
</tr>
<tr>
<td>1A, 2A, 3A, 4A, 5A, 6A</td>
<td>≥ 26,000</td>
</tr>
<tr>
<td>7B</td>
<td>≥ 4,500</td>
</tr>
</tbody>
</table>

NR = Not Required.

For SI: 1 cfm = 0.4719 L/s.

**TABLE C403.2.7(2)**

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3C</td>
<td>NR</td>
</tr>
<tr>
<td>1B, 2B, 3B, 4B, 5C</td>
<td>≥ 19,500</td>
</tr>
<tr>
<td>6B</td>
<td>≥ 2,500</td>
</tr>
<tr>
<td>1A, 2A, 3A, 4A, 5A, 6B</td>
<td>≥ 2,500</td>
</tr>
<tr>
<td>4A, 5A, 6A, 6B, 7B</td>
<td>≥ 4,500</td>
</tr>
<tr>
<td>7B, 8</td>
<td>≥ 4,500</td>
</tr>
</tbody>
</table>

For SI: 1 cfm = 0.4719 L/s.

NR = Not required.

**2009: ERV > 5,000 CFM, ≥ 70% OA**

https://codes.iccsafe.org/content/IECC2015?site_type=public
Energy Recovery Equipment

- Energy Recovery Ventilation (ERV)
- Heat Recovery Ventilation (HRV)

Required Energy Recovery Systems require ability to provide a change in enthalpy of the outdoor air supply of not less than 50% of the difference of OA and RA enthalpies at design conditions (C403.2.7)
New Requirements in IECC 2015, Cont.

- Duct and Plenum Insulation and Sealing (C403.2.9)
  - Increases R-value of supply/return ducts in unconditioned space to R-6 (R-5 previously)
  - Increases R-value of supply/return ducts located outdoors to R-12 (R-8 previously)

- Walk-in coolers and freezers (C403.2.14-18)
  - Distinguish *refrigerated warehouse* from traditional walk-in
  - Wall, floor and ceiling R-values
  - Refrigeration systems
  - Anti-sweat door heater controls
  - Lighting
Commercial Building Requirements

C404 Service Water Heating (Mandatory)
C404.2: Service Water-Heating Equipment

- The following hot water storage tanks must meet Table C404.2 requirements.
  - Electric Storage
  - Gas and Oil Storage
  - Instantaneous Water Heaters – Gas and Oil
  - Hot water boilers – gas and oil
  - Pool heaters
  - Unfired storage tanks
- Efficiency verified through data furnished by manufacturer of equipment or through certification under an approved certification program.
- In 2015, IECC updated for pool heaters (gas and oil) from an $E_t$ of 78% to 82%.

https://codes.iccsafe.org/content/IECC2015?site_type=public
C404.2: Service Water-Heating Equipment, Cont.

Gas-fired equipment installed in new buildings

- Single piece serves entire building with input rating \( \geq 1,000,000 \text{ Btu/h} \)
  - Thermal efficiency \( \geq 90\% \)
- Multiple pieces with combined input rating \( \geq 1,000,000 \text{ Btu/h} \)
  - Combined input-capacity-weighted-average thermal efficiency \( \geq 90\% \)

Exceptions:

- 25\% of annual SWH requirement is provided by site-solar or site-recovered energy
- Individual units with input rating \( \leq 100,000 \text{ Btu/h} \) not considered part of building SWH equipment.

https://codes.iccsafe.org/content/IECC2015?site_type=public
Equipment not supplied with integral heat traps and serving noncirculating systems must have heat traps on the supply and discharge piping associated with the equipment.

https://codes.iccsafe.org/content/IECC2015?site_type=public
C404.9: Energy Consumption of Pools & Permanent Spas

- **Heaters (C404.9.1)**
  - Readily accessible on-off switch, that is an integral part of heater
  - Natural gas or LPG fired pool heaters will not have continuously burning pilot lights

- **Time switches or other control method** required.

- **Outdoor heated pools and outdoor permanent spas required to have a cover**
  - **Exception:** Pools deriving > 70% of operating season energy for heating from site-recovered or solar energy (modification from IECC 2009 Code)

*Swimming pool water-heating systems and spa water heating systems and controls must be commissioned in accordance with C408.2.*

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[https://codes.iccsafe.org/content/IECC2015?site_type=public]
Commercial Building Requirements

C405 Electrical Power and Lighting Systems
C405: Electrical Power and Lighting Systems

Key Changes 2009 to 2015

- **Space-by-space** method for determining allowable lighting power limits based on ASHRAE
- Occupant sensors required for certain space types
- Daylight responsive controls and fenestration area
- More stringent allowable lighting power density (LPD)
Lighting Power Density (LPD)

- Total connected interior lighting power (TCLP) divided by floor area
- Units: Watts per ft² or W/ft²

\[ TCLP = [SL + LV + LTPB + Other] \]

(Equation 4-9)

where:

- TCLP = Total connected lighting power (watts).
- SL = Labeled wattage of luminaires for screw-in lamps.
- LV = Wattage of the transformer supplying low-voltage lighting.
  Wattage of line-voltage lighting tracks and plug-in busways as the specified wattage of the luminaires, but at
- LTPB = least 30 W/lin. ft. (100 W/linm), or the wattage limit of the system’s circuit breaker, or the wattage limit of other permanent current-limiting devices on the system.
- Other = The wattage of all other luminaires and lighting sources not covered previously and associated with interior lighting verified by data supplied by the manufacturer or other approved sources.

https://codes.iccsafe.org/content/IECC2015?site_type=public
Building Area Method

- Sum the general lighting power
- Divide by NET floor area of the building (excluding interior partitions)
- By building area type

Gross Floor Area (GFA)
- Total property square footage measured from outside surface of exterior walls

Net Floor Area
- Useable interior floor area

**Table C405.4.2(1) Interior Lighting Power Allowances: Building Area Method**

<table>
<thead>
<tr>
<th>Building Area Type</th>
<th>LPD (w/ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive facility</td>
<td>0.80</td>
</tr>
<tr>
<td>Convention center</td>
<td>1.01</td>
</tr>
<tr>
<td>Courthouse</td>
<td>1.01</td>
</tr>
<tr>
<td>Dining Bar/Lounge/Leisure</td>
<td>1.01</td>
</tr>
<tr>
<td>Dining Cafeteria/Recreation Center</td>
<td>0.9</td>
</tr>
<tr>
<td>Dining Family</td>
<td>0.95</td>
</tr>
<tr>
<td>Dormitory</td>
<td>0.57</td>
</tr>
<tr>
<td>Exercise Center</td>
<td>0.84</td>
</tr>
<tr>
<td>Fire Station</td>
<td>0.67</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>0.94</td>
</tr>
<tr>
<td>Health Care Clinic</td>
<td>0.90</td>
</tr>
<tr>
<td>Hospital</td>
<td>1.05</td>
</tr>
<tr>
<td>Hotel/ Motel</td>
<td>0.87</td>
</tr>
<tr>
<td>Library</td>
<td>1.19</td>
</tr>
<tr>
<td>Manufacturing Facility</td>
<td>1.17</td>
</tr>
</tbody>
</table>

https://codes.iccsafe.org/content/IECC2015?site_type=public
Space-by-Space Method

- More granular and flexible for varied buildings
- Divide by NET floor area of the space
- Trade offs among spaces are permitted

### TABLE C405.4.2(2) INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

<table>
<thead>
<tr>
<th>Category</th>
<th>Allowance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobby</td>
<td>1.8</td>
</tr>
<tr>
<td>In a facility for the visually impaired (and not used primarily by the staff)</td>
<td></td>
</tr>
<tr>
<td>For an elevator</td>
<td>0.64</td>
</tr>
<tr>
<td>In a hotel</td>
<td>1.06</td>
</tr>
<tr>
<td>In a motion picture theater</td>
<td>0.59</td>
</tr>
<tr>
<td>In a performing arts theater</td>
<td>2.0</td>
</tr>
<tr>
<td>Otherwise</td>
<td>0.9</td>
</tr>
</tbody>
</table>

https://codes.iccsafe.org/content/IECC2015?site_type=public*
C405.2: Lighting Controls

- Required locations for occupancy sensors (C405.2.2.1)
- Time-switch controls (C405.2.2)
- Light reduction controls (C405.2.2.2)
- Daylight-responsive controls (C405.2.2.3)
- Specific application controls (exterior lighting, elevators, etc.)
# Exterior Lighting Zones and Allowances

<table>
<thead>
<tr>
<th>LIGHTING ZONE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Developed areas of national parks, state parks, forest land, and rural areas</td>
</tr>
<tr>
<td>2</td>
<td>Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed-use areas</td>
</tr>
<tr>
<td>3</td>
<td>All other areas not classified as lighting zone 1, 2 or 4</td>
</tr>
<tr>
<td>4</td>
<td>High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority</td>
</tr>
</tbody>
</table>

### Table C405.5.1(2)

**INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS**

<table>
<thead>
<tr>
<th></th>
<th>LIGHTING ZONES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zone 1</td>
</tr>
<tr>
<td>Base Site Allowance</td>
<td>500 W</td>
</tr>
<tr>
<td>(Base allowance is</td>
<td></td>
</tr>
<tr>
<td>usable in tradable or</td>
<td></td>
</tr>
<tr>
<td>nontradable surfaces.)</td>
<td></td>
</tr>
</tbody>
</table>

**Uncovered Parking Areas**

<table>
<thead>
<tr>
<th></th>
<th>Parking areas and drives</th>
<th>Uncovered Parking Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.04 W/ft²</td>
<td>0.06 W/ft²</td>
</tr>
<tr>
<td></td>
<td>0.10 W/ft²</td>
<td>0.13 W/ft²</td>
</tr>
</tbody>
</table>

**Building Grounds**

<table>
<thead>
<tr>
<th></th>
<th>0.7 W/linear foot</th>
<th>0.8 W/linear foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walkways less than 10</td>
<td>0.7 W/linear foot</td>
<td>0.8 W/linear foot</td>
</tr>
<tr>
<td>feet wide</td>
<td>0.14 W/ft²</td>
<td>0.16 W/ft²</td>
</tr>
<tr>
<td>Walkways 10 feet wide</td>
<td>0.7 W/linear foot</td>
<td>1.0 W/linear foot</td>
</tr>
<tr>
<td>or greater, plaza</td>
<td>0.14 W/ft²</td>
<td>0.2 W/ft²</td>
</tr>
<tr>
<td>areas special feature</td>
<td>0.15 W/ft²</td>
<td></td>
</tr>
<tr>
<td>areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stairways</td>
<td>0.75 W/ft²</td>
<td>1.0 W/ft²</td>
</tr>
<tr>
<td>Pedestrian tunnels</td>
<td>0.15 W/ft²</td>
<td>0.2 W/ft²</td>
</tr>
</tbody>
</table>

**Building Entrances and Exits**

<table>
<thead>
<tr>
<th></th>
<th>Main entries</th>
<th>Other doors</th>
<th>Entry canopies</th>
<th>Sales Canopies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main entries</td>
<td>20 W/linear foot of door width</td>
<td>20 W/linear foot of door width</td>
<td>0.25 W/ft²</td>
<td>0.25 W/ft²</td>
</tr>
<tr>
<td>Other doors</td>
<td>20 W/linear foot of door width</td>
<td>20 W/linear foot of door width</td>
<td>0.25 W/ft²</td>
<td>0.6 W/ft²</td>
</tr>
<tr>
<td>Entry canopies</td>
<td>20 W/linear foot of door width</td>
<td>20 W/linear foot of door width</td>
<td>0.25 W/ft²</td>
<td>0.6 W/ft²</td>
</tr>
<tr>
<td>Sales Canopies</td>
<td>Free-standing and attached</td>
<td>0.6 W/ft²</td>
<td>0.6 W/ft²</td>
<td>0.8 W/ft²</td>
</tr>
</tbody>
</table>

**Tradable Surfaces**

(Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas are tradable.)

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Additional Efficiency Package Options (C406)

**C406.1:** Buildings shall comply with at least one of the following:

1. More efficient HVAC Performance by 10%
2. Reduce Lighting Power Density (LPD) by 10%
3. Include enhanced digital lighting controls
4. Include an on-site renewable energy source
5. Use of a DOAS with complex HVAC systems
6. Reduce energy use in service water heating
C407: System Commissioning

- Requires a preliminary commissioning report, drawings and manuals, a system balancing report, a final commissioning report, and a verification of HVAC, Lighting and Electrical Systems
- Small systems (<480 MBH heating and <600 MBH cooling) and systems serving dwelling units are exempt
- Commissioning must be completed by a registered design professional or other approved agency
Chapter 5: 
Existing Buildings
Existing Buildings (2015)

• Additions, alterations, renovations or repairs must comply with provisions for new code. Unaltered portions are exempt.
• New and replacement materials must comply except as otherwise required (i.e., repairs).
• Any non-conditioned space that is altered to become conditioned space must comply.
• More scoping provisions in the International Existing Building Code (IEBC).
C501.6: No provisions of this code are mandatory provided a report is submitted to the code official and signed by a registered design professional, demonstrating that compliance with that provision would threaten, degrade, or destroy the historic form, fabric, or function of the building.

https://codes.iccsafe.org/content/IECC2015?site_type=public
Exceptions for Alterations in Existing Buildings (2015)

- Storm windows over existing fenestration
- Glass only replacements in existing sash and frame
- Construction where the existing roof, wall, or floor cavity is not exposed
Exceptions for Existing Buildings (2015)

Existing ceiling, wall or floor cavities exposed during construction need only be filled with insulation.
Repairs in Existing Buildings

Work on non-damaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and not subject to the requirements for alterations.

[https://codes.iccsafe.org/content/IECC2015?site_type=public](https://codes.iccsafe.org/content/IECC2015?site_type=public)
C502: Additions

- Additions must comply either alone, or if the existing building and addition comply together

- Clarified requirements for fenestration:
  - < 30%, prescriptive per C402.4
  - > 30%, increased vertical fenestration with daylight responsive controls
  - > 40%, total building performance
Thank you for attending!

For additional information and resources please visit:
https://www.efficiencymaine.com/iecc-training/