



**STATE OF WISCONSIN**  
Department of Safety and Professional Services  
1400 East Washington Avenue  
Madison WI 53703

Mail to:  
PO Box 8368  
Madison WI 53708-8368

E-mail: [dsps@wisconsin.gov](mailto:dsps@wisconsin.gov)  
Web: <http://dsps.wi.gov>  
Phone: 608-266-2112

**Governor Scott Walker      Secretary Dave Ross**

---

**COMMERCIAL BUILDING CODE COUNCIL MEETING**  
**Room 121C, 1400 East Washington Avenue, Madison**  
**Contact: Sandra Cleveland (608) 266-0797**  
**June 7, 2016**

*The following agenda describes the issues that the Council plans to consider at the meeting. At the time of the meeting, items may be removed from the agenda. Please consult the resulting meeting minutes for a description of the recommendations of the Council.*

**AGENDA**

**9:00 A.M.**

**CALL TO ORDER – ROLL CALL**

- A. Adoption of Agenda (1)**
- B. Approval of Minutes of May 3, 2016 (2)**
- C. Department Update**
- D. 2015 International Energy Conservation Code and ASHRAE 90.1 Standards (3-48)**
  - 1) Follow-Up Council Review and Discussion
  - 2) SPS 363 Wisconsin Considerations
- E. Exhaust System Requirements in Boat Storage Facilities (49-60)**
  - 1) Follow-up Council Review and Discussion
  - 2) Wisconsin Considerations
- F. Council Review and Discussion of Chapter 17 of the International Building Code, Special Inspections and Tests**
- G. Review of SPS 361 and 362 Draft Rule Language**
- H. Public Comments**
- I. Adjournment**

**COMMERCIAL BUILDING CODE COUNCIL  
MEETING MINUTES  
May 3, 2016**

**PRESENT:** Kevin Bierce, Hunter Bohne, David Enigl, Steven Howard, Steven Klessig, Samuel Lawrence, Corey Rockweiler, Peter Scheuerman

**EXCUSED:** Michael Mamayek, Irina Ragozin

**STAFF:** Sandy Cleveland, Rules Coordinator; Randy Dahmen, Building Plan Reviewer; Jeff Grothman, Policy Advisor; Jason Hansen, Building Plan Reviewer; Robin Zentner, Section Chief-Field Operations; and Nifty Lynn Dio, Bureau Assistant

**CALL TO ORDER**

Samuel Lawrence, Vice Chair, called the meeting to order at 9:02 a.m. A quorum of eight (8) members was confirmed.

**ADOPTION OF AGENDA**

**Amendments to the Agenda**

- *Added: materials to Item F*
- *Added: public comments to Item H (3)*

**MOTION:** David Enigl moved, seconded by Steven Klessig, to adopt the agenda as amended. Motion carried unanimously.

**APPROVAL OF MINUTES**

**MOTION:** Hunter Bohne moved, seconded by David Enigl, to approve the minutes of April 5, 2016 as published. Motion carried unanimously.

**ADJOURNMENT**

**MOTION:** Hunter Bohne moved, seconded by Steven Howard, to adjourn the meeting. Motion carried unanimously.

The meeting adjourned at 12:07 p.m.

## Summary of 2012 and 2015 IECC Changes<sup>a</sup> Significant<sup>b</sup> in Wisconsin<sup>c</sup> and Comparison With Wisconsin’s Requirements<sup>d</sup>

IECC / ASHRAE 90.1 Code Sections	Description		Comments	
	SPS 363	2012 IECC		2015 IECC
		<a href="#">DIS Recommendations</a> / <a href="#">Editorial Clarifications</a>		
<b>P A R T 1 - IECC</b>				
<b>CHAPTER 1 - SCOPE AND ADMINISTRATION</b>				
2012 IECC Table of Contents	SPS 363 numbering is based on the older page numbering of the IECC; <i>the new chapter designations with the C or R prefix will need to be incorporated into SPS 363 to maintain a connection to the appropriate provisions in the IECC</i>	The 2012 IECC was completely reorganized and renumbered for an easier and more user friendly format; the code has been broken into two separate parts for Commercial Energy Efficiency and Residential Commercial Efficiency	Residential chapters apply to multi-family dwellings	
	<b>Renumber: SPS 363.001</b>	SPS 363.0010		
	<b>Renumber: SPS 363.002</b>	SPS 363.0020		
	<b>Amend: SPS 363.002</b>	<b>Application. (1) MIXED OCCUPANCY.</b> Where a building includes both residential and commercial occupancies, each occupancy shall be separately considered and meet the applicable provisions of IECC <del>chapter 4</del> <a href="#">Residential Provisions</a> for residential or IECC <del>chapter 5</del> <a href="#">Commercial Provisions</a> for commercial.		
C101.2 R101.2	SPS 363.0101 states “Except for IECC 101.5.2, the requirements in IECC sections 101 and 103 to 109 are not included as part of this chapter”; additional administrative requirements regarding commissioning occur elsewhere in the 2015 edition of the IECC; <i>the SPS 363.0101 statement</i>	Modifies the scope of the code to include the building site and associated systems and equipment; clarifies that the IECC is not limited to a structure shell and its contents	Should the expanded scope of IECC be included in SPS 363.001?	

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
	<i>may need to address these changes</i>			
	<b>Amend: SPS 363.0100 Note:</b>	<b>Note:</b> The sections in this chapter are generally numbered to correspond to the numbering used in the IECC, <u>with a 0 to the right of the decimal point referring to the Commercial Provisions and a 5 to the right of the decimal point referring to the Residential Provisions of the IECC</u> , i.e., s. SPS 363.0101 refers to section IECC <del>404</del> <u>C101</u> and s. SPS 363.5101 refers to section <u>IECC R101</u> .		
	<b>Amend: SPS 363.0101</b>	<del>Except for IECC 101.5.2, the</del> The requirements in IECC sections <del>401 and 403 to 409</del> <u>C101, and C103 to C109</u> are not included as part of this chapter.		The low-energy building exemption has been moved to C402.1.1 and R402.1, Exception
	<b>Create SPS 363.5101</b>	The requirements in IECC sections R101, and R103 to R109 are not included as part of this chapter.		
C101.3 R101.3		Modifies the intent statement from “effective use of energy” to “effective use and conservation over the useful life of each building”	Removes the word “effective” from the intent statement	
C103.2.1 R103.2.1			Code now requires the building thermal envelope to be explicitly shown on the construction drawings.	
C104.1 R104.4			Code provides for enhanced details governing inspections and provisions are more specific and written to relate to the Energy Code.	
<b>CHAPTER 2 - DEFINITIONS</b>				
Section 202 New		Definitions which are new to the 2012 IECC and their applicable sections are: C Building Commissioning C Building Entrance C,R Building Site C Coefficient of Performance (COP) – Cooling C Coefficient of Performance (COP) – Heating C,R Continuous Air Barrier C,R Demand Recirculation Water System C,R [B] Dwelling Unit C Dynamic Glazing C Enclosed Space		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		C Equipment Room C Fenestration Product, Field Fabricated C,R Fenestration Product, Site Built C Furnace Electricity Ratio C General Lighting C Integrated Part Load Value (IPLV) C Nonstandard Part Load Value (NPLV) C On-site Renewable Energy C,R [B] Sleeping Unit C,R Visible Transmittance (VT) R Whole House Mechanical Ventilation System		
Section 202 Modified		Definitions which are modified in the 2012 IECC and their applicable sections are: C,R Residential Building C,R Skylight		
	Amend: <b>SPS 363.0202 (2)</b>	<b>SUBSTITUTIONS.</b> Substitute the following definition for the corresponding definition listed in IECC section <del>202 C202</del> : “Approved” has the meaning given in s. SPS 362.0202 (2).		
	Create: <b>SPS 363.5202</b>	<b>SUBSTITUTIONS.</b> Substitute the following definition for the corresponding definition listed in IECC section R202: “Approved” has the meaning given in s. SPS 362.0202 (2).		
202	Application of "daylight zone"	Add former amendment from 2006 IECC Comm 63.0505(1)(b) Alternative. The daylight (daylight) area (zone) shall be as calculated using a method acceptable to the department”. This allows single fixtures whose placement is odd for control situations to be placed with lighting controls more appropriate to its location. Location of single fixtures that may visually not seem appropriate for daylight zone controls, can be more appropriately grouped for control purposes, without the need for petition for variance		Amend 363.0202 Daylight zone adjacent to vertical fenestration, "method acceptable to the department" <p style="text-align: right;">3</p>
Section 202 C402.2.2.1		Clarifies that the provisions include multiple definitions of “Above-Grade Wall” for the commercial requirements, the alternate definition in C402.2.2.1 pertains only to walls covered by section C402.2.3		ASHRAE 90.1 uses a third definition for “above grade wall”
<b>CHAPTER 3 - GENERAL REQUIREMENTS</b>				
302	SPS 364.0403(5)(d)2.d.	IECC 302 references 75°F as the indoor design temperature, while SPS 364.0403(5)(d)2.d. references 78°F. Modify WI amendment to compliment wording of the IMC		SPS 364.0403 minimum 75° F cooling <p style="text-align: right;">13</p>
	Amend: <b>SPS 363.0302</b>	<b>Exterior design conditions.</b> These are department rules in addition to the requirements in IECC section <del>302 C302</del> : The exterior design temperatures used for heating and cooling load		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		calculations shall be as specified under Table 363.0302.		
	Create: <b>SPS 363.5302</b>	<b>Exterior design conditions.</b> These are department rules in addition to the requirements in IECC section R302: The exterior design temperatures used for heating and cooling load calculations shall be as specified under Table 363.0302.		
	Amend: <b>SPS 363.0303</b>	<b>Materials, systems and equipment.</b> These are department rules in addition to the requirements in IECC section <del>303</del> <u>C303</u> .		
	Create: <b>SPS 363.5303</b> Copy (1) and (2) from 363.0303	<b>Materials, systems and equipment.</b> These are department rules in addition to the requirements in IECC section R303.		
Tables C303.1.3(3), R303.1.3(3)		Adds Visual Transmittance (VT) values to Table 102.1.3(3); VT is the ratio of visible light entering the space through the fenestration product assembly to the incident visible light, it includes the effects of glazing material and frame, and is expressed as a number between 0 and 1; a “0” is opaque, a “1” is totally transparent”	Allows ANSI/DASMA 105 to be used as a standard for determination of U-factors for garage doors.	VT is one of the factors used when calculating the performance of “dynamic glazing” in a commercial building for compliance with C402.3.3
C303.1.4.1 R303.1.4			Requires R-value of insulated siding to be determined in accordance with ASTM C1363 and installation shall be in accordance with manufacturer’s instructions.	
<b>PART 2 - IECC - COMMERCIAL ENERGY</b>				
<b>CHAPTER C4 - COMMERCIAL ENERGY EFFICIENCY</b>				
C401.1		Modifies the format to more clearly show the three options for compliance, [1] following ANSI/ASHRAE/IESNA 90.1, [2], a prescriptive path, and [3] a performance path; <b>the prescriptive path</b> follows requirements for building envelope in C402, mechanical systems in C403, service water heating in C404, and electrical and lighting in C405, with a requirement for meeting efficiency requirements for either HVAC in C406.2, lighting in C406.3, or on-site renewable energy in C406.4; <b>the performance path</b>		<b>Numbering of SPS 363 will have to change to adapt to the new format in the IECC</b>  For example: Use SPS 363.0405 to modify C405 Use SPS 363.5405 to modify R405

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		follows the requirements of C407, along with C402.4, C403.2, C404, C405.2, C405.3, C405.4, C405.6, and C405.7, and must have an energy cost equal to or less than 85 percent of the standard reference building		
	Renumber and amend <b>SPS 363.0501</b>	<p><b>SPS 363.0401 General application.</b> This is a department rule in addition to the requirements in IECC section <del>501.2</del> <u>R401.2</u>:</p> <p>All of the following rules shall apply regardless of whether the IECC chapter <del>5</del> 4 [CE] or ASHRAE 90.1 standard is used to determine compliance:</p> <p>(1) Section <del>SPS 363.0503</del> <u>SPS 363.0403</u> (1) relating to design loads.</p> <p>(2) Sections <del>SPS 363.0503</del> <u>SPS 363.0403</u> (3) and (4) relating to economizers.</p> <p>(3) Section <del>SPS 363.0505</del> <u>SPS 363.0405</u> relating to lighting systems.</p> <p>(4) IECC section <del>505.2.2.1</del> <u>C405.2.2.2</u> relating to dual switching.</p>		
C401.2.1		Adds a new section with requirements for additions, alterations, and repairs of existing buildings to either follow ANSI/ASHRAE/IESNA 90.1 or the prescriptive requirements of the IECC without the added efficiency requirements of C406		
Section C402		<p>Focuses more on building envelope where the previous commercial section focused more on mechanical, lighting, and service water heating systems;</p> <p><b>new sections include:</b></p> <ul style="list-style-type: none"> <li>▪ roof solar reflectance and thermal emittance</li> <li>▪ insulation of radiant heating systems</li> <li>▪ increased vertical fenestration with daylighting controls</li> <li>▪ increased skylighting with daylighting controls</li> <li>▪ minimum skylight daylight fenestration area</li> <li>▪ haze factor</li> <li>▪ dynamic glazing</li> <li>▪ air barrier construction</li> <li>▪ air barrier compliance options</li> <li>▪ materials</li> <li>▪ assemblies</li> </ul>		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		<ul style="list-style-type: none"> <li>▪ building test, air barrier penetrations</li> <li>▪ building test, air leakage of fenestration</li> </ul> <p><b>revised sections include:</b></p> <ul style="list-style-type: none"> <li>▪ specific insulation requirements</li> <li>▪ opaque thermal envelope requirements</li> <li>▪ building envelope requirements, fenestration</li> <li>▪ maximum fenestration area</li> <li>▪ vestibules</li> <li>▪ outdoor air intakes and exhausts</li> <li>▪ recessed lighting</li> </ul>		
C402.1.1	SPS 363.002 exempts glazed structures from the requirements of the energy code; similar language is now found in IECC C402.1.1, where greenhouses have been added to the list of building types exempt from the thermal envelope provisions of the IECC; <i>the SPS 363.002 statement should be reviewed</i>			
C402.1.2			<p>Exempts the following from envelope provisions:</p> <ul style="list-style-type: none"> <li>• Separate buildings not more than 500 ft<sup>2</sup></li> <li>• Intended to house certain electronic equipment</li> <li>• Buildings that have a heating system capacity <math>\leq 17,000</math> BTU/hr</li> <li>• Thermostat set point restricted to <math>\leq 50^{\circ}</math></li> <li>• Have a maximum average wall and roof U-factor (0.2 or .12)</li> </ul>	
C402.1.3 R402.1.2 Table C402.1.4			Minimum thermal performance increased for roof insulation entirely above deck in Climate Zones 1-5. Increased to be compatible with	

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
			ASHRAE 90.1.	
Table C402.1.4.1			Method to determine effective R-values for steel stud wall assemblies.	
C402.1.5			Establishes an alternative component performance path for commercial buildings to allow trade-offs in the building envelope.	
C402.2		Modifies thermal performance values and adds provisions for the installation of continuous insulation		(prescriptive)
C402.2.1.1		Adds a new section that addresses the amount of solar heat reflected and radiated from low sloped roofs in Climate Zones 1, 2, and 3		NA
C402.2.6		Modifies requirements for slabs on grade by adding a new minimum prescriptive protection requirement for insulation extending away from the building, and by adding a new exception for perimeter insulation with slab on grade floors greater than 24 inches below the finished exterior grade		
C402.2.8		Adds a requirement for insulation of all radiant heated floor slabs and radiant panels designed for sensible heating of internal space		
C402.3		Modifies the building envelope requirements: fenestration table C402.3 with a major overhaul and supplements it with a table for SHGC adjustment multipliers, C405.2.2.3.2		(prescriptive)
C402.3.1		Modifies the baseline maximum for vertical fenestration from 40 percent to 30 percent, but up to 10 percent can be added with the use of automatic daylighting controls; the baseline maximum of 3 percent for skylights can be increased to 5 percent with daylighting controls; and skylights are now required over large spaces exceeding 10,000 square feet with certain uses, but Climate Zones 6-8 are exempt from this requirement		Skylights are now required over certain large spaces for specific uses, but Climate Zones 6-8 are exempt
C402.3.3		Modifies the method of determining the		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		maximum U-factor and solar heat gain coefficient (SHGC) by no longer allowing for an area-weighted projection factor; each area with a different projection factor will be required to be evaluated separately		
C402.3.3.1-4		Modifies provisions by providing additional variables to allow increased design flexibility for adjusting the SHGC		
C402.4.1		Adds requirements for air-barriers with new prescriptive and/or measurable mandatory requirements		
C402.4.7		Modifies vestibule requirements by requiring vestibules for doors adjacent to revolving doors, and by exempting doors used only by employees from needing a vestibule		
C402.5.3 R402.4.4			Rooms containing fuel-burning appliances and their open-combustion air openings: <ul style="list-style-type: none"> <li>• In Climate Zones 3-8</li> <li>• To be isolated from remainder of building in accordance with envelope provisions.</li> </ul>	
	Renumber and amend: <b>SPS 363.0503</b>	<b>SPS 363.0403 Building mechanical systems.</b> <b>(1) CALCULATION OF HEATING AND COOLING LOADS.</b> The following wording is a department requirement in addition to the requirements in IECC section <del>503.2.1</del> <u>C403.2.1</u> : Design heating and cooling loads shall be determined in accordance with s. SPS 363.0302 and Table 363.0302. <b>(2) EQUIPMENT AND SYSTEM SIZING.</b> Substitute the following wording for the requirements and the exceptions in IECC section <del>503.2.2</del> <u>C403.2.2</u> : Heating and cooling equipment and systems shall be sized to provide the minimum space and system loads calculated in accordance with s. SPS 363.0302. <b>(3) HVAC SYSTEM COMPLETION.</b> The requirements in IECC sections <del>503.2.9</del> <u>C403.2.11</u> is not included as part of this chapter. <b>(4) ECONOMIZERS <del>SIMPLE HVAC SYSTEMS</del>.</b> Substitute the following wording for the requirements in IECC section <del>503.3.1</del> <u>the first paragraph C403.3</u> and Table <del>503.3.1 (1)</del> <u>C403.3.3(1)</u> : Supply air economizers shall be provided on the following cooling systems: (a) Package roof top units > 33,000 Btu/h. (b) All other cooling systems > 54,000 Btu/h. <b>(5) <del>ECONOMIZERS COMPLEX HVAC SYSTEMS</del>.</b> Substitute the following wording for the requirements, but not the exceptions, in IECC section <del>503.4.1</del> : Supply air economizers shall be		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		<p><del>provided on cooling systems as described under sub. (4). Economizers shall be capable of operating at 100 percent outside air, even if additional mechanical cooling is required to meet the cooling load of the building.</del></p> <p><del>(6)</del> (5) CLIMATE ZONES <del>3 AND 4</del> 5 THROUGH 8. Substitute the following wording for the requirements in IECC section <del>503.4.3.3.2.2</del> C403.4.2.3.2.2: For climate Zones 5 through 8 as indicated in Figure <del>301.1</del> C301.1 and Table <del>301.1</del> C301.1, if an open-circuit cooling tower is used, then a separate heat exchanger shall be required to isolate the cooling tower from the heat pump loop, and heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop and providing an automatic valve to stop the flow of fluid.</p>		
C403.2.2		<p>Limits sizing of equipment</p> <p>Request committee to review since past advice &amp; practice via previous committees was to allow oversizing to address pick-up loads in factories, warehouses, offices, etc.</p> <p>Review language and acceptable options</p>		97
C403.2.3 C403.2.3.2 Tables C403.2.3 (1-9)		<p>Modifies the equipment performance requirements; adds a new column “Heating Section Type” which differentiates electric resistance equipment from other types; additional equipment types (through-the-wall, air-cooled) have been added; new tables have been added for heat rejection and heat transfer equipment; SEER requirements have been improved; and some equipment efficiencies have improved</p>		
C403.2.4.3.3		<p>Adds a requirement for all HVAC systems to be capable of automatically adjusting the daily start time in order to bring the space that is controlled up to temperature immediately prior to scheduled occupancy</p>		
C403.2.4.4			<p>Requires zones served by HVAC systems over 25,000 square feet or more than one floor to be subdivided into isolation areas to control the HVAC system in each isolation area.</p>	
C403.2.5.1		<p>Modifies the threshold for Demand Control Ventilation (DCV) from average occupant load of 40 people/1,000 square feet to 25 people/1,000 square feet; adds an exception for process loads</p>		
C403.2.6		<p>Modifies energy recovery ventilation system requirements by adding a new table which</p>		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		replaces a single fixed trigger point of 5,000 cfm and 70 percent outdoor air, and provides a comprehensive and scalable energy recovery requirement based on the climate zone and percentage of outdoor air at full design flow rate		
C403.2.6.2			Requires enclosed parking garages used for storing or handling automobiles operating under their own power to use ventilation optimization controls to modulate airflow.	
C403.2.8 Kitchen Exhaust Systems (2015)			Regulates efficiency of kitchen exhaust systems including replacement air and maximum exhaust rates.	
C403.2.8 Piping Insulation (Renumbered C403.2.10 in 2015)		Modifies piping insulation by expanding and clarifying exceptions for smaller strainers, control valves and balancing valves, as well as direct buried piping that conveys fluids at or below 60 degrees Fahrenheit; provides a scalable table which bases insulation thickness on fluid operating temperature range and insulation conductivity		
C403.2.8.1		Adds a requirement for protecting insulation exposed to the elements, but prohibits the utilization of adhesive tape as the protective measure		
C403.2.11	SPS 363.0503 removes IECC 503.2.9 (2009) and its subsections from the code; the IECC commissioning and completion requirements are much stricter now; in the 2015 edition of the IECC, this is now section C403.2.11 and references section C408, which deals with commissioning; <i>the SPS</i>			

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
	<i>361 regulations regarding completion may need to be revised in order to address the commissioning aspects of the current code</i>			
C403.2.14 Refrigeration equipment performance			Tables C403.2.14 (1) and (2): <ul style="list-style-type: none"> <li>List the maximum energy use in kWh/day</li> <li>Organize by equipment type, the operating mode and rating temperature.</li> </ul>	
C403.2.15 C403.2.16			Establishes requirements for walk-in coolers, freezers, refrigerated warehouse coolers and refrigerated warehouse freezers including requirements that: <ul style="list-style-type: none"> <li>Door self-closes</li> <li>Minimum floor, wall and ceiling insulation</li> <li>Anti-sweat heaters and controls</li> <li>Lighting efficiency</li> </ul>	
C403.3.1, Table C403.3.1 (1)	The IECC 2009 requirements for economizers were made more strict by SPS 363.0503; they were made stricter yet in IECC 2012 and in 2015 the IECC continued this trend; <i>SPS 363.0503 (4) and (5) should be revisited in light of these modifications</i>	Modifies the provisions regarding economizers, making requirements more comprehensive than previous editions of the IECC		
C403.3.1 (2015) C503.3.1 (2009)	SPS 363.0503 (4)	Challenges by designers have pointed out that a zone (see Definition in IMC 202) within an enclosed area could be treated differently when attempting to apply this section Add language that defines a zone as an enclosed room or space, or that the application of this section is specific to the enclosed area via walls, ceilings, windows, doors, skylights, etc. served by the cooling system(s).		Clarify definition of Zone as related to economizer requirements

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
C403.4.1.3, C403.4.1.4		Adds a requirement for economizers to be integrated with the associated mechanical cooling system, operate even when additional cooling is required, and provide no-to-minimal impact on the heating system		
C403.4.2		Modifies variable air volume (VAV) controls by reducing minimum motor sizes and allowing vane axial fans with variable pitch blades; and specifies the location(s) for static pressure sensors		
C403.4.2.5			Establishes turndown ratio for boilers with design input over 1,000,000 Btu/hr.	
C403.4.3.2.2	SPS 363.0503 (6) removes closed-circuit cooling towers from this requirement; this paragraph is now found at C403.4.2.3.2.2			
C404	SPS 363.0504 removes sections of the IECC 2009 related to service water heating dealing with temperature controls, heat traps, and pool covers; the latter two may still be appropriate, but the referenced section on temperature controls is not in the 2015 IECC			
	Renumber and amend <b>SPS 363.0504</b>	<del>SPS 363.0504</del> <b>SPS 363.0404 Service water heating. (1) TEMPERATURE CONTROLS.</b> The requirements in IECC section 504.3 are not included as part of this chapter. <del>(2) (1) HEAT TRAPS.</del> The requirements in IECC section 504.4 <u>C404.3</u> are not included as part of this chapter. <del>(3) (2) POOL COVERS.</del> The requirements in IECC section 504.7.3 <u>C404.9.3</u> are not included as part of this chapter.		
	Create <b>363.0504 (3)</b>	<b>SPS 363.0504 (3) COMMISSIONING.</b> The requirements in IECC section C404.11 are not included as part of this chapter.		?
C404.5		Modifies pipe insulation requirements for		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
Pipe Insulation (2012)		automatic circulating hot water and heat traced systems by addressing heat traced systems as an individual item and clarifying insulation requirements for non-circulating systems; modifies the control section to clarify that manually controlled circulating systems are required to stop pumping when there is limited hot water demand		
C404.5 R404.5 Efficient heated water supply piping.			Table C404.5.1 establishes the maximum allowable pipe length method from the nearest source of heated water to termination of the fixture supply pipe, public lavatory faucets and all other fixtures. It also establishes the maximum allowable pipe volume method from the nearest source of heated water to the termination of the fixture pipe, public lavatory faucet and other fixtures.	
C404.7		Modifies requirements for pools by excluding temporary and above ground spas from the scope of the regulations, raising the benchmark percentage for site recovered energy, and setting the criteria for energy use calculations; revises the section title to include in-ground permanently installed spas		
C404.8 R403.5.4			Requires drain water heat recovery units to comply with CSA B55.2 and that potable waterside pressure loss to be less than 10 psi.	
C404.9 (2015) 504.7.2 (2009)		<a href="#">This section requires that time switches be installed in pools. Rules issued by DHS mandate that pump operation occur continuously, 24 hrs/day, 365 days per year.</a>		<a href="#">Amend this section such that the requirements is eliminated</a> 85
C405.1		Modifies from 50 percent to 75 percent the amount of line voltage fixtures required to have high efficacy bulbs		(mandatory)
C405.2.1.2		Modifies lighting reduction controls by limiting the size of exempted single luminaires and by exempting electrical and mechanical rooms		
C405.2.2		Deletes the section on automatic lighting shutoff and adds this section on additional		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		lighting controls which includes automatic daylighting controls; and provides exceptions for sleeping rooms, spaces for patient care, spaces where automatic shutoff would endanger safety or security, and lighting intended for continuous operation		
C405.2.2.1		Modifies requirements for automatic controls by eliminating the 5,000 square feet threshold, and making reductions in the allowable maximum override control area; exempts emergency egress lighting and lighting controlled by occupancy sensors from this requirement		
C405.2.2.2		Adds requirements for occupancy sensors in classrooms, conference rooms, restrooms, private offices, and all areas 300 square feet or less enclosed by floor to ceiling height partitions		
C405.2.2.2.1	SPS 363.0505 (1) (a) 2. References IECC 505.2.2.1, which now pertains to C405.2.2.2.1, <i>this chapter has changed enough that SPS 0505 should be reviewed; additionally, the definitions and provisions regarding daylight zones and daylighting have change and been expanded considerably since 2009</i>			
C405	SPS 363.0505 (2) references IECC section 505.5.1.4 (2009), which has no equivalent section in the 2015 IECC			
	Renumber and amend	<b>SPS 363.0405 Lighting systems. (1) CONTROLS.</b> These are department rules in addition to the		Only reference to track

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
	<b>SPS 363.0505</b>	<p>requirements in IECC section <del>505</del> C405:</p> <p>(a) <i>General</i>. Except as provided in par. (b), daylight zones in any interior enclosed space greater than 250 square feet and a lighting density more than 0.6 W/ft<sup>2</sup> shall have at least one control that meets all of the following requirements:</p> <ol style="list-style-type: none"> <li>1. Controls only luminaires in the daylight zones.</li> <li>2. Controls at least 50% of the lamps or luminaires in the daylight zone, in a manner described in IECC section <del>505.2.2.4</del> C405.2.2.2.</li> </ol> <p>(b) <i>Exceptions</i>. The requirements of this subsection do not apply to any of the following:</p> <ol style="list-style-type: none"> <li>1. Daylight zones where the effective aperture of glazing is equal or less than 0.1 for vertical glazing and 0.01 for horizontal glazing.</li> <li>2. Daylight zones where existing adjacent structures or natural objects obstruct daylight to the extent that effective use of daylighting is not feasible.</li> </ol> <p><del>(2) LINE-VOLTAGE LIGHTING TRACK AND PLUG-IN BUSWAY BUSWAY. Substitute the following for the requirements in IECC section 505.5.1.4 C405: The wattage of line-voltage lighting track and plug-in busway which allows the addition or relocation of luminaires without altering the wiring of the system shall be the volt-ampere rating of the branch circuit feeding the luminaires or an integral current limiter controlling the luminaires, or the higher of the maximum relamping rated wattage of all of the luminaires included in the system, listed on a permanent factory installed label, or 30 W/linear foot.</del></p>		lighting in C405.4.1  Renumber section accordingly if (2) is eliminated
C405.2.2.3		Modifies provisions related to daylight zones, which are areas likely to have sufficient sunlight for compliance with IBC minimum lighting requirements during the day		
C405.2.2.3.2		Adds requirements for automatic daylighting controls to give the user a choice between continuous dimming or stepped dimming		
C405.2.3		<p>Adds additional specific application controls in addition to those for hotel sleeping rooms, and lighting equipment for sale or for lighting demonstrations by including:</p> <ul style="list-style-type: none"> <li>▪ display and accent lighting</li> <li>▪ lighting in cases used for display</li> <li>▪ supplemental task lighting</li> <li>▪ lighting for non-visual applications</li> </ul>		
C405.5.2		Modifies the provisions by providing two methods of demonstrating compliance with the total interior lighting power allowance; the Building Area Method, and the Space by Space Method		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
Table C405.5.2.1		Modifies the Interior Lighting Power Allowances: Building Area Method by removing the additional power allowance for specific merchandizing categories and moves them to the Space by Space Method (Table C405.5.2(2))		
Table C405.5.2 (2)		Adds the Space by Space Method of compliance with Interior Lighting Power Allowance determination and includes the additional power allowance for specific merchandizing categories, which were formally only applicable to the Building Area Method of compliance		
C406		<p>This section requires that one (1) efficiency option be met. The Dept. does not require the submittal of lighting plans, thus review is in question. Additionally, water service is addressed by the plumbing group, and not the building code group.</p> <p>Add language that requires that the specific efficiency project option chosen is clearly addressed on the building/HVAC plans, with appropriate justification of code compliance included.</p> <p>IECC 2015 has requirements that are not spelled out on submitted plans. Not able to track. No lighting submittal makes it difficult to track option selected.</p>		50
C406.1		Adds a new section with additional efficiency package options; where the prescriptive compliance path is followed; at least one of these options is required in addition to all other code requirements; they are described in C406.2, C406.3, and C406.4		
C406.1		<p>Direct COMcheck for use under prescriptive requirements instead of Total Building Performance so that the program may be used prescriptively with C406.1 -the additional efficiency requirements</p> <p>Failure to do so will require that bldg design will be required to meet the prescriptive requirement only. This allows for greater flexibility.</p>		Creates code flexibility for design  102
	Renumber and amend SPS 363.0506	<p><del>SPS 363.0506</del> <b>SPS 363.0407. Total building performance.</b> This is a department informational note to be used under IECC section <del>506</del> C407:</p> <p><b>Note:</b> COMCheck is a computer program that may be used only for determining building envelope or lighting compliance. The COMCheck computer program may be downloaded at: <a href="http://www.energycodes.gov/">http://www.energycodes.gov/</a>.</p>		
C406.2		Adds an efficiency option to continue to use off site generated energy and to increase the		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		HVAC efficiency		
C406.3		Adds an efficiency option to use an efficient lighting system for the entire building as the additional energy efficiency package		
C406.4		Adds an efficiency option to provide on-site renewable energy that is equivalent to or greater than: 75 Btu or 0.50 watts per square foot of conditioned floor area, or three percent of the energy used in the building for non-process loads		
C407.3		Modifies performance based compliance methodology by keeping the requirements the same, but requiring buildings to achieve 15 percent greater energy efficiency, since C401.2 states that “ <i>The building energy cost shall be equal to or less than 85 percent of the standard reference design building</i> ”		
C408.1		Adds a section for building system commissioning which allows performance and efficiencies to be verified, giving a reasonable idea of how a well maintained building will perform		
C408.2		Adds requirements for the <b>registered design professional</b> to: <ul style="list-style-type: none"> <li>▪ provide evidence of commissioning and compliance</li> <li>▪ indicate provisions for commissioning and completion in construction documents</li> <li>▪ provide copies of documents to owner, and if requested, to code official</li> <li>▪ provide written commissioning plan</li> </ul>		
C408.2.2		Modifies requirements for balancing both air and hydronic systems in a manner intended to minimize throttling losses		
C408.2.3		Adds requirements for testing of mechanical equipment, controls, and economizers prior to a final inspection		
C408.2.4		Adds requirements for the registered design professional or approved agency to complete		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		and certify a preliminary report of the commissioning test procedures itemizing: <ul style="list-style-type: none"> <li>▪ uncorrected deficiencies</li> <li>▪ deferred tests</li> <li>▪ conditions for performing deferred tests</li> </ul>		
C408.2.5		Modifies documentation requirements by removing the mechanical contractor as the responsible party; and spelling out that documentation include: <ul style="list-style-type: none"> <li>▪ drawings</li> <li>▪ manuals</li> <li>▪ system balancing report</li> <li>▪ final commissioning report</li> </ul>		
C408.3		Adds functional lighting control testing as part of the commissioning process with the design professional responsible for identifying the party who will do the testing, the plan reviewer is responsible to see that the party is named, and the inspector has a contact to assure compliance prior to approving occupancy		
C403.2.4.2 (2015) 503.2.4.3 (2009)		ASHRAE 90.1 exempts radiant floor and ceiling heating systems from requiring setback controls because the mass/heat capacity of these building systems. This exception should be incorporated into the IECC because requiring the use of such setback controls is inappropriate for such systems. Add language exempting the need for setback controls for radiant floor & ceiling heating systems. Provides recognition of system limitations, and limited energy savings		32
C503.1 exc.7 C503.6		Two referenced sections list different percentages of luminaire replacement (ie. 50% vs 10%) Dept. to define which is to be applicable for code use		104
C600	SPS 363.0900 adds 1 NCMA standard and 4 ASTM standards, one of which is now also cited in the IECC			
	Renumber and amend: <b>SPS 363.0900</b>	<b><del>SPS 363.0900</del> <u>SPS 363.0600</u> Referenced standards.</b> This is a department rule in addition to the requirements in IECC chapter 6 [CE]: The following standards are hereby incorporated by reference into this code: <b>(1) <del>ASTM C177-04</del> <u>C177-13</u>, Test method for steady-state heat flux measurements and</b>		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		<p>thermal transmission properties by means of the guarded-hot-plate apparatus.  <del>(2) ASTM C335-05 C335/C335M-10e1</del>, Test method for steady state heat transfer properties of horizontal pipe insulation.  <del>(3) ASTM C518-04 C518-15</del>, Test Method for steady-state thermal transmission properties by means of the heat flow meter apparatus.  <del>(4) ASTM C1363-05</del>, Test method for thermal performance of materials and envelope assemblies by means of a hot box apparatus.  <del>(5)</del> <b>(4)</b> National Concrete Masonry Association (NCMA) Evaluation Procedures of Integrally Insulated Concrete Masonry Walls, January 1, 1999.</p>		
<b>PART 3 - IECC - RESIDENTIAL ENERGY</b>				
CHAPTER R4 - RESIDENTIAL ENERGY EFFICIENCY				
	Renumber and amend: <b>SPS 363.0401</b>	<b>SPS 363.5401 Certificate.</b> The requirements in IECC section <del>401.3</del> <b>R401.3</b> are not included as part of this code.		
R402.1.1		<p>Section references both the IRC and IBC for vapor retarder requirements  Reference to the IRC for vapor retarder requirements should be stricken since this code is applicable to commercial buildings only  Clarifies that IBC 1405.3 is to be used.</p>		103
Table R402.1.1		Modifies the prescriptive insulation and fenestration requirements by component including requirements for continuous insulation at wood framed walls in Climate Zones 6 and 7	Renamed Table R402.1.2	!
Table R402.1.1		Modifies the footnotes for the table including: <ul style="list-style-type: none"> <li>▪ footnote <i>a</i> notes the reduction in R-value when batt insulation is compressed</li> <li>▪ footnote <i>b</i> allows the exclusion of certain skylights from some SGHC requirements</li> <li>▪ footnote <i>h</i> allows for consistent sheathing thickness while maintaining wall bracing</li> <li>▪ footnote <i>j</i> regarding impact rated fenestration has been eliminated</li> </ul>	Renamed Table R402.1.2	
Table R402.1.3		Modifies the prescriptive Equivalent U-factor table, an alternative to the R-value table, R402.1.1	Renamed Table R402.1.4	
R402.2.3		Adds requirements for eave baffles to maintain openings between soffit and eave vents and a vented attic space		
R402.2.6		Modifies the R-values significantly for steel		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		framed walls to account for the conduction properties of the steel		
R402.2.12, R402.3.5		Modifies requirements for sunrooms by clarifying the wall separation provision and making it clear that these provisions do not apply to spaces that are not thermally isolated; requires the wall separating the conditioned space and the thermally isolated sunroom to meet exterior wall criteria of IECC 2012		
R402.4.1		Modifies building thermal envelope provisions by requiring testing and visual inspection; the code official is authorized to require an approved third party to inspect and verify compliance		Administration issues
R402.4.1.2		Modifies air leakage provisions by requiring inspection and testing while increasing tightness requirements; in most cases mechanical ventilation will be required in houses to meet the air tightness requirements		
R402.4.2		Modifies the requirement for gasketed doors at fireplaces by moving it from the text of the code to table R402.4.1.1; and adds a requirement for tight fitting flue dampers		
	Renumber and amend: <b>SPS 363.0403</b>	<b>SPS 363.5403 Systems. (1) ELECTRICAL POWER AND LIGHTING.</b> This is a department rule in addition to the requirements in IECC section <del>403</del> R403: In residential buildings having individual dwelling units, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units. <b>(2) DUCTS.</b> Substitute the following wording for the requirements in IECC section <del>403.2.2</del> RR403.3.2: All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with IMC section 603.9.		
R403.2	SPS 363 0403 (2) reads in part “all ducts, air handlers, and filter boxes shall be sealed, joints and seams shall comply with IMC section 603.9	Modifies requirements for duct construction and sealing by requiring joints and seams to comply with either the <i>International Mechanical Code (IMC)</i> or the <i>International Residential Code (IRC)</i> , which includes: <ul style="list-style-type: none"> <li>▪ SMACNA HVAC duct construction standards</li> <li>▪ NAIMA fibrous glass duct construction standards</li> </ul>		

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
		<ul style="list-style-type: none"> <li>▪ UL-181 listing for duct board construction</li> <li>▪ UL-181b listing for flexible construction</li> <li>▪ unlisted duct tape is prohibited</li> <li>▪ exception for certain longitudinal seams</li> </ul>		
R403.2		Modifies requirements for duct tightness and verification by compliance with provisions related to a post construction test and a rough-in test		
R403.3.1		Adds a requirement for protecting insulation exposed to the elements, but prohibits the utilization of adhesive tape as the protective measure		
R403.4		Modifies insulation requirements for service hot water systems by increasing the minimum R-value to R-3 and including a list of specific situations where insulation is required, detailed in table R403.4.2		
R403.5		Adds requirements for mechanical ventilation in any building that has less than five air changes per hour at 50 Pascals (5ACH/50)		(mandatory)
R403.5.1		Adds a simple efficiency requirement for various mechanical ventilation system fans in table R403.5.1		
R403.6		Modifies requirements for equipment sizing from a reference through the IRC to a direct reference requiring sizing of equipment per Air Conditioning Contractors of America (ACCA) Manual S based on loads calculated in accordance with ACCA Manual J or other approved method		(mandatory)
R403.9		Modifies requirements for pools by excluding temporary and above ground spas from the scope of the regulations, insulated pool covers are no longer required		(mandatory)
R403.10 (2015) 403.9.2 (2009)		This section requires that time switches be installed in pools. Rules issued by DHS mandate that pump operation occur continuously, 24 hrs/day, 365 days per year.		Amend this section such that the requirements is eliminated 85

IECC/ASHRAE Code Sections	SPS 363	2012 IECC / 2010 ASHRAE 90.1 Changes	2015 IECC / 2013 ASHRAE 90.1 Changes	Comments
R403.10.4 (2015) 403.9.3 (2009)	SPS 363.0504 (3)	<p>This section req's a pool cover be installed for pools located within low rise residential bldgs &lt; 3 stories above grade. SPS 363.0504(3) was created due to health issues from the field that chloramines would overwhelm people when the pool cover was removed, and cause them to go unconscious.</p> <p>Amend this section such that the req't for a pool cover is eliminated just as has been previously done to IECC 504.7.3</p>		86
R404.1		Modifies lighting equipment provisions by requiring that 75 percent of the lamps in permanently installed light fixtures contain only high efficacy lamps		(mandatory)
R405.3		Clarifies that the Commercial provisions require computer modeled performance 15 percent better than the standard reference design, the Residential provisions do not		
Table R405.5.2 (1)		Modifies the language of the table to clarify acceptable compliance methodology with the inclusion of technical details		
	Renumber and amend: <b>SPS 363.0405</b>	<b>SPS 363.5405 Calculation software tools.</b> This is a department informational note to be used under IECC section <del>405.6</del> <b>R405.6</b> :		
	Renumber and amend: <b>SPS 363.0405 Note:</b>	<b>SPS 363.5405 Note:</b> The federal Department of Energy has developed <b>REScheck™</b> , a computer program that may be used in demonstrating compliance for a residential building which has no more than 3 stories above grade and has 3 or more dwelling units. The REScheck program may be downloaded at <a href="http://www.energycodes.gov/">http://www.energycodes.gov/</a> . <del>When using the program, the applicable code must be defined as the "2009 IECC." The use of the "Wisconsin" option will apply requirements associated with a 1 or 2 family dwelling, which are more restrictive than those associated with low-rise multifamily buildings.</del> (new text)		
405.6	363.0405	<p>RESCheck has multiple versions in use, for uniformity the dept recommends using the most recent version.</p> <p>363.0405 Calculation software tools. Add: The most recent version of REScheck shall be used when demonstrating code compliance.</p> <p>This will provide uniformity for reviewers, submitters and users of energy standard to all be consistent and current with energy requirements.</p> <p>As this is utilized in the design stage, there should be minimal impact to construction cost. Software is free download.</p>		Add to the Note: The most recent version of REScheck shall be used when demonstrating code compliance.

## Summary of Significant Changes to ANSI/ASHRAE STANDARD 90.10 Since 2007

Sections Affected	Description of Changes to ASHRAE 90.1 since 2007	Comments
<b>Chapter 4-Administration and Enforcement</b>		
4.2.4	Adds continuous air barriers to the list of required inspection items	
<b>Chapter 5-Building Envelope</b>		
5.1.2	Adds language clarifying that the new requirement for the addition of skylights to certain spaces also applies to unconditioned spaces	
5.1.3	Clarifies that storm window retrofits may be added either inside or outside existing windows and requires that storm windows have low-emissivity coating if the existing glazing is not low-E.	
5.4.3.1	Modifies provisions for sealing the building envelope by adding requirements for <b>design, installation, and materials</b> for the construction of a continuous air barrier for the entire building envelope	
5.4.3.2	Modifies air leakage criteria at fenestration and doors to more closely reflect current practice	
5.5.3.1	Modifies and expands the types of roofs shown by research to reduce the conduction loads through roofs into the conditioned space, allowing designers to select from a number of alternatives and reduce space loads, reducing energy use and cost	
5.5.3.4	Modifies the vestibule requirements for Climate Zone 4	NA
5.5.4.2.2	Adds skylight requirements in larger spaces with specific uses to promote daylighting energy savings, but Climate Zones 6-8 are exempt	NA
5.5.4.4.1	Adds a requirement that the minimum values for dynamic glazing be used to show compliance; in the envelope trade off rules found in Appendix C, the dynamic glazing must use the Standard values from C3.5 to show compliance; when dynamic glazing is used in the Appendix G models, the average values are to be used	
5.5.4.5	Adds a requirement that the area of south facing glass be equal to or larger than the area of east or west facing glass	
Tables 5.5.1 through 5.5.8	Modifies the building envelope requirements for opaque assemblies and fenestration in tables 5.5.1 through 5.5.8 and the associated text in section 5.5.4.5. It also updates NFRC 301 and modifies two metal building roof assemblies in Table A2.3. It increases insulation values for most opaque buildings.	

Sections Affected	Description of Changes to ASHRAE 90.1 since 2007	Comments
5.8.1.10	Adds a requirement for offsetting joints by staggering boards when multiple layers of insulation are used	
5.8.2	Adds Visible Transmittance (VT) to the list of rating and labeling requirements for fenestration products	
<b>Chapter 6-HVAC</b>		
6.4.1.1	Modifies the minimum equipment efficiencies tables by adding new equipment types and requiring compliance with the Standard for equipment used in buildings as defined by the new scope of the Standard	
6.4.1.2	Modifies provisions by introducing a new equation to adjust the performance of centrifugal chillers operating at non-standard conditions to show compliance with the Standard	
6.4.1.2.2	Modifies provisions related to positive displacement chillers that use glycol and other additives by requiring them to be tested with water at standard rating conditions	
6.4.2	Modifies heating and cooling load calculations by reference to ANSI/ASHRAE/ACCA Standard 183, <i>Peak Heating and Cooling Load Calculations in Buildings Except Low-Rise Residential Buildings</i> ; and requires pump head calculation for the critical circuit	
6.4.3.4.3	Modifies provisions to separate the requirements for exhaust/relief dampers from ventilation intake dampers	
6.4.3.4.5	Adds an allowance for a reduction in ventilation in unconditioned garages and requires an automatic control that is capable of staging fans or modulating fan volume as required to maintain carbon monoxide contaminant levels	
6.4.3.9	Adds control requirements for vestibules.	
6.4.3.10	2010 version added a requirement for variable air volume fan speed controls to be included in single zone units. 6.4.3.10 of the 2013 version of ASHRAE mandates Direct Digital Control for many systems.	
6.4.4.1.4	Adds a requirement for minimum insulation to be applied to the back of radiant heating panels	
6.4.4.1.5	Adds a requirement for minimum insulation to be applied to the bottom of radiant heated floors	
6.4.4.2.1	Modifies provisions regarding duct sealing to require ducts and plenums with pressure class ratings to be constructed to seal Class A, and provides a definition for the seal class	

Sections Affected	Description of Changes to ASHRAE 90.1 since 2007	Comments
6.4.5	Adds requirements for commercial refrigeration equipment, including a requirement for automatic closing doors minimum R-values of R-25 for coolers and R-32 for freezers, light source efficiencies, among other requirements.	
6.5.1	Modifies provisions so as to provide minimum fan cooling unit sizes for required economizers on computer rooms	
6.5.1	Modifies the economizer table, requiring economizers to be installed in all units with 54,000 Btu/h or more of cooling in all but Climate Zone 1	
6.5.1.2	Adds requirements for water economizers in computer rooms	
6.5.1.3	Modifies provisions by removing all exceptions from the requirement for integrated economizer control	
6.5.2.1	Adds a control strategy for VAV reheat boxes and eliminates some exceptions from the section	
6.5.2.1.1	Adds a provision limiting the heating air temperature of reheat boxes when the supply and return grilles are both six feet above the floor	
6.5.3.3	Adds a requirement to use ASHRAE 62.1, Appendix A, to optimize the ventilation efficiency and reduce the outside air amount used with room loads below design	
6.5.3.4	Adds a requirement for supply air temperature automatic reset controls for multiple zone HVAC systems	
6.5.3.5	Requires fan motors that are 1/12 hp or greater and less than 1 hp be electronically-commutated motors or have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431.	
6.5.4.1	Modifies the pumping power requirements for HVAC systems	
6.5.4.4.2	Modifies provisions to include water cooled unitary air conditioners with hydronic heat pumps and require both to provide automatic valves that shut off when the compressor does, and provide variable speed pumps	
6.5.4.5	Adds requirements to use a standard table for sizing HVAC piping in order to control pump energy	
6.5.5.3	Adds requirements limiting the power used in open cooling towers with centrifugal fans	
6.5.6.1	Modifies provisions by increasing the requirement for air energy recovery in most climate zones	

Sections Affected	Description of Changes to ASHRAE 90.1 since 2007	Comments
6.5.7.1	Modifies provisions for kitchen exhaust systems by modifying make-up air requirements to prevent short circuiting, by establishing maximum net exhaust flow rates for exhaust hoods, and by requiring exhaust system performance testing	
6.5.7.2	Modifies the equation for designing laboratory exhaust systems by integrating the alternative paths of compliance to allow each system to contribute to the energy savings	
<b>Chapter 9-Lighting</b>		
9.1.2	Modifies the provisions to clarify that alterations to the lighting system must comply with all of the section 9 requirements	
9.1.3	Modifies details of the calculations needed to determine the installed exterior lighting power density requirements	
9.2.2.3	Adds two additional exceptions to the lighting types which are not to be included in the installed lighting power calculation	
9.4.1	Modifies provisions by requiring bi-level lighting control and automatic shutdown in all buildings regardless of size, with exceptions: <ul style="list-style-type: none"> <li>▪ public corridors and stairwells</li> <li>▪ restrooms</li> <li>▪ primary building entrance areas and lobbies</li> </ul> areas where manual-on operation would endanger the safety or security of the room or building occupants	
9.4.1.3	Modifies provisions for lighting control in garages by requiring bi-level lighting control and daylighting controls	
9.4.1.4	Adds a requirement for multilevel daylighting controls for areas adjacent to sidelights	
9.4.1.5	Adds a requirement for multilevel daylighting controls for areas lit by skylights	
9.4.1.6	Modifies provisions to exclude bathroom lighting from being controlled by the master switch required in hotel/motel guest rooms and adds new control requirements for the bathroom lighting	
9.4.1.6	Adds requirements for occupancy lighting controls in building stairwells to dim lighting after occupants leave	

Sections Affected	Description of Changes to ASHRAE 90.1 since 2007	Comments
9.4.1.7	Modifies provisions to require controls for exterior lights to turn off the lights under daylight conditions; older versions of the code merely required that the controls were provided	
9.4.2	Deletes requirements for tandem wiring of light fixtures because of improvements in ballast design	
9.4.3	Modifies provisions to apply a five zone lighting power density approach, each with its own base site allowance, and provide allowances for varying site use classifications in different exterior lighting zones	
9.4.4	Deletes the requirement for minimum efficacy of exterior lamps over 100 watts	
9.4.4	Adds a requirement for functional testing of lighting control devices and control systems	
9.5.1	Modifies the lighting power densities used with the building area method of lighting power allowance calculation	
9.6.1	Modifies the Standard to set the lighting power density by space function whether the function is separated by full height wall or not	
9.6.2	Modifies additional retail lighting provisions to reflect the use of modern lamp technology and adds a power allowance requirement to encourage the use of advanced lighting controls	
9.6.3	Adds an allowance for 20 percent more lighting power to be used in small rooms with high ceilings	
9.7	Adds provisions for submittals to the lighting section requiring the submittal of compliance documentation and supplemental information	Administrati on issues
<b>Other Changes</b>		
1 Purpose and Scope	Modifies the purpose and scope of the Standard by adding building operation and maintenance, on-site renewable energy systems, and commercial systems to those for which the Standard may develop requirements	

Sections Affected	Description of Changes to ASHRAE 90.1 since 2007	Comments
3.2	Modifies provisions by adding multiple definitions, mostly related to daylighting, including: <ul style="list-style-type: none"> <li>▪ Daylight area               <ul style="list-style-type: none"> <li>▪ Under skylights</li> <li>▪ Under rooftop monitors</li> </ul> </li> <li>▪ Daylighted area</li> <li>▪ Dynamic glazing</li> <li>▪ Fenestration, field fabricated</li> <li>▪ Multi-level occupancy sensor</li> <li>▪ Multi-scene control</li> <li>▪ Primary sidelighted area</li> <li>▪ Secondary sidelighted area</li> <li>▪ Sidelighting effective aperture</li> <li>▪ Toplighting</li> <li>▪ Vegetative roof system</li> </ul> Visible transmittance (VT)	
8.4.2	Adds a requirement for the installation of controls to turn off 50 percent of receptacles when the space is unoccupied	
10.4.2	Adds requirements addressing energy waste in service water pressure booster systems	
10.4.3	Modifies energy consumption in elevators by requiring more efficient lighting and fans and by requiring controls that turn the lighting and ventilation off when the elevators are not in use for an extended period of time	
Tables 10.8	Adds efficiency requirements for small electric motors.	

a. Published sources:

2009 *International Energy Conservation Code*<sup>®</sup> – International Code Council<sup>®</sup> (ICC)

2012 *International Energy Conservation Code* – International Code Council

2015 *International Energy Conservation Code* – International Code Council

*Significant Changes to the International Energy Conservation Code and ANSI/ASHRAE/IES Standard 90.1, IECC 2012 Edition, ANSI/ASHRAE/IES 2010 Edition* – International Code Council

*ANSI/ASHRAE Standard 90.1-2007* – American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

*ANSI/ASHRAE/IES Standard 90.1-2010* – American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

*ANSI/ASHRAE/IES Standard 90.1-2013* – American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

*ANSI/ASHRAE/IES 2010 TO 2013 Supplements Addenda to ANSI/ASHRAE/IES STANDARD 90.1-2010* – American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

b. Various ICC code section number references in SPS 363 will be updated where code section numbering has changed, but these modifications are not referenced here.

c. Changes that are not addressed because they do not apply in Wisconsin include the changes for most of chapter 1 Administration

d. Chapters SPS 361 and 363 of the *Wisconsin Administrative Code* (Register, December 2011)

Prepared by Dan Smith and Sandra Cleveland

*File Reference: SPS 363/Summary 2012 & 2015 IECC changes*



# 2015 IECC Update

The International Energy Conservation Code® (IECC®) is recognized as the national model energy code of choice for U.S. cities, counties and states that adopt codes. The IECC and its predecessor, the Model Energy Code (MEC), are cited throughout Federal law for national private and public housing initiatives.

The 2015 edition of the IECC is intended to provide flexibility to permit the use of innovative approaches and techniques. This is achieved by allowing the choice of a prescriptive or performance-based compliance path for both commercial and residential buildings.

## Goal

Participants will be able to use this document to identify changes from the 2012 IECC to the 2015 IECC, allowing them to apply these code requirements to the design, plan review, inspection and commissioning of both residential and commercial buildings.

## Objectives

Upon completion, participants will be better able to:

- Identify the most significant differences between the 2012 IECC and the 2015 IECC
- Explain the differences between the commercial and residential provisions
- Understand the choice of compliance paths
- Identify newly-regulated systems and components
- Identify the applicability of design, plan review, inspection and commissioning requirements

The 2015 edition has numerous changes that provide users of the Code considerably more compliance choices without trading energy efficiency. While there will be regional variability in the technology advances, a preliminary estimate from U.S. Department of Energy (DOE) suggests the 2015 IECC will at least as energy efficient as the 2012 edition [reference: PNNL-23438], which yielded a 32 percent energy savings over the 2006 IECC. Homes built to the IECC consume less energy, and families who live in those homes save energy costs.

The 2015 IECC contains two separate sets of provisions—one for commercial buildings and one for residential buildings. Each set is applied separately to buildings within its scope.

- The IECC—Residential Provisions are referenced as R before the section number. They apply to detached one- and two-family dwellings and multiple single-family dwellings, as well as Group R-2, R-3 and R-4 buildings, three stories or less in height.
- IECC—Commercial Provisions are referenced as C before the section number and apply to all others.

The Commercial and Residential Provisions are independent; and each contains the following chapters:

1. Scope and Administration
2. Definitions
3. Climate Zones and General Materials Requirements
4. Energy Efficiency Requirements (*applicable to buildings within its scope*)
5. Existing Buildings
6. Referenced Standards

**2015 IECC Table of Contents for both Residential and Commercial Provisions**

**TABLE OF CONTENTS**

<i>IECC—COMMERCIAL PROVISIONS. . . . C-1</i>	<i>IECC—RESIDENTIAL PROVISIONS. . . . R-1</i>
CHAPTER 1 SCOPE AND ADMINISTRATION . . . . . C-3	CHAPTER 1 SCOPE AND ADMINISTRATION . . . . . R-3
CHAPTER 2 DEFINITIONS . . . . . C-7	CHAPTER 2 DEFINITIONS . . . . . R-7
CHAPTER 3 GENERAL REQUIREMENTS . . . . C-13	CHAPTER 3 GENERAL REQUIREMENTS . . . . R-11
CHAPTER 4 COMMERCIAL ENERGY EFFICIENCY . . . . . C-31	CHAPTER 4 RESIDENTIAL ENERGY EFFICIENCY . . . . . R-29
CHAPTER 5 EXISTING BUILDINGS . . . . . C-95	CHAPTER 5 EXISTING BUILDINGS . . . . . R-43
CHAPTER 6 REFERENCED STANDARDS . . . . C-99	CHAPTER 6 REFERENCED STANDARDS . . . . R-45

Chapters 1, 2 and 3 are nearly identical for the Commercial and Residential Provisions and have been marked as Section C and R accordingly. For the purpose of this document, they will be explained together, and the differences will be highlighted.

Chapter 4 of the Commercial and Residential Provisions contains the technical requirements for energy efficiency.

Chapter 5 of the Commercial and Residential Provisions contains requirements for existing building.

Chapter 6 of the Commercial and Residential Provisions contains the Referenced Standards.

The 2015 edition of the IECC remains fully compatible with all the International Codes® (I-Codes®) published by the International Code Council® (Code Council®).

Chapter 1: Scope and Administration			
Code Section		Section Title	Description of Change
2015	2012		
C103.2.1 R103.2.1	<b>NEW</b>	Building Thermal Envelope Depiction	Code now requires the building thermal envelope to be explicitly shown on the construction drawings.
C104.1 R104.4	<b>NEW</b>	Inspections - General	Improved and enhanced details governing inspection of construction. The provisions are more specific and written to relate to the Energy Code.
C104.2 R104.2	<b>NEW</b>	Required Inspections	
C104.3 R104.3	<b>NEW</b>	Reinspection	
C104.4 R104.4	<b>NEW</b>	Approved Inspection Agencies	

Chapter 3: General Requirements			
Code Section		Section Title	Description of Change
2015	2012		
C301.4 R301.4	<b>NEW</b>	Tropical Climate Zone	New additional defined Climate Zone 1: <ul style="list-style-type: none"> <li>• Area between the Tropic of Cancer &amp; Tropic of Capricorn</li> <li>• Recognizes the unusually constant and unique climate of this region</li> </ul>
<p>The map displays seven climate zones across the United States. Zone 1 (red) covers the southern United States, including Florida, Texas, and parts of the Southeast. Zone 2 (orange) covers the South and parts of the Midwest. Zone 3 (yellow) covers the central and southern parts of the Midwest. Zone 4 (light green) covers the northern Midwest and parts of the Northeast. Zone 5 (green) covers the northern Midwest and parts of the Northeast. Zone 6 (blue) covers the northern Midwest and parts of the Northeast. Zone 7 (purple) covers the northernmost part of the United States, including Alaska and parts of the Northwest. Two callout boxes provide additional details: one for Alaska (listing various boroughs) and one for Zone 1 (listing Hawaii, Guam, Puerto Rico, and the Virgin Islands).</p>			
R401.2.1	<b>NEW</b>	Tropical Zone Compliance	Unique compliance path for <i>residential occupancies</i> .

Chapter 3: General Requirements			
Code Section		Section Title	Description of Change
2015	2012		
C303.1.3 R303.1.3	<b>C303.1.3</b> <b>R303.1.3</b>	Fenestration Product Rating	<p>U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100.</p> <p>Allows ANSI/DASMA 105 to be used as a standard for determination of U-factors for garage doors</p> 
C303.1.4.1 R303.1.4.1	<b>NEW</b>	Insulated Siding	<p>Requires R-value of insulated siding to be determined in accordance with ASTM C1363. Installation for testing shall be in accordance with the manufacturer's instructions.</p>

Chapter 4: Energy Efficiency			
Code Section		Section Title	Description of Change
2015	2012		
Table C402.1.3	Table C402.2	Opaque thermal envelope insulation component minimum requirements, <i>R</i> -value methods	Minimum thermal performance increased for roof insulation entirely above deck in Climate Zones 1 – 5  Increased to be compatible with ASHRAE 90.1
R402.1.2	R402.1.1	Insulation and fenestration criteria	
Table C402.1.4	Table C402.1.2	Opaque thermal envelope insulation component minimum requirements, <i>U</i> -factor methods	
R402.1.4	R402.1.3	<i>U</i> -factor alternative	
C402.1.2	<b>New</b>	Equipment buildings	Exempt from envelope provisions: <ul style="list-style-type: none"> <li>• Separate buildings not more than 500 ft<sup>2</sup></li> <li>• Intended to house electronic equipment</li> <li>• Heating system capacity ≤ 17,000 Btu/hr</li> <li>• Thermostat set point restricted to ≤ 50°F</li> <li>• Have a maximum average wall and roof <i>U</i>-factor (0.2 or 0.12)</li> <li>• Roof provisions of Climate Zone 1</li> </ul>

Chapter 4: Energy Efficiency																																																		
Code Section		Section Title	Description of Change																																															
2015	2012																																																	
Table C402.1.4.1	<b>New</b>	Effective <i>R</i> -values for steel stud wall assemblies	Method to determine effective <i>R</i> -values for steel stud wall assemblies																																															
<p><b>TABLE C402.1.4.1</b>  <b>EFFECTIVE <i>R</i>-VALUES FOR STEEL STUD WALL ASSEMBLIES</b></p> <table border="1"> <thead> <tr> <th>NOMINAL STUD DEPTH (inches)</th> <th>SPACING OF FRAMING (inches)</th> <th>CAVITY <i>R</i>-VALUE (insulation)</th> <th>CORRECTION FACTOR (<math>F_c</math>)</th> <th>EFFECTIVE <i>R</i>-VALUE (ER) (Cavity <i>R</i>-Value × <math>F_c</math>)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">3½</td> <td rowspan="2">16</td> <td>13</td> <td>0.46</td> <td>5.98</td> </tr> <tr> <td>15</td> <td>0.43</td> <td>6.45</td> </tr> <tr> <td rowspan="2">3½</td> <td rowspan="2">24</td> <td>13</td> <td>0.55</td> <td>7.15</td> </tr> <tr> <td>15</td> <td>0.52</td> <td>7.80</td> </tr> <tr> <td rowspan="2">6</td> <td rowspan="2">16</td> <td>19</td> <td>0.37</td> <td>7.03</td> </tr> <tr> <td>21</td> <td>0.35</td> <td>7.35</td> </tr> <tr> <td rowspan="2">6</td> <td rowspan="2">24</td> <td>19</td> <td>0.45</td> <td>8.55</td> </tr> <tr> <td>21</td> <td>0.43</td> <td>9.03</td> </tr> <tr> <td rowspan="2">8</td> <td>16</td> <td>25</td> <td>0.31</td> <td>7.75</td> </tr> <tr> <td>24</td> <td>25</td> <td>0.38</td> <td>9.50</td> </tr> </tbody> </table>					NOMINAL STUD DEPTH (inches)	SPACING OF FRAMING (inches)	CAVITY <i>R</i> -VALUE (insulation)	CORRECTION FACTOR ( $F_c$ )	EFFECTIVE <i>R</i> -VALUE (ER) (Cavity <i>R</i> -Value × $F_c$ )	3½	16	13	0.46	5.98	15	0.43	6.45	3½	24	13	0.55	7.15	15	0.52	7.80	6	16	19	0.37	7.03	21	0.35	7.35	6	24	19	0.45	8.55	21	0.43	9.03	8	16	25	0.31	7.75	24	25	0.38	9.50
NOMINAL STUD DEPTH (inches)	SPACING OF FRAMING (inches)	CAVITY <i>R</i> -VALUE (insulation)	CORRECTION FACTOR ( $F_c$ )	EFFECTIVE <i>R</i> -VALUE (ER) (Cavity <i>R</i> -Value × $F_c$ )																																														
3½	16	13	0.46	5.98																																														
		15	0.43	6.45																																														
3½	24	13	0.55	7.15																																														
		15	0.52	7.80																																														
6	16	19	0.37	7.03																																														
		21	0.35	7.35																																														
6	24	19	0.45	8.55																																														
		21	0.43	9.03																																														
8	16	25	0.31	7.75																																														
	24	25	0.38	9.50																																														
C402.1.5	<b>New</b>	Component performance alternative.	Alternative component performance path for commercial buildings allows trade-offs in building envelope																																															

<b>Chapter 4: Energy Efficiency</b>			
<b>Code Section</b>		<b>Section Title</b>	<b>Description of Change</b>
<b>2015</b>	<b>2012</b>		
R406	<b>New</b>	Energy rating index compliance alternative	ERI analysis requires that the rated design ERI be $\leq$ the appropriate value listed in Table R406.4

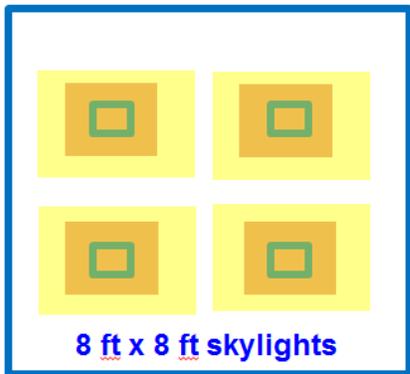
**TABLE R406.4  
MAXIMUM ENERGY RATING INDEX**

<b>CLIMATE ZONE</b>	<b>ENERGY RATING INDEX</b>
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

**Chapter 4: Energy Efficiency**

Code Section		Section Title	Description of Change
2015	2012		
C402.4	C402.3 & C402.3.3.1	Fenestration (Prescriptive)	Building Envelope Fenestration Maximum U-Factor and SHGC Requirements <ul style="list-style-type: none"> <li>Maximum SHGCs based on Projection Factors are folded back into the fenestration table (like 2009 IECC)</li> <li>North-facing fenestrations are allowed higher SHGCs</li> </ul>
C402.4.2	C402.3.2	Minimum skylight fenestration area.	Lowers the threshold for requiring a daylight zone in an enclosed space from 10,000 ft <sup>2</sup> to 2,500 ft <sup>2</sup>

100 ft x 100 ft space  
20 ft ceilings



2012 IECC

28 ft x 28 ft Daylight Zone

Daylight Zone:  
3,136 / 10,000 = 31%

2015 IECC

36 ft x 36 ft Daylight Zone

Daylight Zone:  
5,184 / 10,000 = 51%

**Chapter 4: Energy Efficiency**

Code Section		Section Title	Description of Change
2015	2012		
C402.4.1.1	C402.3.1.1	Increased vertical fenestration area with daylight responsive controls.	In Climate Zones 1-6, up to 40% permitted to be vertical fenestration area, provided: <ul style="list-style-type: none"> <li>• In buildings ≤ 2 stories above grade, ≥ 50 % floor area is within a daylight zone.</li> <li>• In buildings ≥ 3 stories above grade, ≥ 25% floor area is within a daylight zone.</li> <li>• Equipped with daylight responsive controls</li> <li>• VT ≥ 1.1 x SHGC</li> </ul>
<b>Deleted</b>	C402.3.3.2	Increased vertical fenestration SHGC	Removes an exception that allowed an increase in SHGC values in Climate Zones 1, 2, and 3
C402.4.3.3 R402.4.3.2	C402.4.3.3.5 <b>New</b>	Dynamic glazing	Requires a minimum ratio of 2.4 for the higher to lower SHGC rating of dynamic glazing UNLESS both the lower and higher labeled SHGCs comply
C402.5.3 R402.4.4	<b>New New</b>	Rooms containing fuel-burning appliances	Rooms containing fuel-burning appliances and their open-combustion air openings: <ul style="list-style-type: none"> <li>• In Climate Zones 3 - 8</li> <li>• To be isolated from remainder of building in accordance with envelope provisions</li> </ul>
C402.5.7	C402.4.7	Vestibules	New exception allows an air curtain tested in accordance with ANSI/AMCA 220 to be used instead of a vestibule
C403.2.4.4	<b>New</b>	Zone isolation	Requires zones served by HVAC systems over 25,000 square feet or more than one floor to be subdivided into isolation areas to control the HVAC system in each isolation area
C403.2.6.2	<b>New</b>	Enclosed parking garage ventilation controls	Ventilation optimization controls to modulate airflow

**Chapter 4: Energy Efficiency**

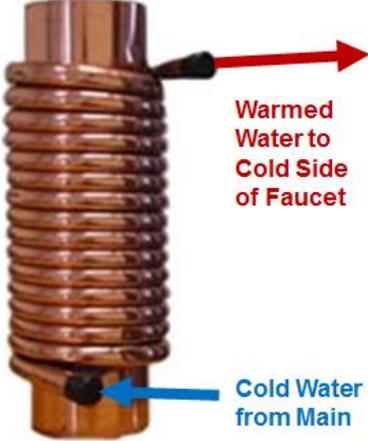
Code Section		Section Title	Description of Change
2015	2012		
C403.2.8	<b>New</b>	Kitchen exhaust systems	Regulates efficiency of kitchen exhaust systems: <ul style="list-style-type: none"> <li>• Replacement air</li> <li>• Maximum exhaust rates</li> </ul>
C403.2.14	<b>New</b>	Refrigeration equipment performance	Tables C403.2.14 (1) & (2): <ul style="list-style-type: none"> <li>• List the maximum energy use in kWh/day</li> <li>• Organized by equipment type, operating mode &amp; rating temperature</li> </ul>
C403.2.15 C403.2.16	<b>New</b>	Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers	Requirements include: <ul style="list-style-type: none"> <li>• Door self-closures</li> <li>• Min. floor, wall &amp; ceiling insulation</li> <li>• Anti-sweat heaters and controls</li> <li>• Lighting efficiency</li> </ul>
C403.4.2.5	<b>New</b>	Boiler turndown	Turndown ratio for boilers with design input over 1,000,000 Btu/h.

**TABLE C403.4.2.5  
BOILER TURNDOWN**

BOILER SYSTEM DESIGN INPUT (Btu/h)	MINIMUM TURNDOWN RATIO
≥ 1,000,000 and less than or equal to 5,000,000	3 to 1
> 5,000,000 and less than or equal to 10,000,000	4 to 1
> 10,000,000	5 to 1

For SI: 1 British thermal unit per hour = 0.2931 W.

**Chapter 4: Energy Efficiency**

Code Section		Section Title	Description of Change
2015	2012		
C404.5 R404.5	<b>New</b>	Efficient heated water supply piping	<p>Maximum allowable pipe length method (Table C404.5.1):</p> <ul style="list-style-type: none"> <li>From the nearest source of heated water to termination of the fixture supply pipe</li> <li>2 columns: public lavatory faucets and all other fixtures</li> </ul> <p>Maximum allowable pipe volume method:</p> <ul style="list-style-type: none"> <li>Volume from the nearest source of heated water to the termination of the fixture supply pipe</li> <li>2 oz. public lavatory faucet, ½ gallon for other fixtures</li> </ul>
C404.8 R403.5.4	<b>New</b>	Drain water heat recovery units	<p>CSA B55.2 (commercial) Max 10 psi pressure loss (C404.8)</p> <p>CSA B55.1 (residential) Max 3 psi pressure loss (R403.5.4)</p> 
C405.9	<b>New</b>	Vertical and horizontal transportation systems and equipment	<ul style="list-style-type: none"> <li>Luminaires</li> <li>Ventilation fans</li> <li>Speed reduction</li> <li>Variable frequency regenerative drive</li> </ul>
C406	C406	Additional Efficiency Package Option	<ul style="list-style-type: none"> <li>More efficient HVAC performance</li> <li>Reduced lighting power density system</li> <li>Enhanced lighting controls</li> <li>On-site supply of renewable energy</li> <li>Provision of a dedicated outdoor air system for certain HVAC equipment</li> <li>High-efficiency service water heating</li> </ul>

**Chapter 4: Energy Efficiency**

Code Section		Section Title	Description of Change
2015	2012		
C408	C408	System Commissioning	<ul style="list-style-type: none"> <li>• Mechanical and service water report in separate sections to allow for independent review</li> <li>• Functional testing of lighting – requirements were broken up and expanded                             <ul style="list-style-type: none"> <li>▪ Construction documents specify performance criteria</li> <li>▪ O&amp;M manuals</li> <li>▪ Schedule for inspection &amp; recalibrating</li> </ul> </li> </ul>

**Summary**

- The format of the IECC slightly changed
- New regulated systems and components were added
- Additional compliance paths are allowed
- Requirements for some systems have been tightened
- Daylight zone dimensions have changed
- Thermal envelope provisions remain mostly unchanged

## Chapter SPS 363

### ENERGY CONSERVATION

**Subchapter I — Purpose and Application**

SPS 363.001 Purpose.

SPS 363.002 Application.

**Subchapter II — Changes, Additions or Omissions to the International Energy Conservation Code (IECC)**

SPS 363.0100 Changes, additions or omissions to IECC.

SPS 363.0101 Administration and enforcement.

SPS 363.0202 General definitions.

SPS 363.0302 Exterior design conditions.

SPS 363.0303 Materials, systems and equipment.

SPS 363.0401 Certificate.

SPS 363.0403 Systems.

SPS 363.0405 Calculation software tools.

SPS 363.0501 General application.

SPS 363.0503 Building mechanical systems.

SPS 363.0504 Service water heating.

SPS 363.0505 Lighting systems.

SPS 363.0506 Total building performance.

SPS 363.0900 Referenced standards.

**Note:** Chapter Comm 63 as it existed on June 30, 2002 was repealed and a new chapter Comm 63 was created, Register December 2001 No. 552, effective July 1, 2002; Chapter Comm 63 was repealed and recreated, Register February 2008 No. 626, eff. March 1, 2008. **Chapter Comm 63 was renumbered chapter SPS 363 under s. 13.92 (4) (b) 1., Stats., Register December 2011 No. 672.**

**Subchapter I — Purpose and Application**

**SPS 363.001 Purpose.** This chapter regulates the design and construction of buildings for the effective use of energy. This chapter provides flexibility to permit the use of innovative approaches and techniques to achieve the effective use of energy. This chapter is not intended to abridge safety, health or environmental requirements contained in other applicable codes.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08.

**SPS 363.002 Application. (1) MIXED OCCUPANCY.** Where a building includes both residential and commercial occupancies, each occupancy shall be separately considered and meet the applicable provisions of IECC chapter 4 for residential or IECC chapter 5 for commercial.

**(2) EXEMPT BUILDINGS AND STRUCTURES.** Glazed structures or glazed portions of buildings used for the production of plant life or for maintaining plant life as the primary purpose are exempt from the building thermal envelope provisions of this code, provided that glazed portions are separated from the remainder of the building by building thermal envelope assemblies complying with this chapter.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08; CR 10–103: r. and recr. (2) Register August 2011 No. 668, eff. 9–1–11.

**Subchapter II — Changes, Additions or Omissions to the International Energy Conservation Code (IECC)**

**SPS 363.0100 Changes, additions or omissions to IECC.** Changes, additions or omissions to the IECC are specified in this subchapter and are rules of the department and are not requirements of the IECC.

**Note:** The sections in this chapter are generally numbered to correspond to the numbering used in the IECC, i.e., s. SPS 363.0101 refers to section IECC 101.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08.

**SPS 363.0101 Administration and enforcement.** Except for IECC section 101.5.2, the requirements in IECC sections 101 and 103 to 109 are not included as part of this chapter.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08; CR 10–103: am. Register August 2011 No. 668, eff. 9–1–11.

**SPS 363.0202 General definitions. (1) ADDITIONS.** This is a department definition for this chapter in addition to the definitions in IMC section 202: “Effective aperture” or “EA” means for windows, the visible light transmittance times the window wall ratio per wall; and for sky lights, the well efficiency times the visible light transmittance times the sky light area times 0.85 divided by the gross exterior roof area.

**(2) SUBSTITUTIONS.** Substitute the following definition for the corresponding definition listed in IECC section 202: “Approved” has the meaning given in s. SPS 362.0202 (2).

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08; correction in (2) made under s. 13.92 (4) (b) 7., Stats., Register August 2011 No. 668; **correction in (2) made under s. 13.92 (4) (b) 7., Stats., Register December 2011 No. 672.**

**SPS 363.0302 Exterior design conditions.** These are department rules in addition to the requirements in IECC section 302: The exterior design temperatures used for heating and cooling load calculations shall be as specified under Table 363.0302.

**Table 363.0302**  
**Exterior Design Conditions**

County	Winter	Summer		County	Winter	Summer	
	Design Temp (F)	Dry Bulb (°F)	Wet Bulb (°F)		Design Temp (F)	Dry Bulb (°F)	Wet Bulb (°F)
Adams	-20	87	75	Marathon	-20	87	75
Ashland	-25	86	70	Marinette	-20	87	75
Barron	-25	86	75	Marquette	-15	87	75
Bayfield	-25	86	70	Menominee	-20	87	75
Brown	-15	87	75	Milwaukee	-10	89	77
Buffalo	-20	87	75	Monroe	-20	87	75
Burnett	-25	86	75	Oconto	-20	87	75
Calumet	-15	87	75	Oneida	-25	86	75
Chippewa	-25	86	75	Outagamie	-15	87	75
Clark	-20	87	75	Ozaukee	-10	89	77
Columbia	-15	87	75	Pepin	-20	87	75
Crawford	-15	87	75	Pierce	-25	86	75
Dane	-15	87	75	Polk	-25	86	75
Dodge	-15	87	75	Portage	-20	87	75
Door	-15	87	75	Price	-25	86	75
Douglas	-25	86	70	Racine	-10	89	77
Dunn	-25	86	75	Richland	-15	87	75
Eau Claire	-20	87	75	Rock	-10	89	77
Florence	-25	86	75	Rusk	-25	86	75
Fond du Lac	-15	87	75	St. Croix	-25	86	75
Forest	-25	86	75	Sauk	-15	87	75
Grant	-15	87	75	Sawyer	-25	86	75
Green	-15	87	75	Shawano	-20	87	75
Green Lake	-15	87	75	Sheboygan	-15	87	75
Iowa	-15	87	75	Taylor	-25	86	75
Iron	-25	86	70	Trempealeau	-20	87	75
Jackson	-20	87	75	Vernon	-20	87	75
Jefferson	-10	89	77	Vilas	-25	86	75
Juneau	-20	87	75	Walworth	-10	89	77
Kenosha	-10	89	77	Washburn	-25	86	75
Kewaunee	-15	87	75	Washington	-10	89	77
La Crosse	-20	87	75	Waukesha	-10	89	77
Lafayette	-15	87	75	Waupaca	-20	87	75
Langlade	-20	87	75	Waushara	-15	87	75
Lincoln	-25	86	75	Winnebago	-15	87	75
Manitowoc	-15	87	75	Wood	-20	87	75

History: CR 06-120: cr. Register February 2008 No. 626, eff. 3-1-08; correction made under s. 13.92 (4) (b) 7., Stats., Register December 2011 No. 672.

**SPS 363.0303 Materials, systems and equipment.**

These are department rules in addition to the requirements in IECC section 303.

(1) GENERAL. Except as specified in sub. (2), when available, information on thermal properties, performance of building envelope sections, and components and heat transfer shall be obtained from ASHRAE Handbook of Fundamentals.

(2) EXCEPTIONS. (a) When the information is not available from ASHRAE Handbook of Fundamentals, the data shall be obtained from laboratory or field-test measurements. If laboratory or field test measurements are used for envelope heat transmission, the measurements shall be obtained using one of the following test methods:

1. ASTM C177, Test method by guarded hot plate apparatus.

2. ASTM C335, Test method of horizontal pipe insulation.
3. ASTM C518, Test method by means of the heat flow meter apparatus.
4. ASTM C1363, Test method by means of a hot box apparatus.

(b) For foam plastic insulation that incorporates a substance other than air as the insulating medium, laboratory or field tests shall be conducted on representative samples that have been aged for the equivalent of 5 years or until the R-Value has stabilized to determine thermal properties or performance. The tests shall be conducted by an independent third party.

(c) Integrally insulated concrete masonry systems within the scope of the National Concrete Masonry Association (NCMA)

shall be evaluated for the thermal performance of the masonry or concrete units in accordance with one of the following:

1. NCMA Evaluation Procedures for the Integrally-Insulated Concrete Masonry Walls.

2. Default values as approved by the department.

(d) All other concrete or masonry units not within the scope of the NCMA Evaluation Procedures shall comply with one of the following methods for determining the thermal performance of the assembly or system:

1. Default values as approved by the department.

2. Laboratory or field-test measurements specified in par. (a).

3. Department material approval process as specified in ch. SPS 361 to determine the U-factor.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08; CR 09–104: r. (1), (2) (title), renum. (2) (a), (b) to be (1), (2) and am. Register December 2010 No. 660, eff. 1–1–11; CR 10–103: renum. from Comm 63.0102 and am. (intro.) Register August 2011 No. 668, eff. 9–1–11; **correction in (2) (d) 3. made under s. 13.92 (4) (b) 7., Stats., Register December 2011 No. 672.**

**SPS 363.0401 Certificate.** The requirements in IECC section 401.3 are not included as part of this code.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08.

**SPS 363.0403 Systems. (1) ELECTRICAL POWER AND LIGHTING.** This is a department rule in addition to the requirements in IECC section 403: In residential buildings having individual dwelling units, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units.

**(2) DUCTS.** Substitute the following wording for the requirements in IECC section 403.2.2: All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with IMC section 603.9.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08; CR 10–103: r. and recr. (2), r. (3) Register August 2011 No. 668, eff. 9–1–11.

**SPS 363.0405 Calculation software tools.** This is a department informational note to be used under IECC section 405.6:

**Note:** The federal Department of Energy has developed REScheck™, a computer program that may be used in demonstrating compliance for a residential building which has no more than 3 stories above grade and has 3 or more dwelling units. The REScheck program may be downloaded at <http://www.energycodes.gov/>. When using the program, the applicable code must be defined as the “2009 IECC.” The use of the “Wisconsin” option will apply requirements associated with a 1 or 2 family dwelling, which are more restrictive than those associated with low-rise multifamily buildings.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08; CR 10–103: renum. from Comm 63.0404 and am. Register August 2011 No. 668, eff. 9–1–11.

**SPS 363.0501 General application.** This is a department rule in addition to the requirements in IECC section 501.2: All of the following rules shall apply regardless of whether the IECC chapter 5 or ASHRAE 90.1 standard is used to determine compliance:

(1) Section SPS 363.0503 (1) relating to design loads.

(2) Sections SPS 363.0503 (3) and (4) relating to economizers.

(3) Section SPS 363.0505 relating to lighting systems.

(4) IECC section 505.2.2.1 relating to dual switching.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08; CR 10–103: am. (2) Register August 2011 No. 668, eff. 9–1–11; **correction in (1), (2), (3) made under s. 13.92 (4) (b) 7., Stats., Register December 2011 No. 672.**

**SPS 363.0503 Building mechanical systems.**

**(1) CALCULATION OF HEATING AND COOLING LOADS.** The following wording is a department requirement in addition to the requirements in IECC section 503.2.1: Design heating and cooling loads shall be determined in accordance with s. SPS 363.0302 and Table 363.0302.

**(2) EQUIPMENT AND SYSTEM SIZING.** Substitute the following wording for the requirements and the exceptions in IECC section

503.2.2: Heating and cooling equipment and systems shall be sized to provide the minimum space and system loads calculated in accordance with s. SPS 363.0302.

**(3) HVAC SYSTEM COMPLETION.** The requirements in IECC sections 503.2.9 to 503.2.9.3 are not included as part of this chapter.

**(4) ECONOMIZERS SIMPLE HVAC SYSTEMS.** Substitute the following wording for the requirements in IECC section 503.3.1 the first paragraph and Table 503.3.1 (1): Supply air economizers shall be provided on the following cooling systems:

(a) Package roof top units  $\geq$  33,000Btu/h.

(b) All other cooling systems  $\geq$  54,000 Btu/h.

**(5) ECONOMIZERS COMPLEX HVAC SYSTEMS.** Substitute the following wording for the requirements, but not the exceptions, in IECC section 503.4.1: Supply air economizers shall be provided on cooling systems as described under sub. (4). Economizers shall be capable of operating at 100 percent outside air, even if additional mechanical cooling is required to meet the cooling load of the building.

**(6) CLIMATE ZONES 3 AND 4.** Substitute the following wording for the requirements in IECC section 503.4.3.3.2.2: For climate Zones 5 through 8 as indicated in Figure 301.1 and Table 301.1, if an open-circuit cooling tower is used, then a separate heat exchanger shall be required to isolate the cooling tower from the heat pump loop, and heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop and providing an automatic valve to stop the flow of fluid.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08; correction made to (9) under s. 13.92 (4) (b) 7., Stats., Register February 2008 No. 626, eff. 3–1–08; CR 10–103: r. (3) to (6), Table 503.2.3 (1), Table 503.2.3 (2), Table 63.0503, (8), (9), renum. (7) to be (3), cr. (4), (5), (6) Register August 2011 No. 668, eff. 9–1–11; **correction in (1), (2) made under s. 13.92 (4) (b) 7., Stats., Register December 2011 No. 672.**

**SPS 363.0504 Service water heating. (1) TEMPERATURE CONTROLS.** The requirements in IECC section 504.3 are not included as part of this chapter.

**(2) HEAT TRAPS.** The requirements in IECC section 504.4 are not included as part of this chapter.

**(3) POOL COVERS.** The requirements in IECC section 504.7.3 are not included as part of this chapter.

**History:** CR 06–120: cr. Register February 2008 No. 626, eff. 3–1–08; CR 09–104: cr. (3) Register December 2010 No. 660, eff. 1–1–11.

**SPS 363.0505 Lighting systems. (1) CONTROLS.** These are department rules in addition to the requirements in IECC section 505:

(a) *General.* Except as provided in par. (b), daylight zones in any interior enclosed space greater than 250 square feet and a lighting density more than 0.6 W/ft<sup>2</sup> shall have at least one control that meets all of the following requirements:

1. Controls only luminaires in the daylight zones.

2. Controls at least 50% of the lamps or luminaires in the daylight zone, in a manner described in IECC section 505.2.2.1.

(b) *Exceptions.* The requirements of this subsection do not apply to any of the following:

1. Daylight zones where the effective aperture of glazing is equal or less than 0.1 for vertical glazing and 0.01 for horizontal glazing.

2. Daylight zones where existing adjacent structures or natural objects obstruct daylight to the extent that effective use of daylighting is not feasible.

**(2) LINE-VOLTAGE LIGHTING TRACK AND PLUG-IN BUSWAY.** Substitute the following for the requirements in IECC section 505.5.1.4: The wattage of line-voltage lighting track and plug-in busway which allows the addition or relocation of luminaires without altering the wiring of the system shall be the volt-ampere rating of the branch circuit feeding the luminaires or an integral current limiter controlling the luminaires, or the higher of the

maximum relamping rated wattage of all of the luminaires included in the system, listed on a permanent factory installed label, or 30 W/linear foot.

**History:** CR 06-120: cr. Register February 2008 No. 626, eff. 3-1-08; CR 10-103: r. (1), (2) (a) 3., (3), renum. (2), (4) to be (1), (2) and am. (1) Register August 2011 No. 668, eff. 9-1-11.

**SPS 363.0506 Total building performance.** This is a department informational note to be used under IECC section 506:

**Note:** ComCheck is a computer program that may be used only for determining building envelope or lighting compliance. The ComCheck computer program may be downloaded at: <http://www.energycodes.gov/>.

**History:** CR 06-120: cr. Register February 2008 No. 626, eff. 3-1-08.

**SPS 363.0900 Referenced standards.** This is a department rule in addition to the requirements in IECC chapter 6: The following standards are hereby incorporated by reference into this code:

(1) ASTM C177-04, Test method for steady-state heat flux

measurements and thermal transmission properties by means of the guarded-hot-plate apparatus.

(2) ASTM C335-05, Test method for steady state heat transfer properties of horizontal pipe insulation.

(3) ASTM C518-04, Test Method for steady-state thermal transmission properties by means of the heat flow meter apparatus.

(4) ASTM C1363-05, Test method for thermal performance of materials and envelope assemblies by means of a hot box apparatus.

(5) National Concrete Masonry Association (NCMA) Evaluation Procedures of Integrally Insulated Concrete Masonry Walls, January 1, 1999.

**Note:** ASTM standards may be purchased from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

NCMA Evaluation Procedures may be obtained from the National Concrete Masonry Association, 2302 Horse Pen Road, Herndon, VA 20171-3499.

Copies of the standards adopted under this section are on file in the offices of the department, the legislative reference bureau.

**History:** CR 06-120: cr. Register February 2008 No. 626, eff. 3-1-08.

(5) **VENTILATION RATE.** Substitute the following wording for the requirements and exception in IMC section 403.3:

(a) *Ventilation rate determination.* 1. Except as provided in sub. (1) (a) and s. SPS 364.0300, a mechanical ventilation system shall be designed to have the capacity to supply a minimum outdoor airflow rate of 7.5 cfm per person as determined in accordance with Table 364.0403 based on the occupancy of the space and the occupant load or other parameters stated therein. A mechanical ventilation system shall be designed to have the capacity to exhaust air as specified in Table 364.0403 except as provided in par. (c).

2. a. Except as provided in subd. 2. b. to d., the occupant load utilized for design of the ventilation system shall not be less than the number determined from the estimated maximum occupant load rate indicated in Table 364.0403.

b. The estimated maximum occupant load rate may be determined using other means with justification acceptable to the department to show that a different number of occupants is reasonable.

c. Where there is no value indicated for the net square feet per person in Table 364.0403, the actual number of occupants shall be used to determine the required amount of outside air.

d. Ventilation rates for occupancies not represented in Table 364.0403 shall be determined by an approved engineering analysis, or by using the most similar occupancy in the table.

(b) *Adjacent spaces with differing ventilation requirements.* 1. Except as provided in subd. 2., spaces with different ventilation requirements shall be provided with a complete solid separation, or the most stringent ventilation requirement shall apply to all unseparated areas.

2. The separation as specified in subd. 1. is not required where an engineered ventilation design system will prevent the concentration of contaminants from exceeding that obtainable by providing a physical separation.

(c) *Exceptions for certain occupancies.* 1. 'Toilet rooms.' A toilet room that has only one water closet or urinal and no bathtub or shower may be provided with either natural ventilation via a window or louvered opening with at least 2 square feet of area openable directly to the outside or mechanical exhaust ventilation as specified in Table 364.0403.

2. 'Janitor closets.' A janitor closet that has only one service sink may be provided with either natural ventilation via a window or louvered opening with at least 2 square feet of area openable

directly to the outside or mechanical exhaust ventilation as specified in Table 364.0403.

3. 'Locker and shower rooms.' An adjoining locker room, shower room and toilet room shall be exhausted at the rate specified in Table 364.0403 based on the largest amount of exhaust required for any of the three rooms. A negative pressure relationship shall be maintained in the shower and toilet rooms with respect to the locker room.

5. 'Pool ventilation.' In a natatorium, the volume of supply air and exhaust air may be reduced to a minimum of 1 cfm per square foot of pool surface provided automatic humidity controls perform so as not to create accelerated building material deterioration from moisture condensation.

(d) *Common ventilation system airflow.* 1. Substitute the following wording for the requirements in IMC sections 403.3.1 through 403.3.2.3.4: Where multiple spaces having different ventilation rate requirements are served by a common ventilation system, the minimum amount of outdoor airflow supplied by the ventilation system shall equal the total outdoor airflow required for each space if each space is provided with minimum air changes in accordance with this paragraph.

2. a. Except as provided in subd. 2. d., an air change rate of 6 air changes per hour shall be provided in each space.

b. The air change air rate under this subsection shall be determined upon either the actual height of the space or 10 feet from the floor level of the space which ever is less.

c. The air movement providing the required minimum air change shall be that amount that is transferred through the air handling equipment where the return air is diluted or replaced with outside air and supplied back to the space.

d. Air change rate of less than 6 air changes per hour is permitted where mechanical cooling is provided to maintain an interior design temperature of 78°F or lower. The air change rate may not be less than the alternative minimum air change rate per hour specified in Table 364.0403. Air changes are not required to be provided for spaces required to be mechanically exhausted.

(6) **SYSTEM OPERATION.** Substitute the following wording for the requirements in IMC section 403.5: The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation may be based on the rate per person indicated in Table 364.0403 and the actual number of occupants present.

Table 364.0403  
Ventilation Requirements

Occupancy Classification	Estimated Maximum Occupant Load (persons per 1,000 sq. ft.) <sup>a</sup>	Exhaust <sup>c</sup> (cfm/net sq. ft. floor area)	Common Ventilation System Alternative - Minimum AC Rate per hour with A/C
<u>Correctional facilities</u>			
Sleeping rooms <sup>d</sup>	20	NR	2.0
Dining halls	100	NR	2.0
Guard stations	40	NR	1.5
<u>Dry cleaners, laundries</u>			
Coin-operated dry cleaners	8	NR	1.0
Coin-operated laundries	8	NR	1.0
Commercial dry cleaners	NA	2.0	NR
Commercial laundries	NA	2.0	NR
Storage, pick up	8	NR	1.0
Apartment laundry rooms	NA	0.5	NR
<u>Education</u>			
Auditoriums	150	NR	2.0
Classrooms	50	NR	2.0
Day care facilities	30	NR	2.0
Laboratories (science)	30	NR	2.0
Music rooms	50	NR	2.0
Special education	35	NR	2.0
Training shops	30	NR	2.0
<u>Food and beverage service</u>			
Bars and cocktail lounges	100	NR	2.0
Cafeterias, fast food	100	NR	2.0
Dining rooms	70	NR	2.0
Kitchens (cooking) <sup>d, e</sup>	20	NR	1.0
<u>Health care facilities</u>			
Hospitals	See s. SPS 364.0300	See s. SPS 364.0300	See s. SPS 364.0300
Nursing homes			
Outpatient surgical facilities			
<u>Hotels, motels, resorts and dorms</u>			
Assembly rooms	120	NR	2.0
Bathrooms <sup>c, d</sup>	NA	35 cfm/room	NR
Bedrooms	footnote f	NR	1.0
Conference rooms	50	NR	2.0
Dormitory sleeping areas	20	NR	1.0
Casinos	NA	2.0	NR
Living rooms	footnote f	NR	1.0
Lobbies	30	NR	2.0
<u>Industrial/Factory</u>			
Factories and machine shops	13	NR	NR
Foundries	13	NR	NR
Sawmills	NA	NR	NR
<u>Offices</u>			
Conference rooms	50	NR	1.5
Office spaces	7	NR	1.5
Reception areas	60	NR	1.5
Telecommunication centers and data entry	60	NR	1.5

Table 364.0403 – Continued  
Ventilation Requirements

Occupancy Classification	Estimated Maximum Occupant Load (persons per 1,000 sq. ft.) <sup>a</sup>	Exhaust <sup>c</sup> (cfm/net sq. ft. floor area)	Common Ventilation System Alternative – Minimum AC Rate per hour with A/C
<u>Private dwellings, single and multiple</u>			
Living areas	2 people for first bedroom plus one person for each additional bedroom	NR	1.0
Kitchens <sup>d</sup>	NA	100 cfm intermittent or 20 cfm continuous	NR
Toilet rooms and bathrooms <sup>d</sup>	NA	Mechanical exhaust capacity 50 cfm intermittent or 20 cfm continuous per room <sup>j</sup>	NR
Garages, separated by a solid wall for each dwelling	NA	100 cfm/vehicle	NR
Garages, common for multiple units <sup>e</sup>	NA	0.5	NR
<u>Retail stores, sales floors and showroom floors</u>	8	NR	1.0
<u>Seasonal occupancies, camps and lodges</u>			
Dining and recreational areas	15	NR	1.0
Living and sleeping areas	NA	NR	1.0
Club houses	15	NR	1.0
Drive-ins	15	NR	1.0
<u>Specialty shops</u>			
Automotive service and repair garages	NA	0.5	NR
Barber shops	25	NR	1.0
Beauty salons <sup>h</sup>	NA	0.5	NR
Car washes	NA	NR	NR
Clothier, furniture specialty shops	8	NR	1.0
Florist shops	8	NR	1.0
Hardware, drugs, fabrics stores	8	NR	1.0
Supermarkets	8	NR	1.0
<u>Sports and amusement</u>			
Ballrooms and discos	100	NR	2.0
Bleacher areas	363 or 18 in./person	NR	2.0
Bowling centers (seating areas)	70	NR	2.0
Game rooms	70	NR	2.0
Ice skating rinks (indoor)	5	NR	NR
Natatoriums	NA	2.0 cfm/sq. ft. pool area	NR
Playing floor (gymnasiums)	30	NR	2.0
Roller skating rinks (indoor)	30	NR	2.0
Spectator areas (non-bleacher)	150	NR	2.0
<u>Storage</u>			
Chlorine storage and handling rooms	NA	2.0	NR
Enclosed parking garages <sup>i</sup>	NA	0.5	NR
Warehouses	NA	NR	NR

Table 364.0403 – Continued  
Ventilation Requirements

Occupancy Classification	Estimated Maximum Occupant Load (persons per 1,000 sq. ft.) <sup>a</sup>	Exhaust <sup>c</sup> (cfm/net sq. ft. floor area)	Common Ventilation System Alternative – Minimum AC Rate per hour with A/C
<b>Theaters</b>			
Auditoriums	150	NR	2.0
Lobbies	150	NR	2.0
Stages, studios	70	NR	2.0
Ticket booths	60	NR	2.0
<b>Transportation</b>			
Platforms	100	NR	2.0
Waiting rooms	100	NR	2.0
<b>Utility and public spaces</b>			
Elevator cars <sup>m</sup>	NA	NR	NR
Janitor closets	NA	2.0 or 75 cfm/sink <sup>g</sup>	NR
Locker and dressing rooms <sup>c</sup>	NA	0.5	NR
Shower rooms	NA	2.0	NR
Toilet rooms <sup>c, d</sup>	NA	75 cfm/TF <sup>g</sup>	NR
<b>Workrooms</b>			
Bank vault	5	NR	NR
Meat processing	10	NR	NR
Pharmacy	20	NR	1.5
Photo studio	10	NR	1.0
Printing	13	footnote j	NR

NA = not applicable; NR = none required; cfm = cubic feet per minute; TF = toilet fixtures (water closets and urinals); A/C = air conditioning

a Based upon net floor area.

b The ventilation rate is based upon cubic feet per minute per square foot of the floor area being ventilated.

c Mechanical exhaust is required and the recirculation of air from these spaces that would otherwise be allowed by IMC section 403.2.1 is prohibited.

d Outdoor air shall be provided at the rate of 1.0 cfm/net sq. ft. floor area. Transfer air is permitted in accordance with IMC section 403.2.2.

e The sum of the outdoor and transfer air from adjacent spaces shall be sufficient to provide an exhaust rate of not less than 1.5 cfm/sf.

f The minimum mechanical ventilation rate is 15 cfm/room of outside air.

g Natural ventilation may be allowed under this section.

h The classification of a 'beauty' salon depends on the types of services provided. Only beauty salons routinely provide chemical processing of hair to produce texture or color changes, or manicures or other services with a similar need for air-borne contaminant and odor control.

i Enclosed parking garages are parking garages with less than 30% open areas in the total wall area enclosing the garage. Ventilation systems in enclosed parking garages shall comply with IMC section 404. A mechanical ventilation system shall not be required in garages having a floor area of 850 square feet or less and used for the storage of 5 or fewer motorized vehicles.

j Refer to IMC chapter 5 for exhaust requirements based upon the chemicals used.

History: CR 00-179: cr. Register December 2001 No. 552, eff. 7-1-02; CR 01-135: renum. (3) to be (3) (b), cr. (3) (a), (4) (a) 6. and (5) (d), am. (5) (a), (b) 1. a., (c) 1. and (6) Table; CR 01-139: renum. (3) to (6) to be (4), (6), (8) and (9), cr. (3), (5) and (7), am. (6) Table, r. and recr. (6) Register June 2002 No. 558, eff. 7-1-02; CR 04-016: am. Table 64.0403 Register December 2004 No. 588, eff. 1-1-05; CR 06-120: r. (1), (4) (a), (6) (a) 3., 6. and (d), am. (2) (a) and (3), renum. (4) (b) to be (4), r. and recr. (6) (intro.), (a) 1., (8) and Table 64.0403 Register February 2008 No. 626, eff. 3-1-08; CR 10-103: r. (6) (c) 4., (9), r. and recr. Table 64.0403, renum. (2) to (7), (8) to (1) to (6), (5) (d) and am. Register August 2011 No. 668, eff. 9-1-11; correction in (2), (4), (5) (a) 1., 2. a., c., d., (c) 1., 2., 3., (d) 2. d., (6), Table 364.0403 made under s. 13.92 (4) (b) 7., Stats., Register December 2011 No. 672.

**SPS 364.0404 Minimum enclosed garage ventilation.** (1) Substitute the following wording for the requirements in IMC section 404.2: Automatic operation of the system shall not reduce the ventilation rate below 0.05 cfm per square foot of the floor area and the system shall be capable of producing a ventilation rate of 0.75 cfm per square foot of floor area.

(2) This is a department alternative to the requirements in IMC sections 404.1 and 404.2: Mechanical ventilation systems for enclosed parking garages are not required to operate continuously where the system conforms to all of the following:

(a) The system is arranged to operate automatically upon detection of carbon monoxide at a level of 35 parts per million (ppm) by automatic detection devices.

(b) If diesel-fueled vehicles are stored, the system is arranged to operate automatically upon detection of nitrogen dioxide at a level of one part per million (ppm) by automatic detection devices.

(c) The system includes automatic controls for providing exhaust ventilation at a rate of 0.75 cfm per square foot for at least 5 hours in each 24-hour period.

(d) The system maintains the garage at negative or neutral pressure relative to other spaces.

History: CR 00-179: cr. Register December 2001 No. 552, eff. 7-1-02; CR 01-139: r. and recr. (1) Register June 2002 No. 558, eff. 7-1-02; CR 06-120: r. and recr. Register February 2008 No. 626, eff. 3-1-08; CR 10-103: am. (1) and (2) (c) Register August 2011 No. 668, eff. 9-1-11.



- [International Mechanical Code](#)
  - [\[ 2009 \(Fifth Printing\) \]](#)
    - [Chapter 4 - Ventilation](#)
      - [SECTION 401 GENERAL](#)
      - [SECTION 402 NATURAL VENTILATION](#)
      - [SECTION 403 MECHANICAL VENTILATION](#)
      - [SECTION 404 ENCLOSED PARKING GARAGES](#)
      - [SECTION 405 SYSTEMS CONTROL](#)
      - [SECTION 406 VENTILATION OF UNINHABITED SPACES](#)

[403.1 Ventilation system.](#)

[403.2 Outdoor air required.](#)

[403.3 Outdoor airflow rate.](#)

[403.4 Exhaust ventilation.](#)

[403.5 System operation.](#)

[403.6 Variable air volume system control.](#)

[403.7 Balancing.](#)

[403.1 Ventilation system.](#)

[403.2 Outdoor air required.](#)

[403.3 Outdoor airflow rate.](#)

[403.4 Exhaust ventilation.](#)

[403.5 System operation.](#)

[403.6 Variable air volume system control.](#)

[403.7 Balancing.](#)

[Top Previous Section](#) [Next Section](#) To view the next subsection please select the Next Section option.

## SECTION 403 MECHANICAL VENTILATION

**403.1 Ventilation system.** Mechanical ventilation shall be provided by a method of supply air and return or *exhaust air*. The amount of supply air shall be approximately equal to the amount of return and *exhaust air*. The system shall not be prohibited from producing negative or positive pressure. The system to convey *ventilation air* shall be designed and installed in accordance with [Chapter 6](#).

**403.2 Outdoor air required.** The minimum outdoor airflow rate shall be determined in accordance with [Section 403.3](#). Ventilation supply systems shall be designed to deliver the required rate of outdoor airflow to the *breathing zone* within each *occupiable space*.

**Exception:** Where the *registered design professional* demonstrates that an engineered ventilation system design will prevent the maximum concentration of contaminants from exceeding that obtainable by the rate of outdoor air ventilation determined in accordance with [Section 403.3](#), the minimum required rate of outdoor air shall be reduced in accordance with such engineered system design.

**403.2.1 Recirculation of air.** The outdoor air required by [Section 403.3](#) shall not be recirculated. Air in excess of that required by [Section 403.3](#) shall not be prohibited from being recirculated as a component of supply air to building spaces, except that:

1. Ventilation air shall not be recirculated from one *dwelling* to another or to dissimilar occupancies.
2. Supply air to a swimming pool and associated deck areas shall not be recirculated unless such air is dehumidified to maintain the relative humidity of the area at 60 percent or less. Air from this area shall not be recirculated to other spaces where more than 10 percent of the resulting supply airstream consists of air recirculated from these spaces.
3. Where mechanical exhaust is required by Note b in Table 403.3, recirculation of air from such spaces shall be prohibited. All air supplied to such spaces shall be exhausted, including any air in excess of that required by Table 403.3.
4. Where mechanical exhaust is required by Note g in Table 403.3, mechanical exhaust is required and recirculation is prohibited where more than 10 percent of the resulting supply airstream consists of air recirculated from these spaces.

**403.2.2 Transfer air.** Except where recirculation from such spaces is prohibited by Table 403.3, air transferred from occupiable spaces is not prohibited from serving as *makeup air* for required exhaust systems in such spaces as kitchens, baths, toilet rooms, elevators and smoking lounges. The amount of transfer air and *exhaust air* shall be sufficient to provide the flow rates as specified in [Section 403.3](#). The required outdoor airflow rates specified in Table 403.3 shall be introduced directly into such spaces or into the occupied spaces from which air is transferred or a combination of both.

**403.3 Outdoor airflow rate.** Ventilation systems shall be designed to have the capacity to supply the minimum outdoor airflow rate determined in accordance with this section. The occupant load utilized for design of the ventilation system shall not be less than the

number determined from the estimated maximum occupant load rate indicated in Table 403.3. Ventilation rates for occupancies not represented in Table 403.3 shall be those for a listed *occupancy* classification that is most similar in terms of occupant density, activities and building construction; or shall be determined by an *approved* engineering analysis. The ventilation system shall be designed to supply the required rate of *ventilation air* continuously during the period the building is occupied, except as otherwise stated in other provisions of the code.

With the exception of smoking lounges, the ventilation rates in Table 403.3 are based on the absence of smoking in occupiable spaces. Where smoking is anticipated in a space other than a smoking lounge, the ventilation system serving the space shall be designed to provide ventilation over and above that required by Table 403.3 in accordance with accepted engineering practice.

**Exception:** The occupant load is not required to be determined based on the estimated maximum occupant load rate indicated in Table 403.3 where *approved* statistical data document the accuracy of an alternate anticipated occupant density.

**TABLE 403.3 MINIMUM VENTILATION RATES**

OCCUPANCY CLASSIFICATION	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, $R_p$ CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, $R_a$ CFM/FT <sup>2</sup> <sup>a</sup>	DEFAULT OCCUPANT DENSITY #/1000 FT <sup>2</sup> <sup>a</sup>	EXHAUST AIRFLOW RATE CFM/FT <sup>2</sup> <sup>a</sup>
<b>Correctional facilities</b>				
Cells				
without plumbing fixtures	5	0.12	25	—
with plumbing fixtures <sup>9</sup>	5	0.12	25	1.0
Dining halls (see food and beverage service)	—	—	—	—
Guard stations	5	0.06	15	—
Day room	5	0.06	30	—
Booking/waiting	7.5	0.06	50	—
<b>Dry cleaners, laundries</b>				
Coin-operated dry cleaner	15	—	20	—
Coin-operated laundries	7.5	0.06	20	—
Commercial dry cleaner	30	—	30	—
Commercial laundry	25	—	10	—
Storage, pick up	7.5	0.12	30	—
<b>Education</b>				
Auditoriums	5	0.06	150	—
Corridors (see public spaces)	—	—	—	—
Media center	10	0.12	25	—
Sports locker rooms <sup>9</sup>	—	—	—	0.5
Music/theater/dance	10	0.06	35	—
Smoking lounges <sup>b</sup>	60	—	70	—
Day care (through age 4)	10	0.18	25	—
Classrooms (ages 5-8)	10	0.12	25	—
Classrooms (age 9 plus)	10	0.12	35	—
Lecture classroom	7.5	0.06	65	—
Lecture hall (fixed seats)	7.5	0.06	150	—
Art classroom <sup>9</sup>	10	0.18	20	0.7
Science laboratories <sup>9</sup>	10	0.18	25	1.0
Wood/metal shops <sup>9</sup>	10	0.18	20	0.5
Computer lab	10	0.12	25	—
Multiuse assembly	7.5	0.06	100	—
Locker/dressing rooms <sup>9</sup>	—	—	—	0.25
<b>Food and beverage service</b>				
Bars, cocktail lounges	7.5	0.18	100	—
Cafeteria, fast food	7.5	0.18	100	—
Dining rooms	7.5	0.18	70	—
Kitchens (cooking) <sup>b</sup>	—	—	—	0.7
<b>Hospitals, nursing and convalescent homes</b>				
Autopsy rooms <sup>b</sup>	—	—	—	0.5
Medical procedure rooms	15	—	20	—
Operating rooms	30	—	20	—
Patient rooms	25	—	10	—
Physical therapy	15	—	20	—
Recovery and ICU	15	—	20	—
<b>Hotels, motels, resorts and dormitories</b>				
Multipurpose assembly	5	0.06	120	—
Bathrooms/toilet—private <sup>9</sup>	—	—	—	25/50 <sup>f</sup>
Bedroom/living room	5	0.06	10	—
Conference/meeting	5	0.06	50	—
Dormitory sleeping areas	5	0.06	20	—

Gambling casinos	7.5	0.18	120	—
Lobbies/prefunction	7.5	0.06	30	—

(continued)

**TABLE 403.3—continued MINIMUM VENTILATION RATES**

OCCUPANCY CLASSIFICATION	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, $R_p$ CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, $R_a$ CFM/FT <sup>2</sup> <sup>a</sup>	DEFAULT OCCUPANT DENSITY #/1000 FT <sup>2</sup> <sup>a</sup>	EXHAUST AIRFLOW RATE CFM/FT <sup>2</sup> <sup>a</sup>
<b>Offices</b>				
Conference rooms	5	0.06	50	—
Office spaces	5	0.06	5	—
Reception areas	5	0.06	30	—
Telephone/data entry	5	0.06	60	—
Main entry lobbies	5	0.06	10	—
<b>Private dwellings, single and multiple</b>				
Garages, common for multiple units <sup>b</sup>	—	—	—	0.75
Garages, separate for each dwelling <sup>b</sup>	—	—	—	100 cfm per car
Kitchens <sup>b</sup>	—	—	—	25/100 <sup>f</sup>
Living areas <sup>c</sup>	0.35 ACH but not less than 15 cfm/person	—	Based upon number of bedrooms. First bedroom, 2; each additional bedroom, 1	—
Toilet rooms and bathrooms <sup>g</sup>	—	—	—	20/50 <sup>f</sup>
<b>Public spaces</b>				
Corridors	—	0.06	—	—
Elevator car	—	—	—	1.0
Shower room (per shower head) <sup>g</sup>	—	—	—	50/20 <sup>f</sup>
Smoking lounges <sup>b</sup>	60	—	70	—
Toilet rooms — public <sup>g</sup>	—	—	—	50/70 <sup>e</sup>
Places of religious worship	5	0.06	120	—
Courtrooms	5	0.06	70	—
Legislative chambers	5	0.06	50	—
Libraries	5	0.12	10	—
Museums (children's)	7.5	0.12	40	—
Museums/galleries	7.5	0.06	40	—
<b>Retail stores, sales floors and showroom floors</b>				
Sales (except as below)	7.5	0.12	15	—
Dressing rooms	—	—	—	0.25
Mall common areas	7.5	0.06	40	—
Shipping and receiving	—	0.12	—	—
Smoking lounges <sup>b</sup>	60	—	70	—
Storage rooms	—	0.12	—	—
Warehouses (see storage)	—	—	—	—
<b>Specialty shops</b>				
Automotive motor-fuel dispensing stations <sup>b</sup>	—	—	—	1.5
Barber	7.5	0.06	25	0.5
Beauty and nail salons <sup>b, h</sup>	20	0.12	25	0.6
Embalming room <sup>b</sup>	—	—	—	2.0
Pet shops (animal areas) <sup>b</sup>	7.5	0.18	10	0.9
Supermarkets	7.5	0.06	8	—
<b>Sports and amusement</b>				
Disco/dance floors	20	0.06	100	—
Bowling alleys (seating areas)	10	0.12	40	—
Game arcades	7.5	0.18	20	—
Ice arenas without combustion engines	—	0.30	—	0.5
Gym, stadium, arena (play area)	—	0.30	—	—
Spectator areas	7.5	0.06	150	—
Swimming pools (pool and deck area)	—	0.48	—	—
Health club/aerobics room	20	0.06	40	—
Health club/weight room	20	0.06	10	—

(continued)

**TABLE 403.3—continued MINIMUM VENTILATION RATES**

OCCUPANCY CLASSIFICATION	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, $R_p$ CFM/PERSON	AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, $R_a$ CFM/FT <sup>2</sup> a	DEFAULT OCCUPANT DENSITY #/1000 FT <sup>2</sup> a	EXHAUST AIRFLOW RATE CFM/FT <sup>2</sup> a
<b>Storage</b>				
Repair garages, enclosed parking garages <sup>b,d</sup>	—	—	—	0.75
Warehouses	—	0.06	—	—
<b>Theaters</b>				
Auditoriums (see education)	—	—	—	—
Lobbies	5	0.06	150	—
Stages, studios	10	0.06	70	—
Ticket booths	5	0.06	60	—
<b>Transportation</b>				
Platforms	7.5	0.06	100	—
Transportation waiting	7.5	0.06	100	—
<b>Workrooms</b>				
Bank vaults/safe deposit	5	0.06	5	—
Darkrooms	—	—	—	1.0
Copy, printing rooms	5	0.06	4	0.5
Meat processing <sup>c</sup>	15	—	10	—
Pharmacy (prep. area)	5	0.18	10	—
Photo studios	5	0.12	10	—
Computer (without printing)	5	0.06	4	—

For SI: 1 cubic foot per minute = 0.0004719 m<sup>3</sup>/s, 1 ton = 908 kg, 1 cubic foot per minute per square foot = 0.00508 m<sup>3</sup>/(s · m<sup>2</sup>),  
 $C = [(F) - 32]/1.8$ , 1 square foot = 0.0929 m<sup>2</sup>.

- a. Based upon net occupiable floor area.
- b. Mechanical exhaust required and the recirculation of air from such spaces is prohibited (see [Section 403.2.1](#), Item 3).
- c. Spaces unheated or maintained below 50°F are not covered by these requirements unless the occupancy is continuous.
- d. Ventilation systems in enclosed parking garages shall comply with [Section 404](#).
- e. Rates are per water closet or urinal. The higher rate shall be provided where periods of heavy use are expected to occur, such as toilets in theaters, schools and sports facilities. The lower rate shall be permitted where periods of heavy use are not expected.
- f. Rates are per room unless otherwise indicated. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted where the exhaust system is designed to operate continuously during normal hours of use.
- g. Mechanical exhaust is required and recirculation is prohibited except that recirculation shall be permitted where the resulting supply airstream consists of not more than 10 percent air recirculated from these spaces (see [Section 403.2.1](#), Items 2 and 4).
- h. For nail salons, the required exhaust shall include ventilation tables or other systems that capture the contaminants and odors at their source and are capable of exhausting a minimum of 50 cfm per station.

**403.3.1 Zone outdoor airflow.** The minimum outdoor airflow required to be supplied to each zone shall be determined as a function of *occupancy* classification and space air distribution effectiveness in accordance with [Sections 403.3.1.1](#) through [403.3.1.3](#).

**403.3.1.1 Breathing zone outdoor airflow.** The outdoor airflow rate required in the *breathing zone* ( $V_{bz}$ ) of the *occupiable space* or spaces in a zone shall be determined in accordance with Equation 4-1.

$$V_{bz} = R_p P_z + R_a A_z \quad \text{(Equation 4-1)}$$

where:

$A_z$  = Zone floor area: the *net occupiable floor area* of the space or spaces in the zone.

$P_z$  = Zone population: the number of people in the space or spaces in the zone.

$R_p$  = People outdoor air rate: the outdoor airflow rate required per person from Table 403.3.

$R_a$  = Area outdoor air rate: the outdoor airflow rate required per unit area from Table 403.3.

**403.3.1.2 Zone air distribution effectiveness.** The zone air distribution effectiveness ( $E_z$ ) shall be determined using Table 403.3.1.2.

**TABLE 403.3.1.2 ZONE AIR DISTRIBUTION EFFECTIVENESS<sup>a,b,c,d,e</sup>**

Air Distribution Configuration	$E_z$
Ceiling or floor supply of cool air	1.0 <sup>f</sup>
Ceiling or floor supply of warm air and floor return	1.0
Ceiling supply of warm air and ceiling return	0.8 <sup>g</sup>
Floor supply of warm air and ceiling return	0.7
Makeup air drawn in on the opposite side of the room from the exhaust and/or return	0.8
Makeup air drawn in near to the exhaust and/or return location	0.5

For SI: 1 foot = 304.8 mm, 1 foot per minute = 0.00506 m/s,  
 $^{\circ}\text{C} = [(^{\circ}\text{F}) - 32]/1.8$ .

- a. "Cool air" is air cooler than space temperature.
- b. "Warm air" is air warmer than space temperature.
- c. "Ceiling" includes any point above the breathing zone.
- d. "Floor" includes any point below the breathing zone.
- e. "Makeup air" is air supplied or transferred to a zone to replace air removed from the zone by exhaust or return systems.
- f. Zone air distribution effectiveness of 1.2 shall be permitted for systems with a floor supply of cool air and ceiling return, provided that low-velocity displacement ventilation achieves unidirectional flow and thermal stratification.
- g. Zone air distribution effectiveness of 1.0 shall be permitted for systems with a ceiling supply of warm air, provided that supply air temperature is less than 15°F above space temperature and provided that the 150 foot-per-minute supply air jet reaches to within 4<sup>1</sup>/<sub>2</sub> feet of floor level.

**403.3.1.3 Zone outdoor airflow.** The zone outdoor airflow rate ( $V_{oz}$ ), shall be determined in accordance with Equation 4-2.

$$V_{oz} = \frac{V_{bz}}{E_z} \quad \text{(Equation 4-2)}$$

**403.3.2 System outdoor airflow.** The outdoor air required to be supplied by each ventilation system shall be determined in accordance with [Sections 403.3.2.1](#) through [403.3.2.3](#) as a function of system type and zone outdoor airflow rates.

**403.3.2.1 Single zone systems.** Where one air handler supplies a mixture of outdoor air and recirculated return air to only one zone, the system outdoor air intake flow rate ( $V_{ot}$ ) shall be determined in accordance with Equation 4-3.

$$V_{ot} = V_{oz} \quad \text{(Equation 4-3)}$$

**403.3.2.2 100-percent outdoor air systems.** Where one air handler supplies only outdoor air to one or more zones, the system outdoor air intake flow rate ( $V_{ot}$ ) shall be determined using Equation 4-4.

$$V_{ot} = \sum_{\text{all zones}} V_{oz} \quad \text{(Equation 4-4)}$$

**403.3.2.3 Multiple zone recirculating systems.** Where one air handler supplies a mixture of outdoor air and recirculated return air to more than one zone, the system outdoor air intake flow rate ( $V_{ot}$ ) shall be determined in accordance with [Sections 403.3.2.3.1](#) through [403.3.2.3.4](#).

**403.3.2.3.1 Primary outdoor air fraction.** The primary outdoor air fraction ( $Z_p$ ) shall be determined for each zone in accordance with Equation 4-5.

$$Z_p = \frac{V_{oz}}{V_{pz}} \quad \text{(Equation 4-5)}$$

where:

$V_{pz}$  = Primary airflow: The airflow rate supplied to the zone from the air-handling unit at which the outdoor air intake is located. It includes outdoor intake air and recirculated air from that air-handling unit but does not include air transferred or air recirculated to the zone by other means. For design purposes,  $V_{pz}$  shall be the zone design primary airflow rate, except for zones with variable air volume supply and  $V_{pz}$  shall be the lowest expected primary airflow rate to the zone when it is fully occupied.

**403.3.2.3.2 System ventilation efficiency.** The system ventilation efficiency ( $E_v$ ) shall be determined using Table 403.3.2.3.2 or Appendix A of ASHRAE 62.1.

**TABLE 403.3.2.3.2 SYSTEM VENTILATION EFFICIENCY<sup>a,b</sup>**

<i>Max</i> ( $Z_p$ )	$E_v$
≤ 0.15	1
≤ 0.25	0.9
≤ 0.35	0.8
≤ 0.45	0.7
≤ 0.55	0.6
≤ 0.65	0.5
≤ 0.75	0.4
> 0.75	0.3

a.  $Max(Z_p)$  is the largest value of  $Z_p$  calculated using Equation 4-5 among all the zones served by the system.

b. Interpolating between table values shall be permitted.

**403.3.2.3.3 Uncorrected outdoor air intake.** The uncorrected outdoor air intake flow rate ( $V_{ou}$ ) shall be determined in accordance with Equation 4-6.

$$V_{ou} = D \sum_{all\ zones} R_p P_z + \sum_{all\ zones} R_a A_z \quad \text{(Equation 4-6)}$$

where:

$D$  = Occupant diversity: the ratio of the system population to the sum of the zone populations, determined in accordance with Equation 4-7.

$$D = \frac{P_s}{\sum_{all\ zones} P_z} \quad \text{(Equation 4-7)}$$

where:

$P_s$  = System population: The total number of occupants in the area served by the system. For design purposes,  $P_s$  shall be the maximum number of occupants expected to be concurrently in all zones served by the system.

**403.3.2.3.4 Outdoor air intake flow rate.** The outdoor air intake flow rate ( $V_{oi}$ ) shall be determined in accordance with Equation 4-8.

$$V_{or} = \frac{V_{ou}}{E_v}$$

(Equation 4-8)

**403.4 Exhaust ventilation.** Exhaust airflow rate shall be provided in accordance with the requirements in Table 403.3. Exhaust *makeup air* shall be permitted to be any combination of outdoor air, recirculated air and transfer air, except as limited in accordance with [Section 403.2](#).

**403.5 System operation.** The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation shall be permitted to be based on the rate per person indicated in Table 403.3 and the actual number of occupants present.

**403.6 Variable air volume system control.** Variable air volume air distribution systems, other than those designed to supply only 100-percent outdoor air, shall be provided with controls to regulate the flow of outdoor air. Such control system shall be designed to maintain the flow rate of outdoor air at a rate of not less than that required by [Section 403.3](#) over the entire range of supply air operating rates.

**403.7 Balancing.** The *ventilation air* distribution system shall be provided with means to adjust the system to achieve at least the minimum ventilation airflow rate as required by [Sections 403.3](#) and [403.4](#). Ventilation systems shall be balanced by an *approved* method. Such balancing shall verify that the ventilation system is capable of supplying and exhausting the airflow rates required by [Sections 403.3](#) and [403.4](#).

[Top Previous Section Next Section](#) To view the next subsection please select the Next Section option.

COPYRIGHT 2007 by INTERNATIONAL CODE COUNCIL



- [International Mechanical Code](#)
- [\[ 2009 \(Fifth Printing\) \]](#)
- [Chapter 4 - Ventilation](#)
- [SECTION 401 GENERAL](#)
- [SECTION 402 NATURAL VENTILATION](#)
- [SECTION 403 MECHANICAL VENTILATION](#)
- [SECTION 404 ENCLOSED PARKING GARAGES](#)
- [SECTION 405 SYSTEMS CONTROL](#)
- [SECTION 406 VENTILATION OF UNINHABITED SPACES](#)

[404.1 Enclosed parking garages.](#)

[404.2 Minimum ventilation.](#)

[404.3 Occupied spaces accessory to public garages.](#)

[404.1 Enclosed parking garages.](#)

[404.2 Minimum ventilation.](#)

[404.3 Occupied spaces accessory to public garages.](#)

[Top Previous Section Next Section](#) To view the next subsection please select the Next Section option.

## **SECTION 404 ENCLOSED PARKING GARAGES**

**404.1 Enclosed parking garages.** Mechanical ventilation systems for enclosed parking garages shall be permitted to operate intermittently where the system is arranged to operate automatically upon detection of vehicle operation or the presence of occupants by *approved* automatic detection devices.

**404.2 Minimum ventilation.** Automatic operation of the system shall not reduce the ventilation airflow rate below 0.05 cfm per square foot ( $0.00025 \text{ m}^3/\text{s} \cdot \text{m}^2$ ) of the floor area and the system shall be capable of producing a ventilation airflow rate of 0.75 cfm per square foot ( $0.0038 \text{ m}^3/\text{s} \cdot \text{m}^2$ ) of floor area.

**404.3 Occupied spaces accessory to public garages.** Connecting offices, waiting rooms, ticket booths and similar uses that are accessory to a public garage shall be maintained at a positive pressure and shall be provided with ventilation in accordance with [Section 403.3](#).

[Top Previous Section Next Section](#) To view the next subsection please select the Next Section option.

COPYRIGHT 2007 by INTERNATIONAL CODE COUNCIL