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INTERNATIONAL GREEN CONSTRUCTION CODE™

PUBLIC VERSION 2.0, NOVEMBER 2010

 **ASHRAE/USGBC/IES STANDARD 189.1-2009**
STANDARD FOR THE DESIGN OF HIGH-PERFORMANCE GREEN BUILDINGS -
A JURISDICTIONAL COMPLIANCE OPTION OF THE IGCC



THE AMERICAN
INSTITUTE
OF ARCHITECTS



**INTERNATIONAL GREEN CONSTRUCTION CODE™
PUBLIC VERSION 2.0**

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INTERNATIONAL CODE COUNCIL, INC.

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PREFACE

Introduction

All levels of government and Building Safety Professionals recognize the need for a mandatory baseline of codes addressing green construction, providing a framework linking sustainability with safety and performance. The *International Green Construction Code™*, in this Public Version 2.0, is designed to meet these needs through model code regulations that promote safe and sustainable construction in an integrated fashion with the ICC Family of Codes.

This comprehensive code establishes minimum regulations for buildings and systems using prescriptive and performance-related provisions, working as an overlay to the I-Codes. For example, the requirements of the 2012 *International Energy Conservation Code* were targeted as a baseline for the *International Green Construction Code* energy provisions that can be increased through the selection of “Jurisdictional Requirements” and “Project Electives.” It is founded on the principle that a model code must address the market segments beyond those captured by rating systems or other evaluation guides, and therefore, must be enforceable, useable, and adoptable.

The *International Green Construction Code* provides many benefits, among which is the model code development process that offers an international forum for building professionals to discuss the science and performance of buildings and systems. This forum provides an excellent arena to debate improvements to the ICC Family of Codes and Standards. The ICC system promotes the mission of the ICC and consistency in the application of codes worldwide.

ASHRAE and its Standard 189 development partners, the U.S. Green Building Council (USGBC) and the Illuminating Engineering Society (IES), support the adoption of the *International Green Construction Code* (IGCC). ASHRAE/USGBC/IES Standard 189.1 is a Jurisdictional Compliance Option of the IGCC. IGCC Section 302.1 and Table 302.1 provide the regulatory framework that allows the jurisdiction to select Standard 189.1 as a compliance option.

This is the first edition of ASHRAE/USGBC/IES Standard 189.1. This standard was created in a collaborative effort between ASHRAE, USGBC, and IES. This standard is written in code-intended language (mandatory, enforceable language).

States and local jurisdictions within the United States that wish to adopt Standard 189.1 as a Jurisdictional Compliance Option of the IGCC into law may want to review applicable federal laws regarding preemption and related waivers that are available from the U.S. Department of Energy (www1.eere.energy.gov/buildings/appliance_standards/state_petitions.html).

You can find more information about the IGCC at <http://www.iccsafe.org/cs/IGCC/Pages/default.aspx>

Development

Public Version 2.0 of the *International Green Construction Code* was issued on November 3, 2010 after the Public Comments submitted to Public Version 1.0 were considered by the IGCC Public Comment Committee at the Public Hearings held in Rosemont, IL, August 14 – 21, 2010. Public Version 2.0 contains the changes to Public Version 1.0 suggested in the Public Comments that were approved or approved with modifications by the Committee (see “Revision Indicators” on page IV). The hearing was conducted in accordance with the “2010 IGCC Public Comment Hearing Procedures” as published on page vi of the *2010 Public Comments to Public Version 1.0 of the International Green Construction Code*. The complete set of public comments and the report of hearing can be found at <http://www.iccsafe.org/cs/IGCC/Pages/PublicVersionDevelopment.aspx>.

Public Version 1.0 of the *International Green Construction Code* was developed in 2010 by the Sustainable Building Technology Committee (SBTC) appointed by the ICC Board of Directors, with the American Institute of Architects and ASTM International as Cooperating Sponsors. The SBTC was a broad based committee representing a balance of interests consistent with the ICC Governmental Consensus process and revised OMB Circular A-119 which establishes policies on Federal use and development of voluntary consensus codes and standards.

2012 Edition of the IGCC

Proposed revisions to Public Version 2.0 will be in the form of code changes which will be processed in accordance with ICC's Code Development Process (as outlined in Council Policy #28 comprised of Code Development and Final Action Hearings in 2011, resulting in the 2012 *International Green Construction Code* - see schedule on page xi. A code change proposal form is provided on page xiii and is available for download at <http://www.iccsafe.org/cs/IGCC/Pages/PublicVersionDevelopment.aspx>.

Adoption

The *International Green Construction Code* Public Version 2.0 is available as a resource document to guide adoption and use by jurisdictions internationally. Its use within a governmental jurisdiction is intended to be accomplished through adoption by reference in accordance with proceedings establishing the jurisdiction's laws. At the time of adoption, jurisdictions should insert the appropriate information in provisions requiring specific local information, such as the name of the adopting jurisdiction. These locations are shown in bracketed words in small capital letters in the code and in the sample adoption ordinance. The sample adoption ordinance on page ix addresses several key elements of a code adoption ordinance, including the information required for insertion into the code text.

Maintenance

The *International Green Construction Code* will be kept up to date through the review of proposed changes submitted by code enforcement officials, industry representatives, design professionals and other interested parties. Proposed changes will be carefully considered through an open code development process in which all interested and affected parties may participate.

For more information regarding the code development process, contact: ICC at 4051 West Flossmoor Road, Country Club Hills, Illinois 60478;

While the development procedure of the *International Green Construction Code* assures the highest degree of care, the ICC, AIA, ASTM International and their members and those participating in the development of this code do not accept any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text. ICC, AIA, and ASTM International do not have power or authority to police or enforce compliance with the contents of this code. Only the governmental body that enacts the code into law has such authority.

Letter Designations in Front of Section Numbers

In each code development cycle, proposed changes to the code are considered at the Code Development Hearings by the applicable ICC Code Development Committee, whose action constitutes a recommendation to the voting membership for final action on the proposed change. Proposed changes to a code section that has a number beginning with a letter in brackets are considered by a different code development committee. For example, proposed changes to code sections that have [B] in front of them (e.g., [B] 202 – definition of "Addition") are considered by the ICC Building Code Development Committee at the code development hearings.

The content of sections in this code that begin with a letter designation are maintained by another code development committee in accordance with the following:

[E] = International Energy Conservation Code Development Committee;

[EB] = International Existing Building Code Development Committee;

[F] = International Fire Code Development Committee;

[FG] = International Fuel Gas Code Development;

[M] = International Mechanical Code Development; and

[P] = International Plumbing Code Development Committee

Revision Indicators

Shading of a section in this Public Version 2.0 indicates that the section has changed from the requirements of Public Version 1.0. Deletion indicators in the form of an arrow (➔) are provided on a blank line of the page on the left side where an entire section, paragraph, exception or table has been deleted, or an item in a list of items has been deleted.

Developed by
Members of the IGCC Public Comment Hearing Committee

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ROADMAP TO THE *INTERNATIONAL GREEN CONSTRUCTION CODE*

Chapter 3 is the core of the *International Green Construction Code*. It is formatted to: facilitate the customization of this code to address local issues; provide options for construction which exceed the minimum requirements of this code; and provide for the implementation of best practices. Table 302.1, which addresses jurisdictional choices, and Table 303.1, which introduces the concept of project electives, are fundamental to the understanding and use of this code.

Table 302.1 is designed to allow the local jurisdiction to meet regional goals and priorities by determining whether certain provisions are to be mandatory and whether enhanced energy performance or reduced plumbing fixture flow rates will be required for compliance with this code. This table also references ASHRAE 189.1 as a compliance path option.

Table 302.1 also requires that the local jurisdiction indicate a value between 1 and 14 as the minimum number of project electives that must be satisfied in order to comply with this code. Project electives are the vehicles by which this code encourages the consideration and implementation of environmentally beneficial practices that might not be appropriate as strict mandatory requirements in some scenarios. They are also used to encourage construction and performance which exceeds the minimum requirements of this code.

All of the provisions of this code, other than those selected by the jurisdiction in Table 302.1 and those designated as project electives, are mandatory as applicable. The section numbers listed in Table 302.1 become mandatory for all buildings in the jurisdiction only where the jurisdiction indicates such applicability in Table 302.1. Project electives, however, become mandatory only where they are selected or chosen by the owner or registered design professional and are indicated in Table 303.1, Project Electives Checklist. The primary functions of the checklist are to: a) give guidance to owners and design professionals as to what project electives are available to choose from, b) to inform the code official as to which project electives have been selected or chosen by the design professional and must, therefore, be complied with and enforced as if they were mandatory requirements and c) to encourage environmental performance that exceeds the minimum requirements of this code.

As an example, provisions of this code have been designated as project electives where mandatory compliance might not be feasible, but where that provision was, nonetheless, important to identify as an option from an environmental perspective. For example, it would be unreasonable to mandate that all buildings be constructed on a brownfield site, as that would preclude the construction of buildings on sites that were not brownfields. However, it is quite reasonable to allow the practice. Therefore, Section 407.2.5, which regulates brownfield sites, is designated as a project elective.

Buildings designed with higher energy performance or lower plumbing fixture flow rates than required by the jurisdiction in Table 302.1, or buildings that incorporate options, are credited with project electives in Table 303.1. Thus the concept of project electives facilitates the option of buildings performance that is higher than the minimum required by the *International Green Construction Code*.

Where a specific building project does not trigger the application of a mandatory provision, or where the jurisdiction has not selected a provision in Table 302.1 as mandatory in their jurisdiction, related project electives have been created to allow the implementation of the practice in those scenarios. For example, since Section 403.3, bicycle parking and storage, is not mandatory for buildings with an area of 2,500 square feet or less, the related project elective, Section 407.3.2, allows the application of the provision to smaller structures by allowing the design professional to select the provision as a project elective.

Provisions which are designated as project electives have been grouped in dedicated sections at the end of Chapters 4 through 9 so that they may be readily identified, and the Project Electives Checklist contained in Table 303.1 ties all project elective strategies from all chapters together in one location.

All sections which are not designated as jurisdictional choices in Table 302.1 or project electives in Table 303.1 are mandatory as applicable. This concept is reinforced in the general provisions at the beginning of Chapters 4 through 11. The vast majority of the provisions of this code are mandatory as applicable in the spirit of all other International Codes.

ORDINANCE

The International Codes are designed and promulgated to be adopted by reference by ordinance. Jurisdictions wishing to adopt the *International Green Construction Code™* as an enforceable regulation governing structures and premises should ensure that certain factual information is included in the adopting ordinance at the time adoption is being considered by the appropriate governmental body. The following sample adoption ordinance addresses several key elements of a code adoption ordinance, including the information required for insertion into the code text.

SAMPLE ORDINANCE FOR ADOPTION OF THE INTERNATIONAL GREEN CONSTRUCTION CODE ORDINANCE NO. _____

An ordinance of the [JURISDICTION] adopting the *International Green Construction Code™*, regulating and governing the impact of buildings and structures on the environment in the [JURISDICTION]; providing for the issuance of permits and collection of fees thereof; repealing Ordinance No. _____ of the [JURISDICTION] and all other ordinances and parts of the ordinances in conflict therewith.

The [GOVERNING BODY] of the [JURISDICTION] does ordain as follows:

Section 1. That a certain document, three (3) copies of which are on file in the office of the [TITLE OF JURISDICTION'S KEEPER OF RECORDS] of [NAME OF JURISDICTION], being marked and designated as the *International Green Construction Code*, including Appendix Chapters [FILL IN THE APPENDIX CHAPTERS BEING ADOPTED] (see International Green Construction Code Section 101.2.1), as published by the International Code Council, be and is hereby adopted as the Green Construction Code of the [JURISDICTION], in the State of [STATE NAME] for regulating and governing the impact of buildings and structures on the environment as herein provided; providing for the issuance of permits and collection of fees thereof; and each and all of the regulations, provisions, penalties, conditions and terms of said Green Construction Code on file in the office of the [JURISDICTION] are hereby referred to, adopted, and made a part hereof, as if fully set out in this ordinance, with the additions, insertions, deletions and changes, if any, prescribed in Section 2 of this ordinance.

Section 2. The following sections are hereby revised:

Section 101.1. Insert: [NAME OF JURISDICTION]

Table 302.1. Insert: [JURISDICTIONAL REQUIREMENTS].

Section 3. That Ordinance No. _____ of [JURISDICTION] entitled [FILL IN HERE THE COMPLETE TITLE OF THE ORDINANCE OR ORDINANCES IN EFFECT AT THE PRESENT TIME SO THAT THEY WILL BE REPEALED BY DEFINITE MENTION] and all other ordinances or parts of ordinances in conflict herewith are hereby repealed.

Section 4. That if any section, subsection, sentence, clause or phrase of this ordinance is, for any reason, held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this ordinance. The [GOVERNING BODY] hereby declares that it would have passed this ordinance, and each section, subsection, clause or phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses and phrases be declared unconstitutional.

Section 5. That nothing in this ordinance or in the International Green Construction Code hereby adopted shall be construed to affect any suit or proceeding impending in any court, or any rights acquired, or liability incurred, or any cause or causes of action acquired or existing, under any act or ordinance hereby repealed as

cited in Section 3 of this ordinance; nor shall any just or legal right or remedy of any character be lost, impaired or affected by this ordinance.

Section 6. That the [**JURISDICTION'S KEEPER OF RECORDS**] is hereby ordered and directed to cause this ordinance to be published. (An additional provision may be required to direct the number of times the ordinance is to be published and to specify that it is to be in a newspaper in general circulation. Posting may also be required.)

Section 7. That this ordinance and the rules, regulations, provisions, requirements, orders and matters established and adopted hereby shall take effect and be in full force and effect [**TIME PERIOD**] from and after the date of its final passage and adoption.

2011 IGCC CODE DEVELOPMENT SCHEDULE

STEP IN CODE DEVELOPMENT CYCLE	DATE
2010 PUBLIC COMMENT HEARING ON COMMENTS SUBMITTED TO IGCC PUBLIC VERSION 1.0	August 14 – 22, 2010 The Westin O'Hare Hotel Rosemont, IL
DEADLINE FOR RECEIPT OF APPLICATIONS FOR THE 2011 IGCC CODE COMMITTEE (1)	October 1, 2010
WEB POSTING OF IGCC PUBLIC VERSION 2.0	November 3, 2010
DEADLINE FOR RECEIPT OF CODE CHANGE PROPOSALS TO IGCC PUBLIC VERSION 2.0	January 3, 2011
WEB POSTING OF "PROPOSED CHANGES TO IGCC PV 2.0"	March 25, 2011
DISTRIBUTION DATE OF "PROPOSED CHANGES TO IGCC PV 2.0" (CD distribution only)	April 25, 2011
IGCC CODE DEVELOPMENT HEARING (CDH)	May 16 – 22, 2011 Sheraton Dallas Hotel Dallas, TX
WEB POSTING OF "REPORT OF THE PUBLIC HEARING"	June 27, 2011
DISTRIBUTION DATE OF "REPORT OF THE PUBLIC HEARING" (CD distribution only)	July 25, 2011
DEADLINE FOR RECEIPT OF PUBLIC COMMENTS	August 12, 2011
WEB POSTING OF PUBLIC COMMENTS "FINAL ACTION AGENDA"	September 16, 2011
DISTRIBUTION DATE OF PUBLIC COMMENTS "FINAL ACTION AGENDA" (CD distribution only)	October 14, 2011
FINAL ACTION HEARINGS (FAH)	November 2 – 6, 2011
ANNUAL CONFERENCES	October 25 – 31, 2010 Charlotte Convention Center Charlotte, NC October 30 – November 3, 2011 Phoenix Convention Center Phoenix, AZ
PUBLISH 2012 IGCC	March/2012



**PUBLIC CODE CHANGE PROPOSAL FORM
FOR PUBLIC PROPOSALS TO PUBLIC VERSION 2.0 OF
THE INTERNATIONAL GREEN CONSTRUCTION CODE**

CLOSING DATE: All Proposals Must Be Received by January 3, 2011.
The 2011 IGCC Code Development Hearings are scheduled for May 16 – 22, 2011, Dallas, TX.

1)

Name:		Date:	
Jurisdiction/Company:			
Submitted on Behalf of:			
Address:			
City:		State:	Zip Code:
Phone:	Ext.:	Fax:	
E-mail address (see item 3 below):			

2) **Copyright Release:** In accordance with Council Policy #28 Code Development, all Code Change Proposals, Floor Modifications and Public Comments are required to include a copyright release. A copy of the copyright release form is included at the end of this form. Please follow the directions on the form. This form as well as an alternative release form can also be downloaded from the ICC website at www.iccsafe.org.

If you have previously executed the copyright release for this cycle, please check the box below:

2011 IGCC Cycle copyright release on file.

3) **E-mail address:** Your email address will be published with your code change proposal unless you check here.

4) **Be sure to format your proposal and include all information as indicated below and in the Code Change Proposal Instructions' section on Page 2 of this form.**

5) Code change proposals should be sent to the following office via regular mail or email. An e-mail submittal is preferred, including an electronic version in Word. The only formatting needed is **BOLD**, ~~STRIKEOUT~~ AND UNDERLINING. Please do not provide additional formatting such as tabs, columns, etc., as this will be done by ICC. **ALSO REMOVE TRACK CHANGES, AUTOMATIC NUMBERING, OR ANY OTHER ADVANCED WORD FORMATTING TOOLS FROM YOUR CODE CHANGE PROPOSAL(S) prior to submittal as these formatting tools cause processing difficulties.**

Please use a separate form (see page 3) for each proposal submitted. Note: All code changes received will receive an acknowledgment by approximately January 21, 2011. Please contact the ICC staff listed below if you do not receive an acknowledgment by January 21, 2011.

Please check here if separate graphic file provided. Graphic materials (Graphs, maps, drawings, charts, photographs, etc.) must be submitted as separate electronic files in .CDR, .IA, .TIF or .JPG format (300 DPI Minimum resolution; 600 DPI or more preferred) even though they may also be embedded in your Word submittal.

Send to:
International Code Council
Chicago District Office
Attn: Dynice Broadnax
4051 West Flossmoor Road
Country Club Hills, IL 60478-5795
Fax: 708/799-0320
codechanges@iccsafe.org

CODE CHANGE PROPOSAL INSTRUCTIONS

Please provide all of the following items in your code change proposal (see form on page 3). Your proposal should be entered on page 3 as a separate file. However, please read the instructions provided below for each part of the code change proposal. The sections identified in parentheses are the applicable sections from CP #28 Code Development. The full procedures can be downloaded from www.iccsafe.org.

PROPOSAL FORMATTING:

Show the proposal (see form on page 3) using ~~strikeout~~, underline format. At the beginning of each section, one of the following instruction lines are also needed:

- Revise as follows
- Add new text as follows
- Delete and substitute as follows
- Delete without substitution

The only formatting that is needed is **BOLDING**, ~~STRIKEOUT~~ AND UNDERLINING. Please do not provide additional formatting such as tabs, columns etc. as this will be done by ICC. **DO NOT USE THE TRACKING CHANGES OPTION, AUTOMATIC NUMBERING, OR ANY OTHER ADVANCED FORMATTING TOOLS PROVIDED BY WORD.**

SUPPORTING INFORMATION: (3.3.4 & 3.4)

The following items are required to be included in your proposal (see form on page 3):

1. The proponent shall clearly state the purpose of the proposed code change (e.g., clarify the Code; revise outdated material; substitute new or revised material for current provision of the Code; add new requirements to the Code; delete current requirements, etc.)
2. The proponent shall justify changing the current code provisions, stating why the proposal is superior to the current provisions of the Code. Proposals that add or delete requirements shall be supported by a logical explanation which clearly shows why the current Code provisions are inadequate or overly restrictive, specifies the shortcomings of the current Code provisions and explains how such proposals will improve the Code.
3. The proponent shall substantiate the proposed code change based on technical information and substantiation. Substantiation provided which is reviewed in accordance with Section 4.2 and determined as not germane to the technical issues addressed in the proposed code change shall be identified as such. The proponent shall be notified that the proposal is considered an incomplete proposal in accordance with Section 4.3, and the proposal shall be held until the deficiencies are corrected. The proponent shall have the right to appeal this action in accordance with the policy of the ICC Board. The burden of providing substantiating material lies with the proponent of the code change proposal. A minimum of two copies of all substantiating information shall be submitted.
4. The proponent shall submit a bibliography of any substantiating material submitted with the code change proposal. The bibliography shall be published with the code change and the proponent shall make the substantiating materials available for review at the appropriate ICC office and during the public hearing.

REFERENCED STANDARDS: (3.4 & 3.6)

List any new referenced standards that are proposed to be referenced in the code and provide a minimum of two copies. For ICC rules on referenced standards, see Section 3.6 of CP #28. Additional copies will be required for committee members. ICC staff will provide you with a mailing list for the appropriate committees.

COST IMPACT: (3.3.4.6)

The proponent shall indicate one of the following regarding the cost impact of the code change proposal:

1. The code change proposal will increase the cost of construction; or
2. The code change proposal will not increase the cost of construction.

This information will be included in the published code change proposal.

CODE CHANGE SUBMITTAL EXAMPLE

Code: GC _____ **– 11** (to be filled in by ICC)
102.12

Commenter: John Q. Public, P.E., Acme Green Buildings, representing himself

Revise as follows:

102.12 Innovative Approaches. ~~It is intended that~~ The provisions of this code are intended to provide flexibility to allow and encourage the use of innovative approaches, techniques and technology to achieve compliance with the intent of the code.

Reason: An editorial rearrangement of the sentence structure to clarify that while "flexibility" is indeed an important attribute of the IGCC, it need not be stated as a code requirement. The entire section addresses the flexible nature of the code by virtue of the innovative approaches being encouraged in this section.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing: Committee: AS AM D
 Assembly: ASF AMF DF

IGCC
CODE CHANGE PROPOSAL FORM
(See instructions on page 2)

Code: GC _____ – 11 *(to be filled in by ICC)*

Code Sections/Tables/Figures Proposed for Revision (3.3.2); Note: *If the proposal is for a new section, indicate (new).*

Proponent: Name/Company/Representing (3.3.1): *(NOTE: DO NOT USE ACRONYMS FOR YOUR COMPANY OR ORGANIZATIONAL NAME)*

Email Address:

Revise as follows:

Reason:

Cost Impact:

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF



International Green Construction Code

**COPYRIGHT RELEASE FOR
2011 PROPOSALS, MODIFICATIONS and PUBLIC COMMENTS
SUBMITTED ON THE IGCC
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INTERNATIONAL CODE COUNCIL**

This form is required for all Proposals, Floor Modifications and Public Comments submitted to the International Code Council. Only one signed Copyright release form is required for the entire 2011 IGCC Cycle and will be kept on file and can be used for all Proposal, Floor Modification and Public Comment submittals you submit to ICC unless you represent multiple entities. An executed form is required for each entity represented.

I hereby grant and assign to ICC all rights in copyright I may have in any authorship contributions I make to ICC in the 2011 IGCC Cycle in connection with any proposal and public comment, in its original form submitted or revised form, including written and verbal modifications submitted in accordance with Section 5.5.2 of CP #28. I understand that I will have no rights in any ICC publications that use such contributions in the form submitted by me or another similar form and certify that such contributions are not protected by the copyright of any other person or entity.

Signature: _____

Please type or print full name: _____

Jurisdiction/Company: _____

Entity Represented: _____

Contact info: Phone: _____ Email: _____

Date signed: _____

PLEASE FAX OR MAIL THE SIGNED COPYRIGHT RELEASE TO:

Fax: ICC Codes & Standards Department – 708/799-0320

*Mail: ICC Codes & Standards Development
Chicago District Office
4051 W. Flossmoor Road
Country Club Hills, IL 60478-5795*

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CHAPTER 1

ADMINISTRATION

PART 1 --- SCOPE AND APPLICATION

SECTION 101 GENERAL

101.1 Title. These regulations shall be known as the Green Construction Code of [NAME OF JURISDICTION], hereinafter referred to as “this code.”

101.2 Scope. The provisions of this code shall apply to the design, construction, *addition, alteration, change of occupancy*, movement, enlargement, replacement, *repair*, equipment, location, maintenance, removal and demolition of every *building or structure* or any appurtenances connected or attached to such *buildings or structures* and to the site on which the *building* is located. Occupancy classifications shall be determined in accordance with the *International Building Code*;

This code shall not apply to the following:

1. Detached one-and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress.
2. Equipment or systems that are used primarily for industrial or manufacturing processes.

101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted.

101.3 Intent. The purpose of this code is to safeguard the environment, public health, safety and general welfare through the establishment of requirements to reduce the negative potential impacts and increase the positive potential impacts of the built environment on the natural environment and *building* occupants, by means of minimum requirements related to: conservation of natural resources, materials and energy; the employment of renewable energy technologies, indoor and outdoor air quality; and *building* operations and maintenance.

SECTION 102 APPLICABILITY

102.1 General. This code is an overlay to the other International Codes. This code is not intended to be used as a stand alone construction regulation document or to abridge or supersede safety, health or environmental requirements under other applicable codes or ordinances. *A jurisdiction* intending to adopt this code without other ICC-Codes is advised to make a detailed review of locally adopted codes to ensure that they adequately correlate with this code.

102.1.1 Code Conflicts. Where there is a conflict between a general requirement and a specific requirement of this code, the specific requirement shall be applicable. Where, in any specific case, different sections of the code specify different materials, methods of construction or other

requirements, the most practical and effective requirement to meet the intent of the code shall govern.

102.1.2 Innovative Approaches. It is intended that the provisions of this code provide flexibility to allow and encourage the use of innovative approaches, techniques and technology to achieve compliance with the intent of the code.

102.2 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

102.3 Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

102.4 Referenced codes and standards. The codes listed in Sections 102.4.2 through 102.4.12, the codes and standards referenced elsewhere in this code, and those referenced standards listed in Chapter 12, shall be considered as part of the requirements of this code to the prescribed extent of each such reference. It is the expressed intent of this code to require higher minimum standards relating to *building* performance than the corresponding minimum standards set by the referenced codes and standards, and in such cases, the higher minimum standards of this code shall take precedence.

102.4.1 Conflicting provisions. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code or the International Codes listed in Section 102.3, the provisions of this code or the International Codes listed in Section 102.4, as applicable, shall take precedence over the provisions in the referenced code or standard.

102.4.2 Building. The provisions of the *International Building Code* shall apply to the extent that such provisions establish minimum requirements to safeguard public health, safety and general welfare through structural strength, means of egress facilities, sanitation, adequate light and *ventilation*, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations. The provisions of Chapter 1 of the *International Building Code* shall also apply.

102.4.3 Fuel Gas. The provisions of the *International Fuel Gas Code* shall apply to the installation, *alteration*, *repair* and replacement of gas piping systems and components, gas appliances and related accessories as covered in this code. These requirements apply to gas piping systems extending from the point of delivery to the inlet connections of appliances and the installation and operation of gas appliances and related accessories.

102.4.4 Mechanical. The provisions of the *International Mechanical Code* shall apply to the installation, *alterations*, *repairs* and replacement of mechanical systems, equipment, appliances, fixtures, fittings and appurtenances, including ventilating, heating, cooling, air-conditioning and refrigeration systems, incinerators and other energy-related systems.

102.4.5 Plumbing. The provisions of the *International Plumbing Code* shall apply to the installation, *alteration*, *repair* and replacement of plumbing systems, including equipment, appliances, fixtures, fittings, appurtenances, and medical gas systems.

102.4.6 Property maintenance. The provisions of the *International Property Maintenance Code* shall apply to *existing structures* and premises; equipment and facilities; light, *ventilation*, space

heating, sanitation, life and fire safety hazards; responsibilities of owners, operators and occupants; and occupancy of existing premises and *structures*.

102.4.7 Fire prevention. The provisions of the *International Fire Code* shall apply to matters affecting or relating to: *structures*, processes and premises from the hazard of fire and explosion arising from the storage, handling or use of *structures*, materials or devices; conditions hazardous to life, property or public welfare in the occupancy of *structures* or premises; and the construction, extension, *repair*, *alteration* or removal of fire suppression and alarm systems or fire hazards in the *structure* or on the premises from occupancy or operation.

102.4.8 Energy. The provisions of the *International Energy Conservation Code* shall apply to matters governing the design and construction of *buildings* for the effective use of energy.

102.4.9 Wildland-urban interface. The provisions of the *International Wildland-Urban Interface Code* shall apply to matters related to the mitigation of risk to life and *structures* from intrusion of fire from wildland fire exposures and fire exposures from adjacent *structures* and to mitigate *structure* fires from spreading to wildland fuels.

102.4.10 Performance. The provisions of the *International Code Council Performance Code* shall be permitted to apply to matters related to the approval of alternative materials and methods and to innovative approaches to code compliance.

102.4.11 Existing buildings. The provisions of the *International Existing Building Code* shall apply to matters governing the design and construction of *additions*, *alterations* or renovations of existing *buildings* as well as to changes in occupancy to the extent that such provisions establish minimum requirements to safeguard public health, safety and general welfare through structural strength, *means of egress* facilities, sanitation, adequate light and *ventilation*, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.

102.4.12 Zoning. The provisions of the *International Zoning Code* shall apply to matters governing zoning requirements related to the scope of this code.



102.5 Partial invalidity. In the event that any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

102.6 Existing structures. The legal occupancy of any *structure* existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, *the International Building Code*, the *International Existing Building Code*, the *International Property Maintenance Code* or the *International Fire Code*, or as is deemed necessary by the *code official* for the general safety and welfare of *building* occupants and the public.

102.7 Mixed occupancy buildings. In mixed occupancy *buildings*, each portion of a *building* shall comply with the specific requirements of this code applicable to each specific occupancy.

PART 2 --- ADMINISTRATION AND ENFORCEMENT

SECTION 103 DUTIES AND POWERS OF THE CODE OFFICIAL

103.1 General. The *code official* established in the *International Building Code* is hereby authorized and directed to enforce the provisions of this code. The *code official* shall have the authority to render binterpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions and how this code relates to other applicable codes and ordinances. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of this code and other applicable codes and ordinances. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code or other applicable codes and ordinances.

103.2 Applications and permits. The *code official* shall enforce compliance with the provisions of this code as part of the enforcement of other applicable codes and regulations, including the referenced codes listed in 102.4.

103.3 Notices and orders. The *code official* shall issue all necessary notices or orders to ensure compliance with this code.

103.4 Inspections. The *code official* shall make inspections, as required to determine code compliance, or the *code official* shall have the authority to accept reports of inspection by *approved agencies* or individuals. The *code official* is authorized to engage such expert opinion as deemed necessary to report upon unusual technical issues that arise, subject to the approval of the appointing authority.

SECTION 104 CONSTRUCTION DOCUMENTS

104.1 Information on construction documents. *Construction documents* shall be dimensioned and drawn upon suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. *Construction documents* shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that such work will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the *code official*. The *construction documents* shall contain a listing of the applicable *project electives* in accordance with Section 303, and shall include the applicable *commissioning* requirements in accordance with Section 903. Where special conditions exist, the *code official* is authorized to require additional *construction documents*.

SECTION 105 APPROVAL

105.1 General. This code is not intended to prevent the use of any material, method of construction, design, system, or innovative approach not specifically prescribed herein, provided that such construction, design, system or innovative approach has been *approved* by the *code official* as meeting the intent of this code and all other applicable laws, codes and ordinances.

105.2 Approved materials and equipment. Materials, equipment, devices and innovative approaches *approved* by the *code official* shall be constructed, installed and maintained in accordance with such approval.

105.2.1 Used materials, products and equipment. The use of used materials, products and equipment that meet the requirements of this code for new materials is permitted. Used equipment and devices shall be permitted to be reused subject to the approval of the *code official*.

105.3 Modifications. Wherever there are practical difficulties involved in carrying out the provisions of this code, the *code official* shall have the authority to grant modifications for individual cases, upon application of the owner or owner's representative, provided the *code official* shall first find that special individual reason makes the strict letter of this code impractical and that the modification is in compliance with the intent and purpose of this code and that such modification does not lessen the minimum requirements of this code. The details of granting modifications shall be recorded and entered in the files of the department.

105.4 Alternative materials, design, innovative approach and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design, innovative approach, or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design, innovative approach or method of construction shall be reviewed and *approved* where the *code official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, design, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code. The details of granting the use of alternative materials, designs, innovative approach and methods of construction shall be recorded and entered in the files of the department.

105.4.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved sources*.

105.4.2 Tests. Wherever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the *code official* shall have the authority to require tests as evidence of compliance to be made at no expense to the *jurisdiction*. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the *code official* shall approve the testing procedures. Tests shall be performed by an *approved agency*. Reports of such tests shall be retained by the *code official* for the period required for retention of public records.

105.5 Compliance materials. The *code official* shall be permitted to approve specific computer software, work- sheets, compliance manuals and other similar materials that meet the intent of this code.

SECTION 106 PERMITS

106.1 Required. Any owner or authorized agent who intends to construct, enlarge, *alter, repair, move, demolish, or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert or replace any energy, electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be done, shall first make application to the code official and obtain the required permit under the applicable code or regulation relevant to the intended work. Separate permits shall not be issued under this code. Exemptions from permit requirements shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other applicable laws, codes or ordinances of this jurisdiction.*

SECTION 107 FEES

107.1 Fees. Fees for *permits* shall be paid as required, in accordance with the schedule as established by the applicable governing authority for the intended work prescribed in an application.

SECTION 108 BOARD OF APPEALS

108.1 General. Appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code shall be made to the Board of Appeals created under the applicable *International Code* of governing regulation.

108.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted there under have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall have no authority to waive requirements of this code.

108.3 Qualifications. The members of the board of appeals related to interpretation of this code shall be qualified by experience and training in the matters covered by this code and shall not be employees of the *jurisdiction*.

SECTION 109 CERTIFICATE OF OCCUPANCY

109.1 Use and occupancy. *Buildings* or *structures* shall not be used or occupied, and changes in the existing occupancy classification of a *building* or *structure* or portion thereof shall not be made, until the *code official* has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the *jurisdiction*.

109.2 Certificate issued. After the *code official* inspects the *building* or *structure* and finds no violations of the provisions of this code or other laws that are enforced by the department of *building* safety, the *code official* shall issue a certificate of occupancy in accordance with the provisions of the *International Building Code*. The certificate of occupancy shall include a stipulation in accordance with Item 12 of Section 111.2 of the *International Building Code* that post occupancy requirements are to be completed in accordance with Chapter 9 of this code.

109.3 Temporary occupancy. The *code official* is authorized to issue a temporary certificate of occupancy before the completion of the entire work covered by the permit, provided that the building or structure or portion thereof is safe to occupy.

CHAPTER 2

DEFINITIONS

SECTION 201 GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the *International Building Code, International Energy Conservation Code, International Fire Code, International Fuel Gas Code, International Mechanical Code or International Plumbing Code*, such terms shall have the meanings ascribed to them as in those codes.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

SECTION 202 DEFINITIONS

95th PERCENTILE RAINFALL EVENT. The rainfall event having a precipitation total greater than or equal to 95 percent of all rainfall events during a 24-hour period on an annual basis.

A-WEIGHTED SOUND LEVEL. Sound pressure level in *decibels* measured with a sound level *meter* using an A-weighted network.

[B] ADDITION. An extension or increase in floor area or height of a *building* or *structure*.

AGED SOLAR REFLECTANCE. The *solar reflectance* value of a material after it has been installed and subjected to actual weather conditions for not less than three years.

[B] ALTERATION. Any construction or renovation to an *existing structure* other than *repair* or *addition*.

ANNUAL NET ENERGY PERFORMANCE (ANEP). The total annual energy use of the building for all purposes minus the annual energy use of the building supplied from renewable energy sources or reclaimed waste energy associated with the *building* or the *building* site.

[B] APPROVED. Acceptable to the *code official* or authority having *jurisdiction*.

[B] APPROVED SOURCE. An independent person, firm or corporation, *approved* by the *code official*, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

[B] APPROVED AGENCY. An established and recognized agency regularly engaged in conducting tests or furnishing *commissioning* services, where such agency has been *approved*.

AREA, TOTAL BUILDING FLOOR: The total of the *total floor areas* on all stories of the *building*.

AREA, TOTAL FLOOR: The total area of a *story* as measured from the interior side of the exterior walls.

AREA, OCCUPIED FLOOR: The area of any *story*, portion of a *story*, or aggregate of multiple *stories* that is used for a specific occupancy or function.

ASBESTOS-CONTAINING PRODUCTS. Building materials containing one or more of the following mineral fibers in any detectable amount that have been intentionally added or are present as a contaminant: chrysotile, amosite, crocidolite, tremolite, actinolite, anthophyllite and any fibrous amphibole.

[E] AUTOMATIC. Self-acting, operating by its own mechanism when actuated by some impersonal influence, such as a change in current strength, pressure, temperature or mechanical configuration (see “Manual”).

[P] BACKWATER VALVE. A device or valve installed in the system drain piping which prevents drainage or waste from backing up into the system and causing contamination or flooding.

BALE. Equivalent to straw bale.

BICYCLE PARKING, LONG TERM. Bicycle racks or storage lockers provided for bicycle riders including, but not limited to, employees and students, anticipated to be at a *building site* for four or more hours.

BICYCLE PARKING, SHORT TERM. Bicycle racks or storage lockers provided for bicycle riders including, but not limited to, customers, visitors, and event audiences, anticipated to be at a *building site* for less than four hours.

BIO-BASED MATERIAL. A commercial or industrial material or product, other than food or feed, that is composed of, or derived from, in whole or in significant part, biological products or renewable domestic agricultural materials, including plant, animal, and marine materials, or forestry materials.

BRANCH CIRCUIT. All circuit conductors between the final branch-circuit overcurrent device and the load.

BROWNFIELD. (also EPA-Recognized Brownfield). Real property, the expansion, redevelopment, or reuse of which might be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant and includes Brownfield Site as defined in Public Law 107-118 (H.R 2869) “Small Business Liability Relief and Brownfield Revitalization Act”, 40 CFR 300.

[M] BTU. Abbreviation for British thermal unit, which is the quantity of heat required to raise the temperature of 1 pound (454 g) of water 1 F (0.56 C) (1 Btu = 1055 J).

[B] BUILDING. Any *structure* used or intended for supporting or sheltering any use or occupancy, including the energy using systems and site sub-systems powered through the building's electrical service.

BUILDING COMMISSIONING (BCx). A process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner's project requirements and construction documents, and to minimum code requirements except as noted herein.

BUILDING SITE. A *lot*, or a combination of adjoining *lots*, that are being developed and maintained subject to the provisions of this code. A *building* site shall be permitted to include public ways, private roadways, bikeways and pedestrian ways that are developed as an element of the total development.

[E] BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof, and any other *building* elements that enclose *conditioned space*. This boundary also includes the boundary between *conditioned space* and any exempt or unconditioned space.

CARBON DIOXIDE EQUIVALENT (CO_{2e}) EMISSIONS. A measure used to compare the emissions from various *greenhouse gases* based upon their *global warming potential* (GWP). CO_{2e} emissions from carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) are included. The carbon dioxide equivalent for a gas is derived by multiplying the weight of the gas by the associated GWP.

CHANGE OF OCCUPANCY. A change in the purpose or level of activity within a *building* that involves a change in application of the requirements of this code.

CODE OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

COLLECTION PIPE. Unpressurized pipe used within the collection system that drains *rainwater* to the *storage tank* by gravity.



COMMISSIONING. A process that verifies and documents that the selected *building* and site systems have been designed, installed, and function in accordance with the owner's project requirements and *construction documents*, and minimum code requirements. [*as reconciled, pending IECC FAH, IgCC FAH, and CCC action*]

CONSERVATION AREA. Land designated by the jurisdiction or by state or federal government, as a result of a community planning process, as appropriate for conservation from development because of the land possessing natural values important to the community including, but not limited to, wildlife habitat, forest or other significant vegetation, steep slopes, ground water recharge area, riparian corridor or wetland.

CONSTRUCTED-COMPACTED SUBSOIL. Subsoils that are compacted through any of the following: clearing, grading, smearing and topsoil removal such that the infiltrative capacity of the soils or the bulk density of the soils is significantly altered in comparison to the reference soil properties.

[B] CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a *building permit*.

CONTROL. A specialized *automatic* or *manual* device or system used to regulate the operation of lighting, equipment or appliances.

DAYLIGHT CONTROL. An *automatic* control device or system complying with Section 505.2.2.3.3 of the *International Energy Conservation Code*. [Section number based on change proposed for incorporation in the 2012 IECC]

CAPTIVE KEY CONTROL. An *automatic* control device or system that energizes circuits when the key that unlocks the sleeping unit is inserted into the device and that de-energizes those circuits when the key is removed.

OCCUPANT SENSOR CONTROL. An *automatic* control device or system complying with Section 505.2.2.3.1 of the *International Energy Conservation Code*. Occupant sensors are permitted to incorporate an integral maximum there (3) watt LED night light that functions when loads are shut off. [Section number based on change proposed for incorporation in the 2012 IECC]

TIME SWITCH CONTROL. An *automatic* control device or system complying with Section 505.2.2.3.2 of the *International Energy Conservation Code*. [Section number based on change proposed for incorporation in the 2012 IECC]

CO₂e. Weight of each gas emitted when consuming a specific energy type in the *building* per unit of the specific energy type provided to the *building* at the utility *meter* multiplied by the GWP of the specific gas, and then summed over all three gases emitted.

Where:

GWP (CO₂) = 1

GWP (CH₄) = 25

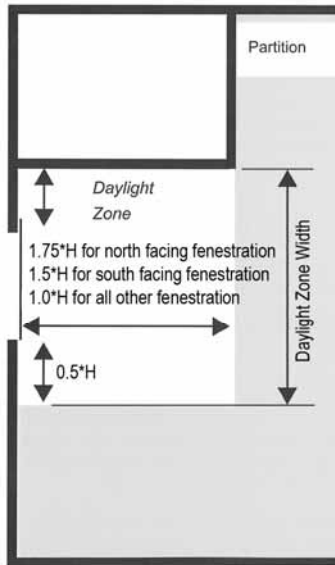
GWP (N₂O) = 298.

[B] COURT. An open, uncovered space, unobstructed to the sky, bounded on three or more sides by exterior *building* walls or other enclosing devices.

DAYLIGHT SATURATION. The percentage of daytime hours throughout the year when not less than 28 foot-candles (300 lux) of natural light is provided at a height of 30 inches (760 mm) above the floor.

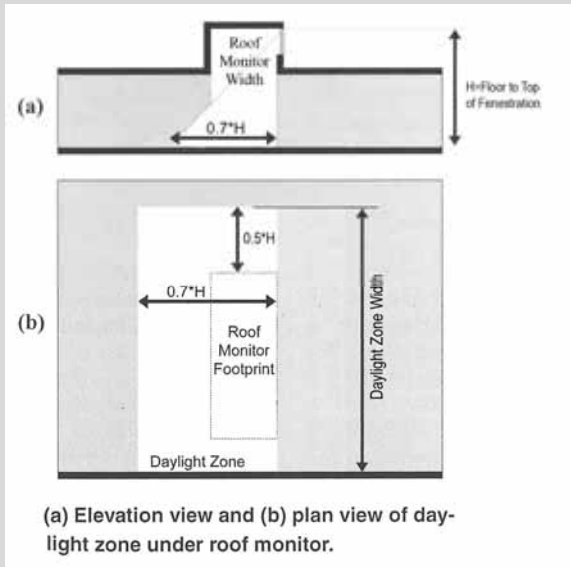
DAYLIT AREA. That portion of a *building's* interior floor area that is regularly illuminated by natural light, as determined in accordance with Sections 808.3.1 and 808.3.2.

DAYLIGHT ZONE, SIDELIGHTING. The floor area illuminated by vertical *fenestration*. Where *fenestration* is located on a roof, this area extends back from the *fenestration* to the nearest 56 inch high partition, or up to 0.7 times the height from the floor to the top of the *fenestration* and laterally from the edge of the *fenestration* to the nearest 56 inch high partition, or up to 0.5 times the height from the floor to the top of the *fenestration*, as indicated in Figures 202.2, 202.3, and 202.4 whichever is less. Otherwise, this area extends back from the *fenestration* to the nearest 56 inch high partition, or up to 1.75 times the height from the floor to the top of north facing *fenestration*, up to 1.5 times the height from the floor to the top of south facing *fenestration*, and up to 1.0 times the height from the floor to the top of all other *fenestration*, and laterally to the nearest 56 inch high partition, or up to 0.5 times the height from the floor to the top of the *fenestration*, as indicated in Figure 202.1 whichever is less.



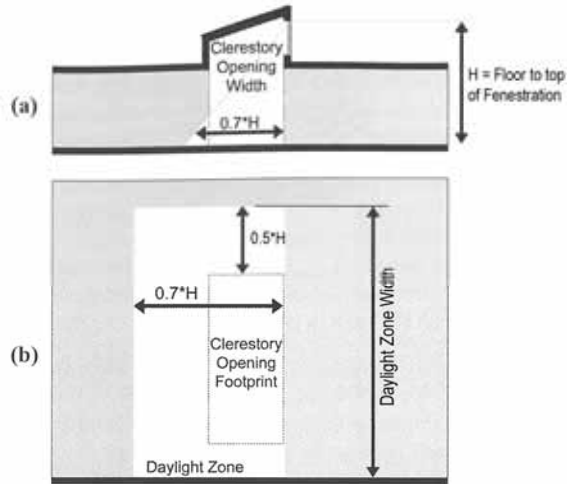
Plan view of daylight zone adjacent to vertical fenestration.
 H = Floor to top of fenestration

Figure 202.1
Daylight Zone Adjacent to Vertical Fenestration in a Wall



(a) Elevation view and (b) plan view of daylight zone under roof monitor.

Figure 202.2
Daylight Zone Adjacent to Vertical Fenestration Above a Roof (Clerestory)



(a) Elevation view and (b) plan view of daylight zone under clerestory roof monitor.

Figure 202.3
Daylight Zone Adjacent to Vertical Fenestration Above a Roof (Sawtooth)

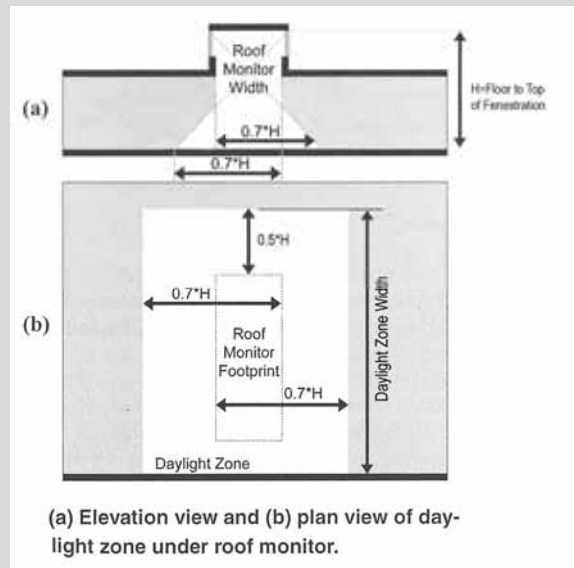


Figure 202.4
Daylight Zone Adjacent to Vertical Fenestration Above a Roof (Monitor)

DAYLIGHT ZONE, TOPLIGHTING. The floor area beneath a *skylight*. This area extends laterally and longitudinally beyond the rough opening of the *skylight* to the nearest 56 inch high partition, or up to 0.7 times the height from the floor to the ceiling, as indicated in Figure 202.5 whichever is less.

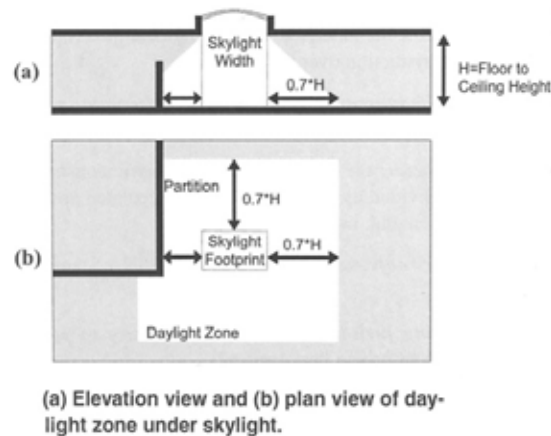


Figure 202.5
Daylight Zone Under a Skylight

DECIBELS (dB). Term used to identify ten times the common logarithm of the ratio of two like quantities proportional to the power of energy.

DECONSTRUCTION. The process of taking a *building* or *structure*, or portion thereof, apart, piece-by-piece, with the intent of recycling or salvaging as many of the materials, products and components as possible.

DEMAND LIMIT. The shedding of loads when pre-determined peak demand limits are about to be exceeded.

DEMAND RESPONSE, AUTOMATED (AUTO-DR). Fully Automated Demand Response initiated by a signal from a utility or other appropriate entity, providing fully-automated connectivity to customer energy end-use control strategies.

DEMAND RESPONSE AUTOMATION INTERNET SOFTWARE. Software that resides in a *Building Energy Management Control System* that can receive a demand response signal and automatically reduce HVAC and lighting system loads. Demand Response programs developed by the electric utility and the *independent system operator* typically depend upon timely and reliable communications of events and information to the *buildings* that are participating in the programs.

DETENTION. The short-term storage of stormwater on a site in order to regulate the runoff from a given rainfall event and to control discharge rates to reduce the impact on downstream stormwater systems.

DISTRIBUTION PIPE. Pressurized or non-pressure piping used within the plumbing system of a building to deliver rainwater or graywater from the storage tank or pump to the point of use.

DIVERSE USE CATEGORIES: Categories of occupancies and land uses which are designated as either retail, service or community facilities:

Retail Uses: The retail use category includes: Convenience store, florist, hardware store, pharmacy, grocery or supermarket and similar retail uses.

Service Uses: The service use category includes: Bank, coffee shop or restaurant; hair care; health club or fitness center; laundry or dry cleaner, medical or dental office and similar service uses.

Community Facilities: The community facilities category includes: Child care; civic or community center; a *building* containing a place of worship; police or fire station; post office, public library, public park, school, senior care facility, homeless shelter, and similar social services facilities.

[B] DWELLING UNIT. A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

DRAIN TILE LOOP. A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a *basement* or crawl space footing.



ENERGY MANAGEMENT AND CONTROL SYSTEM, BUILDING (EMCS). A computerized, intelligent network of electronic devices, designed to automatically monitor and control the energy using systems in a *building*.

ENERGY STAR. A joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) designed to identify and promote energy-efficient products and practices.

[M] EQUIPMENT. All piping, ducts, vents, control devices and other components of systems other than appliances which are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.



[B] EXISTING STRUCTURE. A *structure* erected prior to the date of adoption of the appropriate code, or one for which a legal *building permit* has been issued.



EXTERIOR WALL, OBSTRUCTED. That portion of an exterior wall that does not face a public way or a yard or court complying with Section 1206 of the *International Building Code* or where the distance to any *buildings, structures*, or geological formations in front of the wall is less than two times the height of the *buildings, structures*, or geological formations. For the purposes of this determination, the maximum allowed heights of *buildings* or *structures* on adjacent property under existing zoning regulations is permitted to be considered. Determination is made on a floor by floor basis.

FACILITY OPERATIONS. A facility is operational during the time when the primary activity that facility is designed for is taking place. For Group A and Group M occupancies, this is the time during which the facility is open to the public.

FARM LAND:

Prime farmland. Land that has the best combination of physical and chemical characteristics for producing food, fiber, feed, forage, and oil seed crops and that is also available for these uses, including cropland, pastureland, forest land, range land and similar lands which are not water areas or urban or built-up land areas.

Unique farmland. Land other than prime farmland that is used for the production of specific high-value food or fiber crops. The land has the special combination of soil quality, location, growing season and moisture supply needed to economically produce sustained high-quality crops or high yields of a specific crop where the lands are treated and managed according to acceptable farming methods.

Farmlands of statewide significance. Land, in addition to prime and unique farmlands, that is of statewide importance for the production of food, feed, fiber, forage and oil seed crops. Criteria for delineating this land is determined by the appropriate state agency.

FEEDER CONDUCTORS. The conductors that connect the service equipment to the *branch circuit* overcurrent devices.

FIBER PROCUREMENT SYSTEM. A system that ensures that fiber procured for the manufacture of wood and woodbased products comes from responsible or certified sources in accordance with ASTM D7612.

[B] FIREPLACE. A hearth and fire chamber or similarly prepared place in which a fire can be made and that is built in conjunction with a chimney.

FLAKE. For strawbale applications, an intact slab of straw 3 to 5 inches (76-127mm) thickness, created by the baling machine, and removed from an untied bale.

[B] FLOOD OR FLOODING. A general and temporary condition of partial or complete inundation of normally dry land from:

1. The overflow of inland or tidal waters.
2. The unusual and rapid accumulation of runoff of surface waters from any source.

FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a floodplain subject to a 1-percent or greater chance of flooding in any given year;
2. The area designated as a *flood hazard area* on a community's flood hazard map, or otherwise legally designated.

FLOODPLAIN. An area of land at risk of being inundated with water during high flows. Floodplains are associated with both water courses such as rivers and streams and bodies of water such as oceans and lakes.

FREEBOARD. Height above the base flood elevation of the lowest floor surface of any occupied portion of a *building*.

GEOHERMAL ENERGY. Renewable energy generated from the interior of the Earth and used to produce energy for heating buildings or serving building commercial or industrial processes.

GLOBAL WARMING POTENTIAL (GWP). The cumulative radiative forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas. The GWP-weighted emissions of direct greenhouse gases in the U.S. Inventory are presented in terms of equivalent emissions of carbon dioxide (CO₂), using units of teragrams of carbon dioxide equivalents (TgCO₂ Eq.). conversion: Tg=10⁹ kg = 10⁶ metric tons = 1 million metric tons.

[P] GRAYWATER. Untreated wastewater that has not come into contact with wastewater from water closets, urinals, kitchen sinks, or dishwashers. Graywater includes but is not limited to wastewater from bathtubs, showers, lavatories, clothes washers, and laundry trays.

GREENFIELD. Land that has not been previously developed or has a history of only agricultural use.

GREENHOUSE GAS. A gas in the atmosphere that absorbs and emits radiation within the thermal infrared range.

HARDSCAPE. Areas of a *building* site covered by manmade materials.

HIGH OCCUPANCY VEHICLE. A vehicle which is occupied by two or more people, when arriving and departing the site where parked, for not less than 75 percent of the vehicle trips; or as otherwise defined by state or local regulation.

[B] HISTORIC BUILDINGS. *Buildings* that are *listed* in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law.



INDEPENDENT SYSTEM OPERATOR (ISO). The electric system's operator.

INFILL SITE. Infill sites are one of the following:

1. A vacant *lot*, or collection of adjoining *lots*, located in an established, developed area that is already served by existing *infrastructure*;
2. A previously developed *lot* or a collection of previously developed adjoining lots, that is being redeveloped or is designated for redevelopment.

INFRASTRUCTURE. Facilities within a *jurisdiction* that provide community services and networks for travel and communication including: transportation services such as, but not limited to roads, bikeways and pedestrian ways and *transit services*; utility systems such as, but not limited to, water, sanitary sewage, stormwater management, telecommunications, power distribution and waste management; and community services such as, but not limited to, public safety, parks, schools and libraries.

INFRASTRUCTURE, ADEQUATE. The capacity of *infrastructure* systems, as determined by the *jurisdiction*, to serve the demands imposed by a new development on *building sites* without negatively impacting services to

existing users of the infrastructure and without negatively impacting the overall functionality of the infrastructure. Adequacy can be determined based on existing *infrastructure* or on the *infrastructure* as augmented by a development project.

INFRARED EMITTANCE. The ratio of radiant heat emitted by a sample to that emitted by a black body radiator at the same temperature.

INLET FILTER. A screen, grid or other device installed on a gutter, downspout system or at another location upstream of the *storage tank*. The filter passes liquids and retains solids.

IMPERVIOUS SURFACE. Paved concrete or asphalt and other similar surfaces that readily accommodate the flow of water with relatively little absorption, as typically used at exterior horizontal areas including, but not limited to, parking lots, bikeways, walkways, plazas and fire lanes.

INVASIVE PLANT SPECIES: Species that are not native to the ecosystem under consideration and that cause or are likely to cause economic or environmental harm or harm to human, animal or plant health. Consideration for inclusion as on invasive species shall be permitted to include, but shall not be limited to, those species identified on:

1. City, county or regional lists (when listing occurs through a vetted, transparent process and has been accepted by city, county or regional stakeholders, respectively).
2. State Noxious Weeds laws,
3. Federal Noxious Weeds laws.

[B] JURISDICTION. The governmental unit that has adopted this code under due legislative authority.

[B] LABEL. An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an *approved agency* and that indicates that the representative sample of the product or material has been tested and evaluated by an *approved agency*.

[B] LABELED. Equipment, materials or products to which has been affixed a *label*, seal, symbol or other identifying *mark* of a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-*labeled* items and whose *labeling* indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

LAID FLAT. For strawbale applications, stacking bales so that the faces with the largest area are horizontal and the longest dimension of the bale is parallel with the wall plane.

LIFE CYCLE ASSESSMENT (LCA). A technique to evaluate the relevant energy and material consumed and environmental emissions associated with the entire life of a *building*, product, process, material, component, assembly, activity or service.

LIGHTING BOUNDARY. Where the *lot line* abuts a public walkway, bikeway, plaza, or parking lot, the lighting boundary shall be a line 5 feet from the *lot line* and located on the public property. Where the *lot line* abuts a public roadway or public transit corridor, the lighting boundary shall be the centerline of the public roadway or public transit corridor. In all other circumstances, the lighting boundary shall be at the *lot line*.

[B] LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the *code official* and concerned with evaluation of products or services that maintains periodic inspection of

production of *listed* equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

LOADBEARING. For strawbale applications, a structural strawbale wall or other element that bears the gravity loads and dead and live loads of the roof or floor above.

[B] LOT. A portion or parcel of land considered as a unit.

[B] LOT LINE. A line dividing one *lot* from another, or from a street or any public place.

LOW EMISSION, HYBRID AND ELECTRIC VEHICLE. Vehicles that achieve EPA Tier 2, California LEV-II, or a minimum of EPA LEV standards, whether by means of hybrid, alternative fuel, or electric power.

LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMER. A NEMA ‘Class 1’ transformer that is air-cooled, does not use oil as a coolant, has an input voltage ≤ 600 Volts, and is rated for operation at a frequency of 60 Hertz.

[E] MANUAL. Capable of being operated by personal intervention (see “Automatic”).

MERV. Minimum efficiency reporting value.

MESH. For strawbale applications, an openwork fabric of linked strands of metal, plastic, or natural fiber, embedded in plaster to provide tensile reinforcement or bonding.

METER. A water volume measuring device used to collect data and indicate water usage abnormalities. Such devices are provided by the water purveyor or the *building* owner.

MOISTURE BARRIER. For strawbale applications, a continuous barrier capable of stopping the passage of water.

MUNICIPAL RECLAIMED WATER. Wastewater that has been reclaimed, recycled, reused or treated by a municipality for specific *non-potable* uses.

NATIVE PLANT SPECIES. A species that naturally occurs in a specific area, defined by using the best scientific knowledge of that region. Consideration for inclusion as a native species shall be permitted to include, but is not limited to, those species identified in any of the following:

1. City, county and regional lists.
2. State laws.
3. Federal laws.

NOISE. Any sound which is unnecessary, excessive, unnatural, annoying, prolonged, or unusually loud in relation to its time, place and use effect.

NON-LOADBEARING. For strawbale applications, see non-structural.

NON-POTABLE WATER. Water not safe for drinking, personal or culinary utilization.

NON-STRUCTURAL. For strawbale applications, a strawbale wall or other element that supports only its own weight. Such walls shall also be permitted to resist out-of-plane lateral loads.

OCCUPANT LOAD. The occupant load as calculated in accordance with the requirements of Chapter 10 of the *International Building Code*.

ON-EDGE. For strawbale applications, stacking bales so that the faces with the largest area are vertical and the longest dimension of the bale is parallel with the wall plane.

ORGANIC MATTER. Carbon-containing material composed of both living organisms and formerly living, decomposing plant and animal matter. Soil organic matter content is either naturally occurring or is a result of supplementation with compost or other partially decomposed plant and animal material.

OUTLET FILTER. Devices that are located downstream of a *storage tank* and utilize screens, cartridges or other media to provide a level of filtration appropriate for the intended use of the water.

PEAK NET ENERGY DEMAND (PNED). The peak energy demand of the building for all purposes minus the amount of renewable energy and waste energy available and used during the period where the peak energy demand occurs.

[B] PERMIT. An official document or certificate issued by the *jurisdiction* which authorizes performance of a specified activity.

PINS. For strawbale applications, metal rod, wood dowel, or bamboo, driven into, or secured on the surface of stacked bales for purposes of connection or stability.

PLASTER. For strawbale applications, gypsum, lime, lime-cement, or cement plasters, as defined by the *International Building Code* and Section 507.6 of this code, or clay plaster and soil-cement plaster as defined in Sections 507.5.7 and 507.5.8.

POST-CONSUMER RECYCLED CONTENT. The proportion of recycled material in a product generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product that can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

POTABLE WATER. Water free from impurities present in amounts sufficient to cause disease or harmful physiological effects and conforming to the bacteriological and chemical quality requirements of the Public Health Service Drinking Water Standards or the regulations of the public health authority having jurisdiction.

POWER CONVERSION SYSTEM. The equipment used to convert incoming electrical power, to the force causing vertical motion of the elevator. In a traction system, this would include the electrical drive, motor, and transmission.

PRE-COMPRESSION. For strawbale applications, permanently compressing stacked bales before application of finish.

PRE-CONSUMER (POST-INDUSTRIAL) RECYCLED CONTENT. The proportion of recycled material in a product diverted from the waste stream during the manufacturing process. Pre-consumer recycled content does not include reutilization of material such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

PRIMARY ENERGY USE. The total fuel-cycle energy embedded within building materials and all forms of energy required for building operation. Units of energy are reported in total Btu's for building materials and total Btu's per unit of energy (e.g., kWh, therms, gallons, etc.) consumed in the operation of building mechanical systems (HVAC, lighting, etc.) Total fuel-cycle energy includes energy required from the point of initial extraction, through processing and delivery to the final point of consumption into building materials or building operation.

PROCESS LOADS. *Building* energy loads that are not related to *building* space conditioning, lighting, service water heating or *ventilation* for human comfort.

PROJECT ELECTIVE. The provisions contained in Sections 407, 508, 613, 710 and 809 for which compliance is not mandatory unless selected under Section 303.1 for a specific *building* project. The minimum total number of *project electives* that must be selected and complied with is indicated in Table 302.1.

PROJECTION FACTOR. A ratio that describes the geometry of a horizontal projection, as determined in accordance with Equation 5-1 of the *International Energy Conservation Code*.

PROPOSED DESIGN. A description of the proposed *building* used to estimate annual energy use for determining compliance based on total *building* performance including improvements in design such as the use of passive solar energy design concepts and technologies, improved *building thermal envelope* strategies, increased equipment and systems efficiency, increased use of daylighting, improved *control* strategies and improved lighting sources that will result in a decrease in annual energy.

[E] R-VALUE (THERMAL RESISTANCE). The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($h \times ft^2 \times ^\circ F/Btu$) [$m^2 \times K/W$].

RADON GAS. A naturally-occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock and can accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings.

RAINWATER. Water from natural precipitation that was not contaminated by use.

RAINWATER COLLECTION AND CONVEYANCE SYSTEM. *Rainwater* collection system components extending between the collection surface and the *storage tank* that convey collected *rainwater*, usually through a gravity system.

REBOUND AVOIDANCE, SLOW RECOVERY. Slow recovery strategies slowly recover the target parameter that was controlled in the demand response strategy. Where this strategy is applied, the zone setpoints are gradually restored to the normal setpoints. Where air moving systems are targeted, a limit strategy is applied to the adjustable speed drive(s); fan adjustable speed drive limits are gradually shifted up.

REBOUND AVOIDANCE, SEQUENTIAL EQUIPMENT RECOVERY. Sequential equipment recovery that disperses short duration equipment start up spikes gradually, thereby avoiding a larger whole *building* demand spike.

REBOUND AVOIDANCE, EXTENDED AUTO-DR CONTROL. The *rebound avoidance, extended Auto-DR control* strategy is essentially an extension of the *rebound avoidance, slow recovery* strategy. Although a slow recovery strategy is critical to maximize the benefit of an *Auto-DR* strategy, the *building energy management and control system (EMCS)* programming for just such a strategy can be very complex or might not be possible for many conventional *EMCS*'s. A *rebound avoidance, extended Auto-DR control* strategy also includes logic and controls for avoiding a rebound peak when the control signal is stopped.

RECEIVING WATERS. Groundwater, creeks, streams, rivers, lakes or other water bodies that receive treated or untreated wastewater or stormwater, including water from combined sewer systems and stormwater drains.

RECLAIMED WATER. *Non-potable* water that has been derived from the treatment of wastewater by a facility or system licensed or permitted to produce water meeting the *jurisdiction's* water requirements for its intended uses. Also known as "Recycled Water."

RECYCLABILITY. Ability of a material or product to be captured and separated from a waste stream for conversion, reprocessing or reuse.

REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or *jurisdiction* in which the project is to be constructed.

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: A *registered design professional* engaged by the owner to review and coordinate certain aspects of the project, as determined by the *building official*, for compatibility with the design of the building or structure, including submittal documents prepared by others, deferred submittal documents and phased submittal documents.

REGULARLY OCCUPIED SPACE. A room or enclosed space which is regularly occupied for at least 500 daytime hours per year. Restrooms, locker rooms, showers, changing rooms, closets, elevators, mechanical and electrical equipment rooms are not considered to be regularly occupied.

RENEWABLE ENERGY SOURCE, ON-SITE. Energy derived from solar radiation, wind, waves, tides, landfill gas, biomass, or the *geothermal energy*. The energy system providing on-site renewable energy is located on or adjacent to the *building site*, and generate energy for use on the *building site*.

RENEWABLE ENERGY CREDIT (REC). A REC represents the property rights to the environmental, social, and other non-power qualities of renewable electricity generation. A REC, and its associated attributes and benefits, is sold separately from the underlying physical electricity associated with an on-site renewable energy source. REC's allow organizations to support renewable energy development and protect the environment where renewable power products are not locally available. There are two approaches to verifying REC ownership and the right to make environmental claims: (1) REC contracts from a list of approved providers, including an audit of the chain of custody; and (2) REC tracking systems.

[B] REPAIR. The reconstruction or renewal of any part of an existing *building* or building site for the purpose of its maintenance.



RETENTION (STORMWATER). The permanent holding of stormwater on a site, preventing the water from leaving the site as surface drainage and allowing for use of the water on site, or loss of the water through percolation, evaporation or absorption by vegetation.

ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.



ROOF, OBSTRUCTED. That portion of the roof that is shaded by any *building*, *structure*, or geological formation at the peak solar altitude on the spring equinox, and three hours before and after the peak solar altitude on the spring equinox. For the purposes of this determination, the maximum allowed heights of *buildings* or *structures* on adjacent property under existing zoning regulations are permitted to be considered.

ROOF WASHER. A device or method for removal of sediment and debris from collection surface by diverting initial rainfall from entry into the *storage tank*. Also referred to as a First Flush Device.

RUNNING BOND. For strawbale applications, the placement of straw bales such that the head joints in successive courses are offset at least one quarter of the bale length.

SEMI-HEATED SPACE. An enclosed space within a building that is heated by a heating system having an output capacity greater than or equal to 3.4 Btu/h·ft² (1W/ft²; 10.8 W/m²) of floor area but less than 15 Btu/h·ft² (4.4 W/ft²; 161.5 W/m²) of floor area.

SEQUENCE OF OPERATIONS (HVAC). A fully descriptive, detailed account of the operation of HVAC systems, the operation of systems in narrative terms accounting for all of the equipment that makes up the systems, how they are designed to operate, and how they are to be controlled.

SKIN. For strawbale applications, the compilation of plaster and reinforcing, if any, applied to the surface of stacked bales.

[B] SKYLIGHTS AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. Glazing material in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls, are included in this definition.

[B] SLEEPING UNIT. A room or space in which people sleep, that can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a *dwelling unit* are not sleeping units.

SOIL-GAS-RETARDER. A continuous membrane of 6-mil (0.15 mm) polyethylene or other equivalent material used to retard the flow of soil gases into a building.

SOLAR INSOLATION. A measure of solar radiation energy received on a given surface area in a given time, expressed as average irradiance in kilowatt-hours per square meter per day (kW·h/(m²·day)).

SOLAR PHOTOVOLTAIC EQUIPMENT. Devices such as solar cells and inverters that are used to transform solar radiation into energy.

SOLAR REFLECTANCE. A measure of the ability of a surface material to reflect sunlight. It is the fraction of solar flux, including the visible, infrared and ultraviolet wavelengths, reflected by a surface, expressed as a percentage on a scale of 0 to 1. Solar reflectance is also referred to as "albedo."

SOLAR REFLECTANCE INDEX (SRI). A value that incorporates both *solar reflectance* and *infrared emittance* in a single measure to represent a material's temperature in the sun. SRI quantifies how hot a surface would get relative to standard black and standard white surfaces. SRI is calculated using equations based on previously measured values of *solar reflectance* and *infrared emittance* as laid out in ASTM E1980. SRI is expressed as a fraction, 0.0 to 1.0, or percentage, 0 percent to 100 percent.

SOLAR THERMAL EQUIPMENT. A device that uses solar radiation to heat water or air for use within the facility for service water heating, space heating or space cooling.

STACK BOND. The placement of straw bales such that head joints in successive courses are vertically aligned.

STANDARD REFERENCE DESIGN. A building design that meets the minimum requirements of the *International Energy Conservation Code* and the additional requirements of Section 603.3.

STANDBY MODE (ELEVATOR). An operating mode during periods of inactivity in which electrical loads are reduced to conserve energy. For elevators, standby mode begins up to 5 minutes after an elevator is unoccupied and has parked and completed its last run and ends when the doors are re-opened. For escalators and moving walkways, standby mode begins after traffic has been absent for up to 5 minutes and ends when the next passenger arrives.

STRAW. The dry stems of cereal grains that have had the seed heads removed.

STRAW BALE. A rectangular compressed block of straw, bound by polypropylene strings or baling wire.

STRAWBALE. The adjective form of straw bale.

STRAW-CLAY. A mix of loose straw and clay binder.

STORAGE TANK (GRAYWATER OR RAINWATER). A fixed container for holding water at atmospheric pressure for subsequent reuse as part of a plumbing or irrigation system.

[B] STORY. That portion of a *building* included between the upper surface of a floor and the upper surface of the floor or roof next above. It is measured as the vertical distance from top to top of two successive tiers of beams or finished floor surfaces and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

STRUCTURAL. For strawbale applications, a strawbale wall or other element that supports gravity loads and dead and live loads. Such walls shall also be permitted to resist in-plane lateral loads.

[B] STRUCTURE. That which is built or constructed.

SUBSLAB DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a vent pipe routed through the *conditioned space* of a building and connecting the sub-slab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.

SUBSLAB DEPRESSURIZATION SYSTEM (Active). A system designed to achieve lower sub-slab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.

SUBMEMBRANE DEPRESSURIZATION SYSTEM. A system designed to achieve lower-sub-membrane air pressure relative to crawl space air pressure by use of a vent drawing air from beneath the soil-gas-retarder membrane.

TERTIARY STANDARDS. Standards, practices or policies that ensure that waste water has been treated to achieve a level of quality that is safe for release into the environment, such as, but not limited to, release into seas, rivers, lakes and the ground.

THREE-STRING BALE. A straw bale bound by three strings or wires parallel to its long dimension, approximately 15 inches by 23 inches by 42 to 48 inches in length (380mm by 584mm by 1066 to 1219mm).

TOPSOIL. The upper, outmost layer of soil having the highest concentration of *organic matter* and microorganisms and where the majority of biological soil activity occurs.

TRACTION ELEVATOR. An elevator system in which the cars are suspended by ropes wrapped around a sheave that is driven by an electric motor.

TRANSIT SERVICE. A service that a public transit agency serving the area has committed to provide including, but not limited to, bus, streetcar, light or heavy rail, passenger ferry or tram service.

TRUTH WINDOW. An area of a strawbale wall left without its finish to allow view of the straw that would otherwise be concealed by its finish.

TURFGRASS. Grasses that are regularly mowed and, as a consequence, form a dense growth of leaf blades, shoots and roots.

TWO-STRING BALE. A straw bale bound by two strings or wires parallel to its long dimension, and having a size approximately 16 or 14 inches by 18 inches by 36 to 45 inches long (406 or 356mm by 457mm by 914 to 1143mm).

[E] U-FACTOR (THERMAL TRANSMITTANCE). The coefficient of heat transmission (air to air) through a *building* component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/h · ft² · °F) [W/(m² · K)].

[B] VAPOR-PERMEABLE MEMBRANE. A material or covering having a permeance rating of 5 perms or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E96. A vapor-permeable material permits the passage of moisture vapor.

[B] VAPOR RETARDER. A vapor-resistant material, membrane or covering such as foil, plastic sheeting or insulation facing having a permeance rating of 1 perm or less, when tested in accordance with the desiccant method using Procedure A of ASTM E96. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly.

VEGETATIVE ROOF. An assembly of interacting components designed to waterproof and normally insulate a building's top surface that includes, by design, vegetation and related landscaping elements.

Extensive vegetative roof. A low profile roof with a growing medium less than 8 inches in depth, composed of plants that can thrive in a rooftop environment with limited water, shallow roots and sparse nutrients.

Intensive vegetative roof. A high profile roof with a growing medium 8 inches or more in depth that can support a wide range of vegetables, shrubs and small trees.

[B] VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

[E] VISIBLE TRANSMITTANCE (VT). The ratio of visible light entering the space through the fenestration product assembly to the incident visible light. VT includes the effects of glazing material and frame and is expressed as a number between 0 and 1.

VOLATILE ORGANIC COMPOUND (VOC). A chemical compound based on carbon chains or rings that typically contain hydrogen and sometimes contain oxygen, nitrogen and other elements, and that has a boiling point in the range from (50 °C to 100 °C) to (240 °C to 260 °C).

VOCs, TOTAL (TVOCs). Sum of the concentrations of all identified and unidentified *volatile organic compounds* between and including n-hexane through n-hexadecane (i.e. C₆ - C₁₆) as measured by gas chromatography/mass spectrometry total ion-current chromatogram method and are quantified by converting the total area of the chromatogram in that analytical window to toluene equivalents.

VOLTAGE DROP. A decrease in voltage caused by losses in the circuit conductors connecting the power source to the load.

WASTE ENERGY RECOVERY. The application and use of systems and equipment to capture and reuse any form of energy that would otherwise be discarded and not otherwise be used by the *building* and its systems.

WATERSENSE. A program of the U.S. Environmental Protection Agency (EPA) designed to identify and promote water-efficient products and practices.

WETLAND. Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

WIND POWER CLASS. As a renewable energy source, wind is classified according to wind power classes, based on typical wind speeds. These classes range from Class 1 (the lowest) to Class 7 (the highest). At the 50 meter (164 ft.) height, wind power Classes 4 and higher are considered good for development.

ZERO ENERGY PERFORMANCE INDEX (zEPI). A scalar representing the ratio of energy performance of the proposed design compared to the average energy performance of buildings in the benchmark year of 2000, with similar occupancy, operation schedule and climate. The ratio is multiplied times 100 such that 100 represents a building that uses the same amount of energy as the 2000 average and zero represents a zero net energy building.

CHAPTER 3

JURISDICTIONAL REQUIREMENTS AND PROJECT ELECTIVES

SECTION 301 GENERAL

301.1 Scope. This chapter contains: requirements that are specific to and selected by the *jurisdiction*; elective requirements that are specific to the project and selected by the owner; and provisions for whole-building life-cycle assessment.

301.2 Jurisdictional Requirements and Project Electives. This chapter requires that the *jurisdiction* indicate in Table 302.1 whether specific provisions are mandatory for all *buildings* regulated by this code and, where applicable, the level of compliance required. This chapter also contains *project electives*, as listed in Table 303.1, that become mandatory only as selected and indicated by the owner for the specific project. All other provisions of this code shall be mandatory as applicable.

SECTION 302 JURISDICTIONAL REQUIREMENTS

302.1 Requirements determined by the jurisdiction. The *jurisdiction* shall indicate the following information in Table 302.1 for inclusion in its code adopting ordinance:



1. The *jurisdiction* shall indicate whether ASHRAE 189.1 is applicable by selecting “Yes” or “No” in the optional compliance path in Table 302.1. Where “Yes” is selected, the administrative provisions of Chapter 1 of this code and the provisions of ASHRAE 189.1 listed in Chapter 12 shall apply and the remainder of this code shall not apply.
2. The *jurisdiction* shall indicate the minimum number of *project electives* that must be incorporated into all projects, as modified by Section 303.2.
3. Where the jurisdiction requires enhanced energy performance for buildings designed on a performance basis, and for buildings greater than 25,000 square feet in *total building floor area*, the *jurisdiction* shall indicate a *zEPI* of 46 or less in Table 602.1 for each occupancy required to have enhanced energy performance.
4. Where “Yes” or “No” boxes are provided, the *jurisdiction* shall check the box to indicate “Yes” where that section or appendix is to be enforced as a mandatory requirement in the *jurisdiction*, or “No” where that section or appendix is *not* to be enforced as a mandatory requirement in the *jurisdiction*.



4.1 Where “Yes” is selected for Appendix B, the *jurisdiction* shall select a compliance level phase in accordance with Section B103.1 by checking a box in Table 302.1 corresponding to Phase 1, 2, 3 or 4. The selection of higher phases requires that all lower phases be selected.

4.1.1 Where Phase 1 is selected, the *jurisdiction* shall indicate the number of months to be used in association with Section B103.2.

4.1.2 Where Phase 2 is selected, the *jurisdiction* shall indicate the number of years and the percentage to be used in association with Section B103.3.

4.1.3 Where Phase 3 is selected, the *jurisdiction* shall indicate the number of years to be used in association with Section B103.4.

4.1.4 Where Phase 4 is selected, the *jurisdiction* shall indicate the number of years and the percentage to be used in association with Section B103.5.

4.2 Where “Yes” is selected for other jurisdictional requirements in Table 302.1, the provisions of the indicated section shall apply.

302.1.1 zEPI of 46 or less. Where a *zEPI of 46* or less is indicated by the *jurisdiction* in Table 602.1, *buildings* shall comply on a performance-basis in accordance with Section 602.2.2.

Exception: Buildings less than 25,000 square feet in *total building floor area* pursuing compliance on a prescriptive basis shall be deemed to have a *zEPI* of 51 in accordance with Section 602.2.1 and shall *not* be required to comply with the *zEPI* of Jurisdictional Choice indicated by the *jurisdiction* in Table 602.1.

**TABLE 302.1
REQUIREMENTS DETERMINED BY THE JURISDICTION**

Section	Section Title or Description and Directives	Jurisdictional Requirements	
→			
CH 3. JURISDICTIONAL REQUIREMENTS AND PROJECT ELECTIVES			
302.1 (2)	Optional compliance path – ASHRAE 189.1	<input type="checkbox"/> Yes	<input type="checkbox"/> No
302.1 (3)	Project Electives – The jurisdiction shall indicate a number between 1 and 14 to establish the minimum total number of project electives that must be satisfied.	_____	
CH 4. SITE DEVELOPMENT AND LAND USE			
→			
402.2.3	Conservation area	<input type="checkbox"/> Yes	<input type="checkbox"/> No
402.2.5	Agricultural land	<input type="checkbox"/> Yes	<input type="checkbox"/> No
402.2.6	Greenfields	<input type="checkbox"/> Yes	<input type="checkbox"/> No
402.3.2	Stormwater management	<input type="checkbox"/> Yes	<input type="checkbox"/> No
403.4.1	High occupancy vehicle parking	<input type="checkbox"/> Yes	<input type="checkbox"/> No
403.4.2	Low emission, hybrid and electric vehicle parking	<input type="checkbox"/> Yes	<input type="checkbox"/> No
405.1	Light pollution control	<input type="checkbox"/> Yes	<input type="checkbox"/> No
CH 5. MATERIAL RESOURCE CONSERVATION AND EFFICIENCY			
→			
502.1	Minimum percentage of waste material diverted from landfills.	<input type="checkbox"/> 50% <input type="checkbox"/> 65% <input type="checkbox"/> 75%	
CH 6. ENERGY CONSERVATION AND EARTH ATMOSPHERIC QUALITY			
→			
Table 602.1, 302.1, 302.1.1	<i>zEPI</i> of Jurisdictional Choice – The jurisdiction shall indicate a <i>zEPI</i> of 46 or less in Table 602.1 for each occupancy for which it intends to require enhanced energy performance.	See Table 602.1 and Section 302.1	
602.3.2.3	Total annual CO ₂ e emissions limits and reporting	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Section	Section Title or Description and Directives	Jurisdictional Requirements	
613.2	Post Certificate of Occupancy zEPI, energy demand, and CO2e emissions reporting	<input type="checkbox"/> Yes	<input type="checkbox"/> No
CH 7. WATER RESOURCE CONSERVATION AND EFFICIENCY			
→			
702.1.2	Enhanced plumbing fixture and fitting flow rate tier.	<input type="checkbox"/> Tier 1 <input type="checkbox"/> Tier 2	
702.7	Municipal reclaimed water.	<input type="checkbox"/> Yes	<input type="checkbox"/> No
CH 9. COMMISSIONING, OPERATION AND MAINTENANCE			
904.1.1.1	Periodic reporting	<input type="checkbox"/> Yes	<input type="checkbox"/> No
CH 10. EXISTING BUILDINGS			
→			
1006.4	Evaluation of existing buildings	<input type="checkbox"/> Yes	<input type="checkbox"/> No
APPENDICES			
Appendix B	Greenhouse gas reduction in existing buildings	<input type="checkbox"/> Yes	<input type="checkbox"/> No
B103.1	Compliance level – The jurisdiction to select phases only where “Yes” is selected in the previous row.	<input type="checkbox"/> Phase 1 <input type="checkbox"/> Phase 2 <input type="checkbox"/> Phase 3 <input type="checkbox"/> Phase 4	
B103.2	Where “Phase 1” is selected under Section B103.1 – jurisdiction to indicate the number of months to be used in association with Section B103.2.	_____ months	
B103.3	Where “Phase 2” is selected under Section B103.1 – jurisdiction to indicate the number of years and the percentage to be used in association with Section B103.3.	_____ years _____ %	
B103.4	Where “Phase 3” is selected under Section B103.1 – jurisdiction to indicate the number of years to be used in association with Section B103.4.	_____ years	
B103.5	Where “Phase 4” is selected above – jurisdiction to indicate the number of years and the percentage to be used in association with Section B103.5.	_____ years _____ %	
Appendix C	Sustainability measures	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Appendix D	Enforcement procedures	<input type="checkbox"/> Yes	<input type="checkbox"/> No

SECTION 303 PROJECT ELECTIVES

303.1 Electives required. A total of not less than the number of *project electives* as indicated by the jurisdiction in Section 302.1(2) of Table 302.1 shall be selected by the owner. Such *project electives* shall be applied as mandatory requirements to the project and shall be indicated to the *code official* by means of completion of Table 303.1. Electives identified by the jurisdiction as being “not available” are not available for selection.

303.2 Additional elective. Where required in accordance with Section 705.1, the total number of *project electives* indicated in Table 302.1 shall be increased by one.

303.3 Applicability to existing buildings. *Project electives* shall be applicable to existing *buildings* only where such *buildings* are evaluated in accordance with Section 1007.4.

303.4 Project electives checklist. The submitted *construction documents* shall include a completed copy of Table 303.1 indicating which *project electives* that the owner has selected as a means to comply with Section 303.1. The total number of *project electives* selected shall be in accordance with the minimum number of *project electives* indicated by the *jurisdiction* in Table 302.1. The *Project electives* selected shall be applied and enforced as mandatory requirements.

**TABLE 303.1
PROJECT ELECTIVES CHECKLIST**

Section	Description	Check the corresponding box to indicate each project elective selected.	Jurisdictional determination of non-availability
CH 3. JURISDICTIONAL REQUIREMENTS AND PROJECT ELECTIVES			
304.1	Whole Building Life Cycle Assessment (LCA)	<input type="checkbox"/> (5 Electives ^a)	<input type="checkbox"/>
CH 4. SITE DEVELOPMENT AND LAND USE			
407.2.1	Flood hazard avoidance	<input type="checkbox"/>	<input type="checkbox"/>
407.2.2	Agricultural land	<input type="checkbox"/>	<input type="checkbox"/>
407.2.3	Wildlife corridor	<input type="checkbox"/>	<input type="checkbox"/>
407.2.4	Infill site	<input type="checkbox"/>	<input type="checkbox"/>
407.2.5	Brownfield site	<input type="checkbox"/>	<input type="checkbox"/>
407.2.6	Existing building reuse	<input type="checkbox"/>	<input type="checkbox"/>
407.2.7	Greenfield development	<input type="checkbox"/>	<input type="checkbox"/>
407.2.8	Greenfield proximity to development	<input type="checkbox"/>	<input type="checkbox"/>
407.2.9	Greenfield proximity to diverse uses	<input type="checkbox"/>	<input type="checkbox"/>
407.2.10	Native plant landscaping	<input type="checkbox"/>	<input type="checkbox"/>
407.2.11	Site restoration	<input type="checkbox"/>	<input type="checkbox"/>
407.3.1	Changing and shower facilities	<input type="checkbox"/>	<input type="checkbox"/>
407.3.2	Long term bicycle parking and storage	<input type="checkbox"/>	<input type="checkbox"/>
407.3.3	Preferred parking	<input type="checkbox"/>	<input type="checkbox"/>
407.4.1	Site hardscape 1	<input type="checkbox"/>	<input type="checkbox"/>
407.4.2	Site hardscape 2	<input type="checkbox"/>	<input type="checkbox"/>
407.4.3	Site hardscape 3	<input type="checkbox"/>	<input type="checkbox"/>
407.4.4	Roof covering	<input type="checkbox"/>	<input type="checkbox"/>
407.5	Light pollution	<input type="checkbox"/>	<input type="checkbox"/>
CH 5. MATERIAL RESOURCE CONSERVATION AND EFFICIENCY			
508.2	Waste management (502.1 + 20%)	<input type="checkbox"/>	<input type="checkbox"/>
508.3(1)	Reused, recycled content, recyclable, bio-based and indigenous materials (70%)	<input type="checkbox"/>	<input type="checkbox"/>
508.3(2)	Reused, recycled content, recyclable, bio-based and indigenous materials (85%)	<input type="checkbox"/> (2 Electives ^a)	<input type="checkbox"/>
→			
508.4.1	Service life – 100 year design life category	<input type="checkbox"/>	<input type="checkbox"/>
508.4.1	Service life– 200 year design life category	<input type="checkbox"/> (2 Electives ^a)	<input type="checkbox"/>

Section	Description	Check the corresponding box to indicate each project elective selected.	Jurisdictional determination of non-availability
508.4.2	Interior adaptability	<input type="checkbox"/>	<input type="checkbox"/>
→			
CH 6. ENERGY CONSERVATION, EFFICIENCY AND EARTH ATMOSPHERIC QUALITY			
613.3	zEPI reduction project electives		
613.3	Project zEPI is at least 5 points lower than required by Table 302.1	<input type="checkbox"/>	<input type="checkbox"/>
613.3	Project zEPI is at least 10 points lower than required by Table 302.1	<input type="checkbox"/> (2 electives)	<input type="checkbox"/>
613.3	Project zEPI is at least 15 points lower than required by Table 302.1	<input type="checkbox"/> (3 electives)	<input type="checkbox"/>
613.3	Project zEPI is at least 20 points lower than required by Table 302.1	<input type="checkbox"/> (2 electives)	<input type="checkbox"/>
613.3	Project zEPI is at least 25 points lower than required by Table 302.1	<input type="checkbox"/> (4 electives)	<input type="checkbox"/>
613.3	Project zEPI is at least 30 points lower than required by Table 302.1	<input type="checkbox"/> (5 electives)	<input type="checkbox"/>
613.3	Project zEPI is at least 35 points lower than required by Table 302.1	<input type="checkbox"/> (6 electives)	<input type="checkbox"/>
613.3	Project zEPI is at least 40 points lower than required by Table 302.1	<input type="checkbox"/> (8 electives)	<input type="checkbox"/>
613.3	Project zEPI is at least 45 points lower than required by Table 302.1	<input type="checkbox"/> (9 electives)	<input type="checkbox"/>
613.3	Project zEPI is at least 51 points lower than required by Table 302.1	<input type="checkbox"/> (10 electives)	<input type="checkbox"/>
→			
613.4	Mechanical systems	<input type="checkbox"/>	<input type="checkbox"/>
613.5	Service Water Heating	<input type="checkbox"/>	<input type="checkbox"/>
613.6	Lighting Systems	<input type="checkbox"/>	<input type="checkbox"/>
613.7	Passive design	<input type="checkbox"/>	<input type="checkbox"/>
CH 7. WATER RESOURCE CONSERVATION AND EFFICIENCY			
710.2.1	Fixture flow rates are one tier above that required by Table 302.1	<input type="checkbox"/>	<input type="checkbox"/>
710.2.1	Fixture flow rates are two tiers above that required by Table 302.1.	<input type="checkbox"/> (2 Electives ^a)	<input type="checkbox"/>
710.3	On-site wastewater treatment	<input type="checkbox"/>	<input type="checkbox"/>
710.4	Non-potable outdoor water supply	<input type="checkbox"/>	<input type="checkbox"/>
710.5	Non-potable water for plumbing fixture flushing	<input type="checkbox"/>	<input type="checkbox"/>
710.6	Automatic fire sprinkler system	<input type="checkbox"/>	<input type="checkbox"/>
710.7	Non-potable water supply to fire pumps	<input type="checkbox"/>	<input type="checkbox"/>
710.8	Non-potable water for industrial process makeup water	<input type="checkbox"/>	<input type="checkbox"/>
710.9	Efficient hot water distribution system	<input type="checkbox"/>	<input type="checkbox"/>
710.10	Non-potable water for cooling tower makeup water	<input type="checkbox"/>	<input type="checkbox"/>
710.11	Graywater collection	<input type="checkbox"/>	<input type="checkbox"/>

Section	Description	Check the corresponding box to indicate each project elective selected.	Jurisdictional determination of non-availability
CH 8 INDOOR ENVIRONMENTAL QUALITY AND COMFORT			
809.2.1	VOC emissions - flooring	<input type="checkbox"/>	<input type="checkbox"/>
809.2.2	VOC emissions – ceiling systems	<input type="checkbox"/>	<input type="checkbox"/>
809.2.3	VOC emissions- wall systems	<input type="checkbox"/>	<input type="checkbox"/>
809.2.4	Total VOC limit	<input type="checkbox"/>	<input type="checkbox"/>
809.3	Views to building exterior	<input type="checkbox"/>	<input type="checkbox"/>
809.4	Interior plant density	<input type="checkbox"/>	<input type="checkbox"/>

a. Where multiple electives are shown in the table in the form “(x electives)”, “x” indicates the number of credits to be applied for that elective to the total number of *project electives* required by the jurisdiction as shown in Section 302.1(3) of Table 302.1.

SECTION 304 WHOLE BUILDING LIFE CYCLE ASSESSMENT

304.1 Whole building life cycle assessment project elective. A whole *building life cycle assessment* shall be a *project elective*. The requirements for the execution of a whole *building life cycle assessment* shall be performed in accordance with the following: The data and final report shall be included in the owner education manual required by Section 904.4.

1. The assessment shall demonstrate that the *building* project achieves not less than a 20 percent improvement in environmental performance for each of at least three of the following impact measures, one of which shall be *global warming potential*, as compared to a reference *building* of similar useable floor area, function and configuration that meets the minimum energy requirements of this code and the structural requirements of the *International Building Code*:
 - 1.1 *Primary energy use*
 - 1.2 *Global warming potential*
 - 1.3 Acidification potential
 - 1.4 Eutrophication potential
 - 1.5 Ozone depletion potential
 - 1.6 Smog potential
2. The reference and project *buildings* shall utilize the same *life cycle assessment* tool.
3. The *life cycle assessment* tool shall be approved by the code official.
4. *Building* operational energy shall be included.
5. *Building* process loads shall be permitted to be included.
6. The *reference service life* of the reference *building* shall be in accordance with Section 505.1.
7. Maintenance and replacement schedules and actions for components shall be included in the assessment.
8. The full life cycle, from resource extraction to demolition and disposal, including but not limited to, on-site construction, maintenance and replacement, and material and product embodied acquisition, process and transportation energy, shall be assessed.

Exception: Electrical and mechanical equipment and controls, plumbing products, fire detection and alarm systems, elevators and conveying systems shall not be included in the assessment.

9. The complete *building* envelope, structural elements, inclusive of footings and foundations, and interior walls, floors and ceilings, including interior and exterior finishes, shall be assessed to the extent that data is available for the materials being analyzed in the selected *life cycle assessment* tool.

10. Mechanical, electrical and plumbing components and specialty items shall not be included in this calculation.

11. The *life cycle assessment* shall conform with the requirements of ISO 14044.

CHAPTER 4

SITE DEVELOPMENT AND LAND USE

SECTION 401 GENERAL

401.1 Scope and intent. This chapter provides requirements for the development and maintenance of building and building sites to minimize negative environmental impacts and to protect, restore and enhance the natural features and environmental quality of the site.



SECTION 402 PRESERVATION OF NATURAL RESOURCES

402.1 General. In order to limit the use of, and impact on, natural resources, development of a building site shall comply with Sections 402.2 through 402.3.6.

402.2 Protection by Area. Where park lands, agricultural lands, floodplains, conservation areas, greenfields and surface water bodies or wetlands are located on, or adjacent to, a lot, the development of the lot as a building site shall comply with the provisions of Sections 402.2.1 through 402.2.6.

402.2.1 Floodplains. Building and building site improvements shall not be located within a floodplain.

402.2.2 Surface water protection. Building and building site improvements shall not be located: within a buffer around a wetland; or within a buffer around a water body, as defined as the ordinary high-water mark of seas, lakes, rivers, streams and tributaries which support or could support fish, recreation or industrial use.

Exception: Buildings and associated site improvements specifically related to the use of the water including, but not limited to, piers, docks, fish hatcheries, and habitat restoration facilities, shall be permitted where the impacts of the construction and location adjacent to or over the water on the habitat is mitigated.

402.2.3 Conservation area. Where this section is indicated to be applicable in Table 302.1, site disturbance or development of land within 50 feet (15 240 mm) of any designated conservation area shall not be permitted.

402.2.4 Park land. Site disturbance or development of land located within a public park shall not be permitted.

Exceptions:

1. *Buildings* and site improvements shall be permitted to be located within a park where the *building* and-site improvements serve a park related purpose.
2. Park lands owned and managed by the Federal government shall be exempt from this prohibition.
3. Privately held property located within the established boundary of a park shall be exempt from this prohibition.

402.2.5 Agricultural land. Where this section is indicated to be applicable in Table 302.1, *buildings* and associated site improvements shall not be located on land zoned for agricultural purposes.

Exception: *Buildings* and associated site improvements shall be permitted to be located on agriculturally zoned land where the *building* serves an agriculturally related purpose, including, but not limited to, primary residence, farmhouse, migrant workers housing, farm produce storage, processing and shipping.

402.2.6 Greenfield sites. Where this section is indicated to be applicable in Table 302.1, site disturbance or development shall not be permitted on *greenfield* sites.

Exception: The development of new *buildings* and associated site improvements shall be permitted on *greenfield* sites where the *jurisdiction* determines that *adequate infrastructure* exists, or can be provided, and where the sites comply with at least one of the following:

1. The *greenfield* site is located within 1/4 mile (0.4 km) of developed residential land with an average density of not less than 8 *dwelling units* per acre (3.24 dwelling units per hectare)
2. The *greenfield* site is located within 1/4 mile (0.4 km) distance, measured over roads or designated walking surfaces, of not less than 5 diverse uses and within 1/2 mile (0.8 km) walking distance of not less than 7 diverse uses. The diverse uses shall include at least one use from each of the following categories of diverse uses: retail, service, community facility.
3. The *greenfield* site has access to *transit service*. The *building* on the *building site* shall be located in compliance with one of the following:
 - 3.1. Within 1/4 mile (0.4 km) distance, measured over designated walking surfaces, of existing or planned bus or streetcar stops.
 - 3.2. Within 1/2 mile (0.8 km) distance, measured over designated walking surfaces, of existing or planned rapid transit stops, light or heavy passenger rail stations, ferry terminals, or tram terminals.
4. The *greenfield* site is located adjacent to areas of existing development that have connectivity of not less than 90 intersections per square mile (35 intersections per square kilometer). Not less than 25 percent of the perimeter of the *building site* shall adjoin, or be directly across a street, public bikeway or pedestrian pathway from the qualifying area of existing development.
 - 4.1. Intersections included for determination of connectivity shall include the following:
 - 4.1.1. Intersections of public streets with other public streets,
 - 4.1.2. Intersections of public streets with bikeways and pedestrian pathways that are not part of a public street for motor vehicles, and
 - 4.1.3. Intersections of bikeways and pedestrian pathways that are not part of a public street for motor vehicles with other bikeways and pedestrian pathways that are not part of a public street for motor vehicles.
 - 4.2. The following areas need not be included in the determination of connectivity:
 - 4.2.1. Water bodies, including, but not limited to lakes and *wetlands*.
 - 4.2.2. Parks larger than 1/2 acre (2023 m²), designated *conservation areas* and areas preserved from development by the *jurisdiction* or by the state or federal government.

4.2.3. Large facilities including, but not limited to airports, railroad yards, college and university campuses.

402.2.6.1 Site disturbance limits on greenfield sites. For greenfield sites that are permitted to be developed, site disturbances shall be limited to the following areas:

1. Within 40 feet (18 288 mm) of the perimeter of the building;
2. Within 15 feet (4572 mm) of proposed surface walkways, roads, paved areas and utilities;
3. Within 25 feet (7620 mm) of constructed areas with permeable surfaces that require additional staging areas to limit compaction in the constructed areas.

402.3 Site design and development. The design and development of *buildings* and associated site improvements shall comply with the site design, water management, vegetation management, soil management and waste management requirements of Sections 402.3.1 through 402.3.6.

402.3.1 Predesign site inventory and assessment. An inventory and assessment of the natural resources and baseline conditions of the *building site* shall be submitted. The inventory and assessment shall:

1. Determine the location of any protection areas identified in Section 402.2 that are located on, or adjacent to the *building site*;
2. Determine whether, and to the degree to which, the native soils and hydrological conditions of the *building site* have been disturbed and altered by previous use or development;
3. Identify invasive vegetation on the site for removal; and
4. Identify native plant species on the site.

402.3.1.1 Submittal documents. The findings of the pre-design site inventory and assessment shall be included in the submittal documents for *permit* application.

402.3.2 Stormwater management. Where this section is indicated to be applicable in Table 302.1, stormwater management systems, including, but not limited to, infiltration, evapo-transpiration; *rainwater* harvest and runoff reuse; shall be provided and maintained on the *building site*. Stormwater management systems shall address the increase in runoff that would occur resulting from development on the *building site* and shall either:

1. Manage rainfall on-site and size the management system to retain, at a minimum, the volume of a single storm which is equal to the *95th percentile rainfall event* and all smaller storms and maintain the predevelopment natural temperature of the runoff; or
2. Maintain or restore the pre-development stable, natural runoff hydrology of the site throughout the development or redevelopment process. Post construction runoff rate, volume, duration, and temperature shall not exceed predevelopment rates. The stormwater management system design shall be based, in part, on a hydrologic analysis of the *building site*.

The stormwater management system shall not redirect or concentrate off-site discharge that would cause increased erosion or other drainage related damage to adjoining *lots* or public property.

402.3.3 Landscape irrigation systems. Irrigation of exterior landscaping shall comply with Sections 402.3.3.1 and 402.3.3.2.

402.3.3.1 Water for outdoor landscape irrigation. Water used for outdoor landscape irrigation shall be non-potable and shall comply with Section 406.2.



Exceptions: *Potable* water is permitted to be used as follows:

1. During the establishment phase of newly planted landscaping. The establishment phase shall be not longer than the following:
 - 1.1. 3 years for trees
 - 1.2. 2 years for shrubs
 - 1.3. 1 year for herbaceous cover plants
2. To irrigate food production.
3. To supplement *non-potable* water irrigation of shade trees provided in accordance with Section 404.2.3.
4. *Potable* water is permitted for landscape irrigation where *approved* by local ordinance or regulation.



402.3.3.2 Irrigation system design and installation. Landscape irrigation systems shall be designed and installed to provide the minimum amount of irrigation required for maintenance of vegetation in the landscaping of the building site. The systems shall utilize one or more of the following: drip irrigation, subsurface, subsoil and surface irrigation. The irrigation system shall be divided into zones based on the water needs of the plant materials. Landscape irrigation systems shall not direct water onto building exterior surfaces, foundations or exterior paved surfaces.

402.3.4 Outdoor ornamental fountains and water features. Outdoor ornamental fountains and other water features constructed or installed on a *building site* shall be supplied with either municipally reclaimed or collected *rainwater* complying with Section 406.2. Signage in accordance with Section 706.2 shall be posted at each outdoor fountain and water feature where *non-potable* water is used.

402.3.5 Management of vegetation, soils and erosion control. During construction on a *building site*, vegetation and soils shall be protected, selected and reused as provided in Sections 402.3.5.1 through 402.3.5.8.

402.3.5.1 Landscape, soil and water quality protection plan. A soil and water quality protection plan shall be submitted by the owner and *approved* prior to construction. The protection plan shall be in accordance with Section 406.5.

402.3.5.2 Vegetation and soil protection. Where existing soils and vegetation are to be protected, a vegetation and soil protection plan establishing designated vegetation and soil protection areas (VSPA's) shall be submitted with the construction drawings and other submittal documents. The protection plan shall be in accordance with Section 406.3.

402.3.5.3 Topsoil protection. *Topsoil* that could potentially be damaged by construction activities or equipment shall be removed from areas to be disturbed and stockpiled on the *building site* for future reuse on the *building site* or other *approved* location. *Topsoil* stockpiles shall be secured and protected

throughout the project with temporary or permanent soil stabilization measures to prevent erosion or compaction.

402.3.5.4 Soil reuse and restoration. Soils that are being placed or replaced on a *building site* shall be prepared, amended and placed in a manner that establishes or restores the ability of the soil to support the vegetation that has been protected and that will be planted. Soil reuse and restoration shall be in accordance with Section 406.4.

402.3.5.5 Imported soils. *Topsoils* or soil blends imported to a *building site* to serve as *topsoil* shall not be mined from the following locations:

1. Sites that are *prime farmland, unique farmland, or farmland of statewide importance*.
2. Greenfield sites where development is prohibited by Section 402.2.6.

Exception: Soils shall be permitted to be imported from the locations in Items 1 and 2 where those soils are a byproduct of a *building* and *building site* development process provided that imported soils are reused for functions comparable to their original function.

402.3.5.6 Invasive species. Invasive species shall not be planted on a *building site*. A management plan for the containment, removal and replacement of any *invasive plants* currently on the site shall be generated based on either published recommendation for the referenced invasive plant or guidance prepared by a qualified professional. Existing vegetation that is to be retained on a *building site* shall be protected as required by Section 402.3.5.2.

402.3.5.7 Turfgrass. Not more than 40 percent of the area of the vegetated area of the building site shall be planted with turfgrass. Calculations of the percentage shall not include vegetative roof areas, areas not external to the building, and areas not on the ground plane of the building.

Exception: For schools and recreational facilities, the area dedicated to athletic fields is excluded from the calculation of the vegetated area.

402.3.5.8 Documentation. Documentation demonstrating compliance with Section 402.3.5 shall be provided as part of the submittal documents and during the construction and inspection process.

402.3.6 Building site waste management plan. A *building site* waste management plan shall be developed and implemented to recycle or salvage not less than 75 percent of the land-clearing debris and excavated soils. Land-clearing debris includes rock, trees, stumps and associated vegetation. The plan shall include provisions that address all of the following:

1. Materials to be diverted from disposal by efficient usage, recycling or reuse on the *building site* shall be specified. Documentation supplied by the recycling or reuse facility collecting materials shall be provided as proof of compliance with this code.
2. Diverted materials shall not be sent to sites that are agricultural land, flood hazard areas or greenfield sites where development is prohibited by Section 402.2.
3. The effective destruction and disposal of invasive plant species.
4. Where contaminated soils are removed, the methods of removal and location where the soils are to be treated and disposed.

5. The amount of materials to be diverted shall be specified and shall be calculated by weight or volume, but not both.

6. Where the site is located in a federal or state designated quarantine zone for invasive insect species, building site vegetation management shall comply with the quarantine rules.

Construction materials and waste and *hardscape* materials removed during site preparation shall be managed in accordance with Section 502.1.

SECTION 403 TRANSPORTATION IMPACT

403.1 Walkways and bicycle paths. Not less than one independent, paved walkway or bicycle path suitable for bicycles, strollers, pedestrians, and other forms of non-motorized locomotion connecting a street or other path to a building entrance shall be provided. Walkways and bicycle paths shall connect to existing paths or sidewalks, and shall be designed to connect to any planned future paths. Paved walkways and bicycle paths shall be designed to ensure and support stormwater management infrastructure including, but not limited to, pervious pavement.

403.2 Changing and shower facilities. Buildings with a total building floor area greater than 10,000 square feet (929 m²) and that are required to be provided with long term bicycle parking and storage in accordance with Section 403.3 shall be provided with on-site changing room and shower facilities. Not less than one shower shall be provided for each 200 occupants, or fraction thereof.

Exception: Where only one changing room and shower facility is required, the changing room and shower facility shall be permitted to be a single facility available to all occupants.



403.3 Bicycle parking and storage. Long term and short term bicycle parking shall be designated on the site plan by a registered design professional and as specified in Table 403.3. The required minimum number of spaces shall be determined based upon the occupied floor area of each primary use or occupancy of building. Accessory occupancy areas shall be included in the calculation of primary occupancy area.

Exceptions:

1. Long term bicycle parking shall not be required where the total building floor area is less than 2,500 square feet (232 m²).
2. Subject to the approval of the code official, the number of bicycle parking spaces shall be permitted to be reduced due to building site characteristics including, but not limited to, isolation from other development.

403.3.1 Short term bicycle parking. Short term bicycle parking shall comply with all of the following:



1. Shall be provided with illumination of not less than 1 footcandle at the parking surface;
2. Shall be located at the same grade as the sidewalk or at a location reachable by ramp or accessible route;
3. Shall have an area of not less than 18 inches (457 mm) by 60 inches (1524 mm) per bicycle;
4. Shall be provided with a rack or other facility for locking or securing each bicycle.

Exception: Where directional signage is provided at the main *building* entrances, *short term bicycle parking* shall be permitted to be located inside a *building* or at locations not visible from the main entrance.

403.3.2 Long term bicycle parking. *Long term bicycle parking* shall comply with all of the following:

1. Shall be located on the same site and within the *building* or within 300 feet of the main entrances;
2. Shall be provided with illumination of not less than 1 footcandle at the parking surface;
3. Shall have an area of not less than 18 inches (457 mm) by 60 inches (1524 mm) per bicycle; and
4. Shall be provided with a rack or other facility for locking or securing each bicycle.

Not less than 50 percent of *long term bicycle parking* shall be within a *building* or provided with a permanent cover including, but not limited to, roof overhangs, awnings, or bicycle storage lockers.

Vehicle parking spaces, other than those required by Section 403.4 and accessible parking required by the *International Building Code*, shall be permitted to be used for the installation of *long term bicycle parking* spaces.

403.4 Vehicle parking. Where either Section 403.4.1 or 403.4.2 is indicated to be applicable in Table 302.1, parking provided at a *building site* shall comply with this section. Parking spaces required by this section shall be those in the parking facility that are located on the shortest *route* of travel from the parking facility to a *building* entrance, but shall not take precedence over parking spaces that are required to be accessible in accordance with the *International Building Code*. Where *buildings* have multiple entrances with adjacent parking, parking spaces required by this section shall be dispersed and located near the entrances. Such parking spaces shall be provided with *approved* signage that specifies the permitted usage.

403.4.1 High occupancy vehicle parking. Where employee parking is provided for a *building* that has a *total building floor area* greater than 10,000 square feet (929 m²) and that has a *building occupant load* greater than 100, at least 5 percent, but not less than 2, of the employee parking spaces provided shall be designated as preferred parking for high occupancy vehicles. For the purpose of this section, preferred parking is considered to be those parking spaces in the parking facility that are located on the shortest route of travel from the employee parking area to a building entrance. Preferred parking shall not take precedence over parking spaces that are required to be accessible in accordance with the *International Building Code*.

403.4.2 Low emission, hybrid, and electric vehicle parking. Where parking is provided for a *building* that has a *total building floor area* greater than 10,000 square feet (929 m²) and that has an *building occupant load* greater than 100, at least 5 percent, but not less than 2, of the parking spaces provided shall be designated as preferred parking for *low emission, hybrid, and electric vehicles*.

**TABLE 403.3
BICYCLE PARKING^a**

Occupancy	Specific Use	Short term spaces	Long Term spaces ^{b, c}
R-1	Hotel, motel, boarding houses	None	1 per 50 employees; not less than 2 spaces
R-2, R-3, R-4	All	None	None
A-1	Movie theaters	1 per 50 seats; not less than 4 spaces	
	Concert hall, Theaters other than for movies	1 per 500 seats	

Occupancy	Specific Use	Short term spaces	Long Term spaces ^{b, c}
A-2	Restaurants	1 per 50 seats; not less than 2 spaces	1 per 50 employees; not less than 2 spaces
A-3	Places of worship	1 per 500 seats	
	Assembly spaces other than places of worship	1 per 25,000 square feet; not less than 2 spaces	
A-4 – A-5	All	1 per 500 seats	
B	All	1 per 50,000 square feet; not less than 2 spaces	1 per 25,000 square feet; not less than 2 spaces
F, H, S	All, except parking facilities	None	1 per 50 employees; not less than 2 spaces
M	All	1 per 25,000 square feet; not less than 2 spaces	1 per 50,000 square feet; not less than 2 spaces
S	Transit park and ride lots	None	1 per 20 vehicle parking spaces.
	Commercial Parking facility	1 per 20 vehicle parking spaces	None
I-2	All	1 per 25,000 square feet; not less than 2 spaces	1 per 50 employees; not less than 2 spaces
I-1	All	None	
E, I-4	Day Care	None	1 per 10 students
E	Schools	None	
Other	Outdoor recreation, parks	1 per 20 vehicle parking spaces; not less than 2 spaces	None

For SI: 1 minute per inch = min/25.4 mm,

- Requirements based on square feet shall be the *occupied floor area* of the occupancy or use.
- Employees shall be based on the number of full time equivalent employees during the largest shift.
- When a calculations results in a fraction of a space, the requirement shall be rounded to the next higher whole number.

SECTION 404 HEAT ISLAND MITIGATION

404.1 General. The heat island effect of *building* and *building site* development shall be mitigated in accordance with Sections 404.2 and 404.3.

404.2 Site Hardscape. In climate zones 1 through 6, as established in the *International Energy Conservation Code*, not less than 50 percent of the site *hardscape* shall be provided with one or any combination of options described in Sections 404.2.1 through 404.2.4. For the purposes of this section, site *hardscape* shall not include areas of the site covered by *solar photovoltaic* arrays or *solar thermal* collectors.

404.2.1 Site hardscape materials. *Hardscape* materials shall have a minimum initial *Solar Reflectance Index* of 29 when determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h-ft² (12 W/m²*k).

Exception: Pervious concrete pavements shall be allowed to be considered as a hardscape material that is deemed to comply with the criteria for solar reflectance and need not be tested in accordance with ASTM E1980.

404.2.2 Shading structures. Where shading is provided by a building or structure or an element or component thereof, such building, structure, component or element shall comply with all of the following:

- Where open trellis-type free standing structures such as, but not limited to, covered walkways, and trellises or pergolas, are covered with native plantings, the plantings shall be designed to achieve mature coverage within five years;

2. Parking shading *structures* shall comply with Section 404.3;
3. Shade provided onto the *hardscape* by an adjacent *building* or structure located on the same *lot* shall be calculated and credited toward compliance with this section based on the projected peak sun angle on the summer solstice.

404.2.3 Shade by trees. Where shading is provided by trees, such trees shall be selected and placed in accordance with all of the following:

1. Trees selected shall be those that are native to, or non-invasive and adaptive to, the region and climate zone in which the project site is located. Plantings shall be selected and sited to produce a hardy and drought resistant vegetated area;
2. *Construction documents* shall be submitted that show the planting location and anticipated ten year canopy growth of all trees and that show the contributions of existing tree canopies; and;
3. Shading calculations shall be shown on the *construction documents* demonstrating compliance with this section and shall include only those *hardscape* areas directly beneath the trees based on a ten year growth canopy. Duplicate shading credit shall not be granted for those areas where multiple trees shade the same *hardscape*.

404.2.4 Pervious and permeable pavement. Pervious and permeable pavements including open grid paving systems and open-graded aggregate systems shall have a percolation rate not less than 2 gallons per minute per square foot (100 L/min x m²) and shall have not less than 6 inches (152 mm) of open graded base below the pavement or pavers. Pervious and permeable pavement shall be permitted where the use of these types of *hardscapes* does not interfere with fire and emergency apparatus or vehicle or personnel access and egress, utilities, or telecommunications lines. Aggregate used shall be of uniform size.

404.3 Roof coverings. Not less than 75 percent of the roof surfaces of *buildings* located in climate zones 1 through 3, as established in the *International Energy Conservation Code*, shall be in compliance with Section 404.3.1 or 404.3.2, or a combination of both methods.

Exception: Portions of roof surfaces where *solar thermal* collectors, *solar photovoltaic* systems, roof penetrations and associated equipment, portions of the roof used to capture heat for building energy technologies, rooftop decks or walkways, or vegetative roofing systems are provided shall be permitted to be deducted from the roof surface required to comply with this section.

404.3.1 Roof solar reflectance and thermal emittance. Where *roof coverings* are used for compliance with Section 404.3, *roof coverings* shall comply with Section 404.3.1.1 or 404.3.1.2. The values for *solar reflectance* and thermal emittance shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be *labeled* and certified by the manufacturer demonstrating compliance.

404.3.1.1 Roof products testing. Roof products shall be tested for a minimum three-year aged *solar reflectance* in accordance with ASTM E1918, ASTM C1549 or Test Method One of CRRC-1 Standard and thermal emittance in accordance with ASTM C1371 or ASTM E408, and shall comply with the minimum values in Table 404.3.1.

404.3.1.2 Solar reflectance index. Roof products shall be permitted to use a *Solar Reflectance Index* (SRI) where the calculated value is in compliance with Table 404.3.1 values for Minimum Aged SRI. The SRI value shall be determined using ASTM E1980 with a convection coefficient of 2.1 Btu/h-ft² (12 W/m²*k) based on three-year aged roof samples tested in accordance with the test methods in Section 404.3.1.1

**TABLE 404.3.1
REFLECTANCE AND EMITTANCE**

Roof Slope	Minimum Aged Solar Reflectance	Minimum Aged Thermal Emittance	Minimum Aged SRI
Less than 2:12	0.55	0.75	60
2:12 or greater	0.30	0.75	25

404.3.2 Vegetative roofs. Roofs shall be covered with either an *extensive* or *intensive vegetative roof*. *Vegetative roofs* shall comply with Section 406.6.

**SECTION 405
SITE LIGHTING**

405.1 Light pollution control. Where this section is indicated to be applicable in Table 302.1, uplight, light trespass, and glare shall be limited for all exterior lighting equipment as described in Sections 405.2 and 405.3.

Exceptions: Lighting used for the following exterior applications is exempt where equipped with a control device independent of the control of the non-exempt lighting:

1. Specialized signal, directional, and marker lighting associated with transportation;
2. Advertising signage or directional signage;
3. Lighting integral to equipment or instrumentation and installed by its manufacturer;
4. Theatrical purposes, including performance, stage, film production, and video production;
5. Athletic playing areas where lighting is equipped with hoods or louvers for glare control;
6. Temporary lighting;
7. Lighting for industrial production, material handling, transportation sites, and associated storage areas where lighting is equipped with hoods or louvers for glare control;
8. Theme elements in theme and amusement parks
9. Roadway lighting required by governmental authorities;
10. Lighting used to highlight features of public monuments and registered landmark *structures*.

[E] 405.1.1 Exterior lighting zones. The lighting zone for the *building site* shall be determined from Table 405.1.1 unless otherwise specified by the *jurisdiction*.

**[E] TABLE 405.1.1
EXTERIOR LIGHTING ZONES**

LIGHTING ZONE	DESCRIPTION
1	Developed areas of national parks, state parks, forest land and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas
4	High-activity commercial districts in major metropolitan areas as designated by the local jurisdiction

405.2 Uplight. All exterior lighting shall comply with the requirements of Table 405.2 for the exterior lighting zones (LZ) appropriate to the *building site*.

Exception: Lighting used for the following exterior applications shall be exempt from the requirements of Table 405.2.

1. Lighting for *building* facades, landscape features, and public monuments in exterior lighting zones 3 and 4.
2. Lighting for *building* facades in exterior lighting zone 2.

**TABLE 405.2
UPLIGHT RATINGS^{a,b}**

	LZ 1	LZ 2	LZ 3	LZ 4
Maximum Luminaire Uplight Rating	U1	U2	U3	U4

- a. Uplight ratings are defined by IESNA TM-15-07 Addendum A.
- b. The rating shall be determined by the actual photometric geometry in the specified mounting orientation.

405.3 Light trespass and glare. Where luminaires are mounted on *buildings* at locations that are within a distance to the *lighting boundary*, measured horizontally, that is equal to twice the height that the luminaire is mounted, such luminaires shall not exceed the applicable glare ratings specified in Table 406.3(1). All other exterior luminaires shall not exceed the applicable backlight and glare ratings specified in Table 406.3(2).

**Table 405.3(1)
Maximum Glare Ratings for Building Mounted Luminaires Located
Two Mounting Heights or Less from Lighting Boundary^{a, b, c}**

	LZ1	LZ2	LZ3	LZ4
Maximum luminaire glare rating	G0	G1	G1	G2

- a. Mounting height is the distance above finished grade at which a luminaire is mounted, measured to the midpoint of the luminaire.
- b. Uplight and glare ratings are defined by IESNA TM-15-07 Addendum A.
- c. The rating shall be determined by the actual photometric geometry in the specified mounting orientation.

**Table 405.3(2)
Maximum allowable Backlight and Glare Ratings^{a,b,c}**

	LZ 1	LZ 2	LZ 3	LZ 4
Luminaire located more than two mounting heights from <i>lighting boundary</i>	B4 G1	B4 G2	B4 G3	B4 G4
Luminaire located one to two mounting heights from <i>lighting boundary</i>	B3 G1	B3 G2	B3 G3	B4 G4

	LZ 1	LZ 2	LZ 3	LZ 4
Luminaire located one-half to one mounting heights from <i>lighting boundary</i>	B2 G1	B2 G2	B2 G3	B3 G4
Luminaire located less than one-half mounting height from <i>lighting boundary</i>	B0 G1	B0 G2	B1 G3	B2 G4

- Backlight and glare ratings are defined by IESNA TM-15-07 Addendum A.
- Luminaires located two mounting heights or less from the *lighting boundary* shall be installed with backlight towards the nearest *lighting boundary*, unless they are lighting a roadway, bikeway, or walkway that intersects a public roadway.
- The rating shall be determined by the actual photometric geometry in the specified mounting orientation.

SECTION 406 DETAILED SITE DEVELOPMENT REQUIREMENTS

406.1 General. The provisions of this section shall govern the design and installation of site development systems and use of materials.

406.2 Non-potable water systems for irrigation systems. Non-potable water systems used for irrigation shall comply with the graywater, municipal reclaimed water and collected rainwater provisions of this section.

406.2.1 Graywater systems. *Graywater* systems used for landscape irrigation purposes shall be limited to subsurface and surface irrigation applications. The *retention* time for surface irrigation shall be 24 hours or less. *Graywater* to be used in *graywater* irrigation shall comply with the provisions of Section 708 other than Sections 708.6 and 708.12.6.5. Subsurface *graywater* systems shall be in accordance with Section 406.3. *Graywater* shall be filtered by a 100 micron or finer filter. The control panel for the *graywater* irrigation system shall be provided with signage in accordance with Section 706.2.

406.2.2 Municipal reclaimed water. *Municipal reclaimed water* used for landscape irrigation purposes shall be limited to subsurface applications. *Reclaimed water* used in irrigation systems shall comply with the provisions of Section 709 except for Section 709.5. *Reclaimed water* shall be filtered by a 100 micron or finer filter. The control panel for the *reclaimed water* irrigation system shall be provided with signage in accordance with Section 706.2.

Exception: Subject to the approval of the *code official* based on the extent of purification occurring in reclamation process, *municipal reclaimed water* shall be permitted in sprinkler irrigation applications.

406.2.3 Collected rainwater. *Rainwater* collected on the surface of the *building site*, or from the roof surfaces of the *building*, and used for landscape irrigation purposes shall not be limited regarding the method of application. *Rainwater* collected from elevated *building* locations that is to be used in *building site* irrigation, shall be in compliance with the provisions of Section 707 other than Sections 707.6, 707.12.1, 707.12.1.1 and 707.12.7.4.

406.3 Subsurface graywater irrigation systems. Gravity subsurface gray water irrigation systems, where provided in accordance with Section 402.3.3.1, shall be designed and installed in accordance with Sections 406.3.1 through 406.3.6. *Graywater* collection and storage systems shall comply with this section and the provisions of Section 708 other than Sections 708.6 and 708.12.6.5.

406.3.1 Estimating graywater discharge. The irrigation system shall be sized in accordance with the gallons-per-day-per-occupant number based on the type of fixtures connected to the *graywater* system. The discharge shall be calculated by the following equation:

$$C = (A \times B) - D$$

(Equation 4-1)

Where:

A = Number of occupants:

Residential—For dwelling units regulated by this code in accordance with Section 101.2, the number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.

Commercial—Number of occupants for buildings without dwelling units shall be determined by the *International Building Code*

B = Estimated flow demands for each occupant:

Residential— For dwelling units regulated by this code in accordance with Section 101.2, 25 gallons per day (94.6 Lpd) per occupant for showers, bathtubs and lavatories and 15 gallons per day (56.7 Lpd) per occupant for clothes washers or laundry trays.

Commercial—For buildings, without dwelling units, based on type of fixture or water use records minus the discharge of fixtures other than those discharging gray water.

C = Estimated gallons *graywater* discharge based on the total number of occupants.

D= Estimated gallons of *graywater* to be used within the interior of the *building*.

406.3.2 Percolation tests. The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.

406.3.2.1 Percolation tests and procedures. At least three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.

406.3.2.1.1 Percolation test hole. The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. All loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.

406.3.2.1.2 Test procedure, sandy soils. The hole shall be filled with clearwater to a minimum of 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows:

1. Water shall be added to a point not more than 6 inches (152 mm) above the gravel or coarse sand.
2. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour.
3. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 6 inches (152 mm).

mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported.

4. The final water level drop shall be used to calculate the percolation rate.

Soils not meeting the above requirements shall be tested in accordance with Section 406.3.2.1.3.

406.3.2.1.3 Test procedure, other soils. The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows:

1. Any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand.
2. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than 1/16 inch (1.59 mm). At least three water level drops shall be observed and recorded.
3. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop.
4. When the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period.
5. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.

406.3.2.1.4 Mechanical test equipment. Mechanical percolation test equipment shall be of an *approved* type.

406.3.3 Permeability evaluation. Soil shall be evaluated for estimated percolation based on soil structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section 406.3.2.1 for evaluating the soil.

406.3.4 Subsurface landscape irrigation site location. The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining *lots*. Where this is not possible, the irrigation system shall be located so that surface water drainage from the *building site* is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table 406.3.4 and as provided in Section 708.14.7. Surface water shall be diverted away from any soil absorption site on the same or adjoining *lots*.

**TABLE 406.3.4
LOCATION OF GRAYWATER SYSTEM**

ELEMENT	MINIMUM HORIZONTAL DISTANCE (feet)
	IRRIGATION DISPOSAL FIELD
Buildings	2
Lot lines other than lot lines adjoining public ways	5
Water wells	100
Streams, lakes and wetlands	50
Critical root zone (CRZ) of protected trees	2
Seepage pits	5
Septic tanks	5
Water service	5
Public water main	10

For SI: 1 minute per inch = min/25.4 mm,

406.3.5 Installation. Absorption systems shall be installed in accordance with Sections 406.3.5.1 through 406.3.5.5 to provide landscape irrigation without surfacing of *graywater*. Excavations shall not encroach upon the critical root zone (CRZ) of protected trees.

406.3.5.1 Absorption area. The total absorption area required shall be computed from the estimated daily *graywater* discharge and the design-loading rate based on the percolation rate for the site. The required absorption area equals the estimated *graywater* discharge divided by the design-loading rate from Table 406.3.5.1.

**TABLE 406.3.5.1
DESIGN LOADING RATE**

PERCOLATION RATE (minutes per inch)	DESIGN LOADING FACTOR (gallons per square foot per day)
Less than 10	1.2
10 to less than 30	0.8
30 to less than 45	0.72
45 and greater	0.4

For SI: 1 minute per inch = min/25.4 mm,
1 gallon per square foot = 40.7 L/m².

406.3.5.2 Seepage trench excavations. Seepage trench excavations shall be a minimum of 1 foot (304 mm) to a maximum of 5 feet (1524 mm) wide. Trench excavations shall be spaced a minimum of 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be a maximum of 100 feet (30 480 mm) in *developed length*.

406.3.5.3 Seepage bed excavations. Seepage bed excavations shall be a minimum of 5 feet (1524 mm) wide and have more than one *distribution pipe*. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. *Distribution piping* in a seepage bed shall be uniformly spaced a maximum of 5 feet (1524 mm) and a minimum of 3 feet (914 mm) apart, and a maximum of 3 feet (914 mm) and a minimum of 1 foot (305 mm) from the sidewall or headwall.

406.3.5.4 Excavation and construction. The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between

the hands forms a soil wire. All smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

406.3.5.5 Aggregate and backfill. A minimum of 6 inches of aggregate ranging in size from 1/2 to 2-1/2 inches (12.7 mm to 64 mm) shall be laid into the trench below the *distribution piping* elevation. The aggregate shall be evenly distributed a minimum of 2 inches (51 mm) over the top of the *distribution pipe*. The aggregate shall be covered with *approved* synthetic materials or 9 inches (229 mm) of uncompacted marsh hay or straw. *Building* paper shall not be used to cover the aggregate. A minimum of 9 inches (229 mm) of soil backfill shall be provided above the covering.

406.3.6 Distribution piping. *Distribution piping* shall be not less than 3 inches (76 mm) in diameter. The top of the *distribution pipe* shall be not less than 8 inches (203 mm) below the original surface. The slope of the *distribution pipes* shall be a minimum of 2 inches (51 mm) and a maximum of 4 inches (102 mm) per 100 feet (30 480 mm).



406.4 Vegetation and soil protection. Vegetation and soil protection plans, where provided in accordance with Section 402.3.5, shall address the following:

1. Identification of existing vegetation located on a *building site* that is to be preserved and protected;
2. Identification of portions of the *building site* to be designated vegetation and soil protection areas (VSPAs) that are to be protected during the construction process from being affected by construction activities;
3. Specification of methods to be used such as temporary fencing or other physical barriers to maintain the protection of the designated vegetation and soil protection areas (VSPAs).
4. Specification of protected perimeters around trees and shrubs that are to be included in the designated vegetation and soil protection areas (VSPAs). Perimeters around trees shall be identified as a circle with a radius of not less than 1 foot (305 mm) for every inch (25.4 mm) of tree diameter with a radius of not less than 5 feet (1524 mm) and around shrubs shall be not less than twice the radius of the shrub.

Exception: *Approved* alternative perimeters appropriate to the location and the species of the trees and shrubs shall be permitted.

5. Specification of methods to protect the viability of the designated vegetation and soil protection areas (VSPAs) to support the remaining vegetation at the conclusion of the construction process including minimizing impacts on the existing stormwater drainage patterns associated with the VSPAs.
6. Identification of plans, methods and practices used to designate essential areas of soil and subsoil disturbance.

406.4.1 Tree protection zones (TPZ). Where tree protection zones are specified, the specifications and documentation shall be in accordance with Part 5 of ANSI A300.

406.5 Soil reuse and restoration. Soils that are reused and restored on a *building site* shall comply with Sections 406.5.1 through 406.5.4.

406.5.1 Preparation. Before placing stockpiled or imported *topsoils*, compliance with all of the following shall occur:

1. Areas shall be cleared of debris including, but not limited to, *building* materials, plaster, paints, road base type materials, petroleum based chemicals, and other harmful materials;
2. Areas of construction-compacted subsoil shall be scarified; and
3. The first lift of replaced soil shall be mixed into this scarification zone to improve the transition between the subsoil and overlying soil horizons.

Exception: Scarification is prohibited in all of the following locations:

1. Where scarification would damage existing tree roots.
2. On inaccessible slopes.
3. On or adjacent to trenching and drainage installations.
4. On areas intended by the design to be compacted such as abutments, footings, inslopes.
5. Brownfields.
6. Other locations where scarification would damage *existing structures*, utilities and vegetation being preserved.

406.5.2 Restoration. Soils disturbed during construction shall be restored in all areas that will not be covered by *buildings, structures* or *hardscapes*. Soil restoration shall comply with Sections 406.5.2.1 and 406.5.2.2.

406.5.2.1 Organic matter. To provide appropriate *organic matter* for plant growth and for water storage and infiltration, soils shall be amended with a mature, stable compost material so that not less than the top 12 inches of soil contains not less than 3 percent *organic matter*. Sphagnum peat or organic amendments that contain sphagnum peat shall not be used. Soil *organic matter* shall be determined in accordance with ASTM D2974. Organic materials selected for on-site amendment or for blending of imported soils shall be renewable within a 50-year cycle.

Exception: Where the reference soil for a *building site* has an organic level depth other than 12 inches, soils shall be amended to *organic matter* levels and *organic matter* depth that are comparable to the site's reference soil.

406.5.2.2 Additional soil restoration criteria. In addition to compliance with Section 406.5.2.1, soil restoration shall comply with not less than three of the following criteria:

1. **Compaction.** Bulk densities within the root zone shall not exceed the densities specified in Table 406.4.2.2. The root zone shall be not less than 12 inches nor less than the site's reference soil, whichever results in the greater depth of measurement.
2. **Infiltration rates.** Infiltration rates or saturated hydraulic conductivity of the restored soils shall be comparable to the site's reference soil. Infiltration rates shall be determined in accordance with ASTM D3385 or ASTM D5093. For sloped areas where the methods provided in the referenced standards cannot be used successfully, alternate methods *approved* by the *code official* shall be permitted provided that the same method is used to test both reference soil and on-site soil.
3. **Soil biological function.** Where remediated soils are used, the biological function of the soils' mineralizable nitrogen shall be permitted as a proxy assessment of biological activity.

- 4. Soil chemical characteristics.** Soil chemical characteristics appropriate for plant growth shall be restored. The pH, cation exchange capacity and nutrient profiles of the original undisturbed soil or the site’s reference soil shall be matched in restored soils. Salinity suitable for regionally appropriate vegetation shall be established. Soil amendments and fertilizers shall be selected from those which minimize nutrient loading to waterways or groundwater.

**TABLE 406.4.2.2
MAXIMUM CONE PENETROMETER READINGS**

Surface Resistance (PSI)		Subsurface Resistance (PSI)	
All Textures Sand	Sand (includes loamy sand, sandy loam, sandy clay loam, and sandy clay)	Silt (includes loam, silt loam, silty clay loam, and silty clay)	Clay (includes clay loam)
110	260	260	225

406.5.3 Engineered growing media. Where engineered growing media are used on-site, including, but not limited to vegetative roofs, trees located within *hardscape* areas, and special soils specified for *wetlands* and environmental restoration sites, such media shall comply with the best available science and practice standards for that engineered growing media and use.

406.5.4 Documentation. The following shall be provided to document compliance:

1. Documentation, such as receipts from a soil, compost and amendments supplier, to demonstrate that techniques to restore soil occurred;
2. Soil test results to demonstrate that the selected techniques achieved the criteria of Sections 406.5.2.1 and 406.5.2.2. Not less than two soil tests shall be conducted on the *building site*. For *building sites* where more than 8,000 square feet (744 m²) of soil is to be disturbed during construction, there shall be not less than one report for every 4,000 square feet (372 m²) disturbed or report frequency as determined by the registered design professional.

406.6 Landscape, soil and water quality protection plan. A landscape, soil and water quality protection plan, where provided in accordance with Section 402.3.5.1, shall address the following:

1. A soils map, site plan, or grading plan that indicates designated soil management areas for all site soils, including, but not limited to:
 - 1.1. Soils that will be retained in place and designated as vegetation and soil protection areas (VSPAs).
 - 1.2. *Topsoils* that will be stockpiled for future reuse and the locations for the stockpiles.
 - 1.3. Soils that will be disturbed during construction and plans to restore disturbed soils and underlying subsoils to soil reference conditions.
 - 1.4. Soils that will be restored and re-vegetated.
 - 1.5. Soils disturbed by previous development that will be restored in place and re-vegetated.
 - 1.6. Locations for all laydown and storage areas, parking areas, haul roads and construction vehicle access, temporary utilities and construction trailer locations.

- 1.7. Treatment details for each zone of soil that will be restored, including the type, source and expected volume of materials, including compost amendments, mulch and *topsoil*.
- 1.8. A narrative of all measures to be taken to ensure that areas not to be disturbed and areas of restored soils are protected from compaction by vehicle traffic or storage, erosion, and contamination until project completion.
2. A written erosion, sedimentation and pollutant control program for construction activities associated with the project. The program shall describe the best management practices (BMPs) to be employed including how the BMPs accomplish the following objectives:
 - 2.1 Prevent loss of soil during construction due to stormwater runoff or wind erosion, including the protection of *topsoil* by stockpiling for reuse.
 - 2.2. Prevent sedimentation of stormwater conveyances or *receiving waters* or other public *infrastructure*.
 - 2.3. Prevent polluting the air with dust and particulate matter.
 - 2.4. Prevent runoff and infiltration of other pollutants from construction site, including, but not limited to thermal pollution, concrete wash, fuels, solvents, hazardous chemical runoff, pH and pavement sealants. Ensure proper disposal of pollutants.
 - 2.5. Protect from construction activities all designated vegetation and soil protection areas, flood hazard areas and other areas of vegetation that will remain on site.
3. A written periodic maintenance protocol for all landscaping and stormwater management systems, including, but not limited to:
 - 3.1 A schedule for periodic watering of new planting which reflects different water needs during the establishment phase of new plantings as well as after establishment. Where development of the *building site* changed the amount of water reaching the preserved natural resource areas, include appropriate measures for maintaining the natural areas.
 - 3.2 A schedule for the use of fertilizers appropriate to the plants species, local climate and the pre-establishment and post-establishment needs of the installed landscaping. Non-organic fertilizers shall be discontinued following plant establishment.
 - 3.3 A requirement for a visual inspection of the site after all major precipitation events to evaluate systems performance and site impacts.
 - 3.4 A schedule of maintenance activities of the stormwater management system including, but not limited to, cleaning of gutters, downspouts, inlets and outlets, removal of sediments from pretreatment sedimentation pits and wet *detention* ponds, vacuum sweeping followed by high-pressure hosing at porous pavement and removal of litter and debris.
 - 3.5 A schedule of maintenance activities for landscaped areas including, but not limited to, the removal of dead or unhealthy vegetation; reseeding of turf areas; mowing of grass to a height which optimizes lawn health and *retention* of precipitation.

406.7 Vegetative roofs. *Extensive* and *intensive vegetative roofs*, where provided in accordance with Section 404.3 shall comply with the following:

1. All plantings shall be selected according their United States Department of Agriculture hardiness zone classifications and shall be capable of withstanding the climate conditions of the *jurisdiction* and the micro climate conditions of the *building site* including, but not limited to, wind, precipitation and temperature. Planting density shall provide foliage coverage, in the warm months, of not less than 80 percent within two years of the date of installation unless a different time period is established in the *approved design*. Plants shall be distributed to meet the coverage requirements. *Invasive plant* species shall not be planted. Selected plants shall not add to the potential for fire hazard in the event of severe drought.
2. The engineered soil medium shall be designed for the physical conditions and local climate to support the plants and shall consist of non-synthetic materials. The planting design shall include measures to protect the engineered soil medium until the plants are established. Protection measures include, but are not limited to, installation of pre-grown vegetated mats or modules, tackifying agents, fiber blankets and reinforcing mesh. The maximum wet weight and water holding capacity of an engineered soil medium shall be determined in accordance with ASTM E2399.
3. Where access to the *building* facades is provided from locations on the perimeter of the roof, non-vegetated buffers adequate to support associated equipment and to protect the roof shall be provided.
4. Plantings shall be managed to maintain the function of the vegetative roof.

SECTION 407 PROJECT ELECTIVES

407.1 General. Section 407 shall regulate *project electives* related to natural resource conservation and *building site* development. *Project electives* shall not be mandatory unless selected by the owner and indicated in the Project Elective Checklist required by Section 303.1.

407.2 Preservation of natural resources. *Project electives* related to the preservation of natural resources shall comply with Sections 407.2.1 through 407.2.11. Development of a *building site* is permitted to comply with individual electives and to comply with more than one elective. Compliance with multiple electives shall be recognized.

407.2.1 Flood hazard avoidance project elective. Projects seeking a *flood* hazard avoidance *project elective* in accordance with Table 303.1 and Section 303.4 shall comply with this section. Where 25 percent or more of a *building site* is located within the designated one percent annual probability *flood hazard area*, all *building* and site development shall be located on portions of the *building site* that are not located within the one percent annual probability *flood hazard area*. The *building site* shall not be regraded to raise the elevation of the site to remove areas from the *flood hazard area*.

407.2.2 Agricultural land project elective. Where Section 402.2.5 is not listed in Table 302.1 as a mandatory requirement, and where not less than 50 percent of the land within the *jurisdiction* is zoned for agricultural use, development of a *building site* that is not zoned for agricultural use shall be recognized as a *project elective*.

407.2.3 Wildlife corridor project elective. Site development that restores a wildlife corridor, connecting wildlife corridors on adjacent lots, shall be recognized as a *project elective*.

407.2.4 Infill site project elective. The development of a *building site* that is an *infill site* with a new *building* and associated site improvements shall be recognized as a *project elective*.

407.2.5 Brownfield site project elective. The development of a *building site* that is a brownfield site with a new *building* with associated site improvements shall be recognized as a *project elective*. The development shall be in accordance with one of the following:

1. Phase I and II Environmental Assessment and, as necessary, the documentation of the site remediation plan and completion of the plan, as approved by the jurisdictional agency in charge of environmental regulations or;
2. Where classified as a brownfield site by a local, state or federal government agency, *building* and site development shall provide effective remediation *approved* by the agency which classified the site as a brownfield.

407.2.6 Existing building reuse project elective. The development of a building site on which an existing building is already located and in which not less than 75 percent of the existing core and shell of the structure will be reused shall be recognized as a project elective.

407.2.7 Greenfield development project elective. Where Section 402.2.6 is not listed in Table 302.1 as a mandatory requirement, and where a new *building* and associated site improvements are built on a site which is not a *greenfield* site, compliance with this *project elective shall be recognized*. Where the *building site* meets the criteria of one or more of the exceptions to Section 402.2.6, this *project elective* shall not be available for selection.

407.2.8 Greenfield proximity to development project elective. Where Section 402.2.6 is listed in Table 302.2 as a mandatory requirement, and where a *building site* is a *greenfield* site located within 1/4 mile (0.4 km) distance, measured over roads or designated walking surfaces, of developed residential land with an average density of not less than 16 *dwelling units* per acre (6.48 dwelling units per hectare), the development of a *building* and associated site improvements shall be recognized as a *project elective*.

407.2.9 Greenfield proximity to diverse uses project elective. Where Section 402.2.6 is listed in Table 302.1 as a mandatory requirement, and where a *building site* is a *greenfield* site located within 1/4 mile (0.4 km) distance, measured over roads or designated walking surfaces, of not less than 10 diverse uses and within 1/2 mile (0.8 km) distance of not less than 14 diverse uses, the development of a *building* and associated site improvements shall be recognized as a *project elective*. The diverse uses shall include at least two uses from each of the following categories of diverse uses: retail, service and community facility.

407.2.10 Native plant landscaping project elective. Where new landscaping is installed as part of a site plan or within the building site, and where 75 percent or more of the newly landscaped area is planted with native species, the landscaping shall be recognized as a project elective.

407.2.11 Site restoration project elective. Previously developed sites that restore 25 percent or more of the non-building footprint building site area with native or adaptive vegetation shall be recognized as a project elective.

407.3 Transportation impact. *Project electives* related to transportation impact shall comply with Sections 407.3.1 through 407.3.4. Compliance with multiple electives shall be recognized.

407.3.1 Changing and shower facilities project elective. Where a new *building* is less than 10,000 square feet (929 m²) in *total building floor area*, providing changing and shower facilities in accordance with Section 403.2 shall be recognized as a *project elective*.

407.3.2 Long term bicycle parking and storage project elective. The development of a new *building* and associated site improvements where additional *long term bicycle parking* is provided in accordance with all of the following shall be recognized as a single *project elective*:

1. Provide *long term bicycle parking* which is twice the number of parking spaces required by Table 403.3;
2. Provide spaces in accordance with the Section 403.3.2; and
3. Locate not less than 90 percent of *long term bicycle parking* within a *building* or provide the parking with a permanent cover including, but not limited to, roof overhangs, awnings, or bicycle storage lockers.

407.3.3 Preferred parking project elective. A *project elective* shall be recognized where preferred parking for *high occupancy, low emission, hybrid or electric vehicles* in accordance with Section 403.4 is provided under one of the following conditions:

1. Where Section 403.4 is listed in Table 302.1 as a mandatory requirement, and a new *building* is less than 10,000 square feet in *total building floor area*.
2. Where Section 403.4 is *not* listed in Table 302.1 as a mandatory requirement.

407.4 Heat island. *Project electives* related to heat island impact shall comply with Sections 407.4.1 through 407.4.4. Compliance with multiple electives shall be recognized.

407.4.1 Site hardscape project elective 1. In climate zones 1 through 6, as established in the *International Energy Conservation Code*, the development of a new *building* and associated site improvements where a minimum of 75 percent of the site *hardscape* shall be in accordance with one or any combination of options in Sections 404.2.1 through 404.2.4, shall be recognized as a *project elective*.

407.4.2 Site hardscape project elective 2. In climate zones 1 through 6, as established in the *International Energy Conservation Code* the development of a new *building* and associated site improvements where a minimum of 100 percent of the site *hardscape* shall be in accordance with one or any combination of options in Sections 404.2.1 through 404.2.4, shall be recognized as a *project elective*.

407.4.3 Site hardscape project elective 3. In climate zones 7 and 8, as established in the *International Energy Conservation Code* the development of a new *building* and associated site improvements where a minimum of 50 percent of the site *hardscape* shall be in accordance with one or any combination of options in Sections 404.2.1 through 404.2.4, shall be recognized as a *project elective*.

407.4.4 Roof covering project elective. In climate zones 4 through 8, as established in the *International Energy Conservation Code* the development of a new *building* with *roof coverings* in accordance with Section 404.3, shall be recognized as a *project elective*.

407.5 Light pollution reduction elective. Where Section 405.1 is not listed in Table 302.1 as a mandatory requirement, the development of a new *building* and associated site improvements in accordance with Section 405.1 shall be recognized as a *project elective*.

CHAPTER 5

MATERIAL RESOURCE CONSERVATION AND EFFICIENCY

SECTION 501 GENERAL

501.1 Scope. The provisions of this chapter shall govern matters related to *building* material conservation, resource efficiency and environmental performance.

SECTION 502 MATERIAL AND WASTE MANAGEMENT

502.1 Construction material and waste management plan. Not less than 50 percent of non-hazardous construction waste shall be diverted from landfills, except where other percentages are indicated in Table 302.1. A Construction Material and Waste Management Plan shall be developed and implemented to recycle or salvage construction materials and waste. The Construction Material and Waste Management Plan shall comply with all of the following:

1. The location where the collection, separation and storage of recyclable construction waste materials such as wood, paper, plastic, aluminum, steel, iron, gypsum board, carpet, mineral fiber, acoustical ceiling tile, glass and concrete, shall be indicated.
2. Materials to be diverted from disposal by efficient usage, recycling, reuse on the project, or salvage for future use or sale shall be specified.
3. The amount of materials to be diverted shall be specified and shall be calculated by weight or volume, but not both.

For the purpose of this section, construction and waste materials shall not include land clearing debris, excavated soils and fill and base materials such as, but not limited to, *topsoil*, sand and gravel. Land-clearing debris shall include trees, stumps, rocks, and vegetation. Excavated soil, fill material and land-clearing debris shall be managed in accordance with Section 402.3.6.

502.2 Recycling areas for waste generated post certificate of occupancy. Waste recycling areas for use by *building* occupants shall be provided in accordance with one of the following:

1. Waste recycling areas shall be designed and constructed in accordance with the *jurisdiction's* laws or regulations;
2. Where laws or regulations do not exist or where limited recycling services are available, waste recycling areas shall be designed and constructed to accommodate recyclable materials based on the availability of recycling services;
3. Where recycling services are not available, waste recycling areas shall be designed and constructed to accommodate the future recycling of materials in accordance with an *approved* design. The *approved* design shall meet one of the following:

3.1 The approved waste recycling area design shall be based on analysis of other regional recycling services, laws or regulations.

3.2 The approved waste recycling area shall be designed to meet the needs of the occupancy, facilitate efficient pick-up, and shall be available to occupants and haulers.

502.3 Storage of lamps, batteries and electronics. Storage space shall be provided for fluorescent lamps, HID lamps, batteries, electronics, and other discarded items requiring special disposal by the *jurisdiction*.

SECTION 503 MATERIAL SELECTION

503.1 Material selection and properties. *Building* materials shall conform to Sections 503.2 and 503.3.

Exception: Electrical, mechanical, plumbing, security and fire detection, and alarm equipment and controls, automatic fire sprinkler systems, elevators and conveying systems shall not be required to comply with Section 503.

503.2 Material selection. Not less than 55 percent of the total *building* materials used in the project, based on mass or cost, shall comply with Section 503.2.1, 503.2.2, 503.2.3, 503.2.4 or 503.2.5. Compliance shall be demonstrated in accordance with those sections singularly or in combination. Materials regulated by Sections 503.2.2, 503.2.3, 503.2.4 and 503.2.5 shall have a *design life* that is equal to or greater than that indicated in the *building service life* plan in accordance with Section 505.1.

503.2.1 Used materials. Used materials shall comply with the provisions for such materials in accordance with the applicable code referenced in Section 102.4 and the applicable requirements of this code.

503.2.2 Recycled content building materials. *Recycled content building* materials shall comply with one of the following:

1. Contain not less than 25 percent combined *post-consumer* and *pre-consumer* recovered material, and shall comply with Section 503.2.3.

2. Contain not less than 50 percent combined *post-consumer* and *pre-consumer* recovered material.

The *pre-consumer* recycled content shall be counted as one-half of its actual content in the material.

503.2.3. Recyclable building materials. *Building* materials shall be manufactured for recyclability with a minimum recovery rate of not less than 30 percent through recycling and reprocessing.

503.2.4 Bio-based materials. *Bio-based* materials shall be those materials that comply with one or more of the following:

1. Contain not less than 25 percent combined post-consumer and pre-consumer recovered material, and shall comply with Section 503.2.3. The *bio-based* content is not less than 50 percent as determined by testing in accordance with ASTM D6866.

2. Wood and wood products used to comply with this section, other than salvaged or reused wood products, shall be *labeled* in accordance with the SFI Standard, FSC Indicators of Sustainable Forestry, PEFC Council Technical Document or equivalent fiber procurement system. As an alternative to an on-product *label*, a Certificate of Compliance indicating conformance with the fiber procurement system shall be permitted. Manufacturer's fiber procurement systems shall be audited by an accredited third-party.

3. The requirements of USDA 7CFR Part 2902.

503.2.5 Indigenous materials. Indigenous materials or components shall be composed of resources that are recovered, harvested, extracted and manufactured within a 500 mile (800 km) radius of the *building site*. Where only a portion of a material or product is recovered, harvested, extracted and manufactured within 500 miles (800km), only that portion shall be included. Where resources are transported by water or rail, the distance to the *building site* shall be determined by multiplying the distance that the resources are transported by water or rail by 0.25, and adding that number to the distance transported by means other than water or rail.



SECTION 504 LAMPS

504.1 Low mercury lamps. The mercury content in lamps shall comply with Section 504.2 or 504.3.

Exceptions: Appliance, black light, bug, colored, germicidal, plant, shatter-resistant/shatter-proof/shatter-protected, showcase, sultan, T-8 and T-12 lamps with a color rendering index of 87 or higher, lamps with RDC bases, and lamps used for special-needs lighting for individuals with exceptional needs.

504.2 Straight fluorescent lamps. Straight, double-ended fluorescent lamps less than 6 feet in nominal length and with bi-pin bases shall contain not more than 5 milligrams of mercury per lamp.

Exception: Lamps with a rated lifetime greater than 22,000 hours at 3 hours per start operated on an ANSI reference ballast shall not exceed 8 milligrams of mercury per lamp.

504.3 Compact Fluorescent Lamps. Single-ended pin-base and screw-base compact fluorescent lamps shall contain not more than 5 milligrams of mercury per lamp.

Exception: Lamps rated at 25 watts or greater shall contain not more than 6 milligrams of mercury per lamp.

SECTION 505 SERVICE LIFE

505.1 Building service life plan. A *building service life plan* (BSLP) in accordance with this section shall be included in the *construction documents*. The design service life shall be not less than 60 years and the BSLP shall indicate the design service life selected for the *building*.

Exception: Where justified by community development plans and *approved* by the code official, a BSLP of 25 years shall be permitted. A BSLP of 25 years shall be comprised of a dismantling, de-mounting, and re-use plan.

505.1.1 Core, shell and site hardscape components. The *Building Service Life Plan* (BSLP) shall be based on the *Building Service Life Category* (BSLC) selected from Table 505.1.1. The *design life* of components shall be not less than indicated in Table 505.1.1 for the BSLC selected, except as *approved* by the *code official* in cases where practical difficulties are identified in the BSLP. The BSLP shall include a maintenance, *repair*, and replacement schedule for each component. Values for component *design life* and the *in-use conditions* related to maintenance, *repair* and replacement schedule shall be based on manufacturer's *reference service-life data* or other *approved sources* and shall be included in the documentation.

Table 505.1.1

BUILDING DESIGN LIFE CATEGORIES AND MINIMUM COMPONENT DESIGN LIFE

BUILDING DESIGN LIFE CATEGORY	60 Years	25 Years
COMPONENT	COMPONENT MINIMUM DESIGN LIFE (Years)	
Structural elements and concealed materials and assemblies	60	25
Materials and assemblies where replacement is cost prohibitive or impractical	60	25
Major materials and assemblies that are replaceable	40	25
Roof Coverings	20	20
Mechanical, electrical and plumbing equipment and systems	25	25
Site hardscape	30	25

505.1.2 Interior adaptability. A plan to accommodate future re-configuration, dismounting, and disassembly of interior non-loadbearing walls, partitions, lighting and electric systems, suspended ceilings, raised floors, and interior air distribution systems for a minimum of 25 years shall be included in the BSLP. The plan shall verify that the interior materials, components and assemblies have a minimum service life of 25 years, and are adaptable to future reconfigurations within the interior spaces of the *building*.

**SECTION 506
MOISTURE CONTROL AND MATERIAL STORAGE AND HANDLING**

506.1 Storage and handling of materials. Materials stored and handled on-site during construction phases shall comply with applicable manufacturer’s recommendations. Where the manufacturer’s recommendations are not available, *approved* standards or guidelines shall be followed.

506.2 Construction phase moisture control. Porous or fibrous materials and other materials subject to moisture damage shall be protected from moisture during the construction phase. Material damaged by moisture during the construction phase shall be cleaned and dried or, where damage cannot be corrected by such means, shall be removed and replaced.

506.3 Moisture control preventative measures. Moisture preventative measures shall be inspected in accordance with Sections 902 and 903 for the categories listed in Items 1 through 5. Inspections shall be executed in a method and at a frequency as listed in Table 903.1. Inspections shall be conducted by an approved agency that shall report to the *code official* based on the *approved* pre-determined frequency schedule. Discrepancies shall be brought to the attention of the *code official* prior to the completion of that work. A final inspection report documenting required testing and corrections of any discrepancies noted in prior inspections shall be submitted at a point in time agreed upon by the *code official* for purposes of demonstrating compliance.

1. Foundation sub-soil drainage system.
2. Foundation damp-proofing and water-proofing.
3. Flashings: Windows, exterior doors, *skylights*, wall flashing and drainage systems.
4. Exterior wall coverings.
5. *Roof coverings*, roof drainage, and flashings.

SECTION 507 STRAWBALE CONSTRUCTION

507.1 Scope. This section shall govern the use of baled straw as a building material. Unless stated otherwise in this section, the provisions of the *International Building Code*, the *International Mechanical Code*, the *International Plumbing Code*, the *International Fuel Gas Code*, NFPA 70 and other applicable codes shall apply to structures using baled straw as a building material.

507.2 Bales. Bales for strawbale construction that is intended to comply with Section 507 shall be in accordance with the requirements of Sections 507.2.1 through 507.2.9.

507.2.1 Shape. Bales shall be rectangular in shape.

507.2.2 Size. Bales used within a continuous wall shall be of consistent height and width to ensure even distribution of loads within the wall system.

507.2.3 Ties. Bales shall be bound with ties of polypropylene string or baling wire. Ties shall be at least 3 inches (76mm) and not more than 6 inches (152mm) from faces adjacent and parallel to the ties, and shall be otherwise equally spaced. Bales with broken or loose ties shall be firmly retied.

507.2.4 Moisture content. The moisture content of bales, at the time of procurement, and at the time of application of the first coat of plaster or installation of another weather protective finish, shall not exceed 20 percent of the total weight of the bale. The moisture content of bales shall be determined by use of a moisture meter designed for use with baled straw or hay, equipped with a probe of sufficient length to reach the center of the bale, or by other approved means. At least 5 percent of and not less than 10 of the bails used shall be randomly selected and tested to determine if all of the bales for the building are of acceptable moisture content.

507.2.5 Density. Bales shall have a minimum dry density of 6.5 pounds per cubic foot (92 kg/cubic meter). The dry density shall be determined by reducing the actual bale weight by the weight of the moisture content in pounds (kg), and dividing by the volume of the bale in cubic feet (cubic meters). At least 2 percent of and not less than 5 of the bails to be used shall be randomly selected and tested to determine that the bales for the building are of acceptable density.

507.2.6 Partial bales. Custom-made partial bales shall be firmly retied and, where possible, utilize the same number of ties as the standard size bales.

507.2.7 Types of straw. Bales shall be made of straw from wheat, rice, rye, barley, oat, and similar grain plants. Bales of hay and other grasses containing seed shall not be used.

507.2.8 Protection of bales prior to installation. Prior to installation, bales shall be stored so as to protect them from weather and other sources of moisture damage.

507.2.9 Unacceptable bales. Bales that show signs of damage from moisture, including but not limited to, mold or fungus growth or associated discoloration, including those bales that are of an acceptable moisture content and density, shall not be used.

507.3 Moisture control. All weather-exposed bale walls, other weather-exposed bale elements, and bale walls enclosing showers or steam rooms, shall be protected from water damage and moisture intrusion in accordance with Sections 507.3.1 through 507.3.6.

507.3.1 Moisture content of bales. The moisture content of bales shall be in accordance with Section 507.2.4.

507.3.2 Moisture barriers and vapor retarders. Plastered bale walls shall be permitted to be constructed without any membrane barrier between straw and plaster to facilitate transpiration of moisture from the bales, or to secure a structural bond between straw and plaster, except as allowed or required elsewhere in this section. A vapor retarder shall not be used on bale walls, nor shall any other material be used, that has a vapor permeance rating of less than 5 perms, except as permitted or required elsewhere in this section, or as deemed to be necessary by an architect or engineer.

507.3.3 Horizontal surfaces. Bale walls and other bale elements shall have a moisture barrier at all horizontal surfaces exposed to weather. The moisture barrier shall be of a material and installation that will prevent water from entering the wall system or other bale element. Horizontal surfaces shall include, but are not limited to, exterior window sills, sills at exterior niches, bale vaults and arches, tops of landscape walls, and weather-exposed benches. The finish material at all such surfaces shall be sloped not less than 1 unit vertical in 12 units horizontal (8-percent slope) and shall drain water away from all bale walls and elements. Where the moisture barrier is below the finish material, it shall be sloped not less than 1 unit vertical in 12 units horizontal (8-percent slope) and shall drain water beyond the outside surface of the bale's vertical finish, wherever possible.

507.3.4 Bale and concrete separation. A moisture barrier and a capillary break shall be installed between bales and supporting concrete or masonry. The moisture barrier shall be a durable sheet or liquid applied membrane that is impervious to water. The capillary break shall be gravel or other material that prevents the wicking of moisture across that material and into the bale. Where bales abut a concrete or masonry wall that retains earth, a moisture barrier shall be provided between such wall and the bales.

507.3.5 Separation of plaster and earth. Exterior plaster skins applied to straw bales shall be separated from the earth by a distance of not less than 6 inches (152mm).

507.3.6 Shower walls, steam rooms. Bale walls enclosing showers, bathtub/shower combinations or steam rooms shall be protected by a moisture barrier or by a vapor retarder.

507.4 Structure. Buildings constructed with straw bales shall comply with Sections 507.4.1 through 507.4.15 and with the structural provisions of the *International Building Code*, except as otherwise provided for in Sections 507.4.1 through 507.4.15. The type of structural system used shall be a type allowed by the *International Building Code* and Sections 507.4.1 through 507.4.15.

507.4.1 Foundations. Foundations for strawbale walls and other straw bale elements shall be of any foundation type permitted by the *International Building Code*. Such foundations shall be designed to allow design loads from the skins, bales, and any structural framing at the base of the wall to be transferred to the ground.

507.4.2 Wall height. Structural and non-structural strawbale walls shall not exceed a 6:1 ratio of stacked bale height to bale width, except where engineering is provided to substantiate that the wall will resist buckling from gravity loads and out-of-plane seismic and wind loads.

507.4.3 Configuration of bales. Bales shall be laid flat or on-edge. Bales in walls with reinforced plaster shall be laid in a running or stack bond. Bales in walls with unreinforced plaster shall be laid in a running bond.

507.4.4 Pre-compression of strawbale walls. Prior to application of a finish surface, walls bearing gravity loads shall be permanently pre-compressed by an approved means to a force equal to or greater than the design loads on the wall.

Exceptions:

1. Walls bearing roof loads shall not be required to be pre-compressed where the design snow load does not exceed 20 psf (80kg/sq.m), and where the full dead load of the roof is imposed and remains on the wall not less than 14 days before application of finish.

2. Assembled bales in applications other than walls bearing gravity loads, including for use in lateral load resisting elements, shall not be required to be pre-compressed.

507.4.5 Voids and stuffing. Voids between bales in structural strawbale walls shall not exceed 4 inches (101mm) in width, and such voids shall be firmly stuffed with flakes of straw or straw-clay, before application of finish.

507.4.6 Plaster skins. Plaster skins on structural walls shall be of any type permitted by Section 507.5 except gypsum plaster, and shall also be limited by Tables 507.4(2) and 507.4(3).

507.4.6.1 Straightness. On structural walls, plaster skins shall be straight, as a function of the bale wall surface they are applied to, as follows:

1. Across the face of a bale – Straw bulges shall not protrude more than 3/4 inch (19mm) across 2 feet (610mm) of its height or length.
2. Across the face of a bale wall – Straw bulges shall not protrude from the vertical plane of a bale wall more than 2 inches (51mm) over 8 feet (2438mm).
3. Offset of bales – The vertical face of adjacent bales shall not be offset more than 1/2 inch (13mm)

507.4.6.2 Plaster and membranes. Structural bale walls shall not have a membrane between straw and plaster, or shall have sufficient attachment through the bale wall from one plaster skin to the other in accordance with an engineered design.

507.4.7 Transfer of loads to plaster skins. Where plastered strawbale walls are used to carry gravity loads, such loads shall be transferred to the plaster skins by continuous direct bearing or by other approved transfer mechanism. Lateral loads shall be transferred by the reinforcing mesh adequately fastened to the structural members or assembly above or by other approved means.

507.4.8 Support of plaster skins. Support of plaster skins shall be in accordance with Sections 507.4.8.1 and 507.4.8.2.

507.4.8.1 Support of plaster skins for structural walls. Plaster skins for structural strawbale walls shall be continuously supported along their bottom edge to facilitate the transfer of loads to the foundation system. Acceptable supports include, but are not limited to: concrete or masonry stem wall, concrete slab, wood-framed floor adequately blocked, wood beam, or steel angle adequately anchored. A conventional metal or plastic weep screed alone shall not be considered an acceptable support.

507.4.8.2 Support of plaster skins for non-structural walls. Plaster skins for non-structural walls shall not be required to be supported along their bottom edge.

507.4.9 Loadbearing strawbale walls. Loadbearing strawbale walls shall be in accordance with Table 507.4(2) and shall be limited by the allowable load values therein.

507.4.10 Lateral load resisting strawbale walls. Strawbale walls shall be permitted to be used to resist in-plane lateral wind and seismic forces where detailed in accordance with Table 507.4(3), and shall be limited by the allowable load values therein. Other lateral load resisting systems including, but not limited to, plywood shear walls, pre-fabricated steel moment frames and steel cross-bracing, shall be permitted where they are in accordance with the prescriptive or performance based requirements of the *International Building Code*.

507.4.11 Design coefficients and factors for seismic design. The values given in Table 507.4(1) shall apply to reinforced plastered straw bale walls detailed in accordance with Table 507.4(3).

**TABLE 507.4(1)
DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC-FORCE-RESISTING SYSTEMS**

Seismic-Force-Resisting System	Response Modification Coefficient, R^a	System Overstrength Factor, Ω^b	Deflection Amplification Factor, C	Structural System Limitations and Building Height (ft) Limit ^c				
				Seismic Design Category				
				B	C	D	E	F
A. Bearing Wall Systems								
Reinforced straw bale walls	3	3	4	25	25	25	25	25
B. Building Frame Systems								
Reinforced straw bale walls	3.5	3	4.5	25	25	25	25	25

- a. R reduces forces to a strength level, not an allowable stress level
- b. The tabulated value of the overstrength factor shall be permitted to be reduced by subtracting one-half for structures with flexible diaphragms, but shall not be taken as less than 2.0 for any structure.
- c. Height shall be defined in accordance with the *International Building Code*.

**TABLE 507.4(2)
ALLOWABLE GRAVITY LOADS (POUNDS PER FOOT) FOR PLASTERED STRAWBALE WALLS**

WALL	PLASTER^a	SILL PLATES^{b, c}	ANCHOR³ BOLTS (or other sill fastening)	MESH^d	STAPLES^{e, f, g}	ALLOWABLE BEARING CAPACITY^h (plf)
A	Clay ^j	c	c	none required ^j	none required ¹⁰	300
B	soil-cement ^k	c	c	d	e, f, g	800
C	lime	c	c	d	e, f, g	450
D	cement-lime	c	c	d	e, f, g	800
E	cement	c	c	d	e, f, g	800

For SI: 1 inch=25.4mm, 1 pound per foot = 14.5939 N/m.

- a. Plasters shall conform with Sections 507.6.9 through 507.6.12 for makeup and thickness, with Section 507.5.6.1 for straightness, and with Section 507.5.8 for support of plaster skins.
- b. Sill plates shall support and be flush with each face of the bale wall.
- c. For walls supporting gravity loads only or for non-structural walls, sill plates and fastening shall be in accordance with the requirements for wood framed walls in the *International Building Code*. See Table 507.5(3) for requirements for shear walls and braced panel walls.
- d. Any metal mesh allowed by this section shall be installed throughout the plaster with minimum 4-inch laps and fastened per footnote e.
- e. Staples shall be at maximum spacing of 2-inches o.c., to roof or floor bearing assembly, or as shown necessary to transfer loads into the plaster skins in accordance with Section 507.5.8, and at a maximum spacing of 4-inches o.c. to sill plates.
- f. Staples shall be gun staples, stainless steel or electro-galvanized, 16 gauge with 1 ¼-inch legs, 7/16-inch crown; or manually driven staples, galvanized 15 gauge with 7/8-inch legs, 3/16-inch inner spread and rounded shoulder. Other staples shall be permitted to be used as designed by an architect or engineer.
- g. Staples shall be firmly driven, diagonally across mesh intersections at the spacing indicated.
- h. For walls with a different plaster on each side, the lower value shall be used.
- i. Minimum 1 ½-inch thickness. A compression test shall be provided that demonstrates a minimum 100 psi compressive strength.
- j. Except as necessary to transfer roof or floor loads to the plaster skins per 507.5.8.
- k. Minimum 1 ½-inch thickness. A compression test shall be provided that demonstrates a minimum 1000 psi compressive strength.

**TABLE 507.4(3)
ALLOWABLE SHEAR (POUNDS PER FOOT) FOR PLASTERED STRAWBALE PANELS**

WALL	PLASTER^a (both sides)	SILL PLATES^b	ANCHOR^c BOLTS (on center)	MESH^d	STAPLES^{e, f, g} (on center)	ALLOWABLE SHEAR^{h, i} (plf)
A1	Clay ^j	2x4	2 ft. 8 in.	none	none	60
A2	Clay ^j	2x4	2 ft. 8 in.	3 in. by 3 in. knotted sisal	3-inches	70
A3	Clay ^j	2x4	2 ft. 8 in.	2 in. by 2 in. high-density polypropylene	2-inches	120
A4	Clay ^j	2x4	2 ft. 8 in.	2"x2"x14ga ^k	4-inches	160
B	soil-cement ^l	4x4	2 ft. 0 in.	2 in. by 2 in. by14ga ^k	2-inches	320
C1	lime	2x4	2 ft. 8 in.	17ga. woven wire	3-inches	180
C2	lime	4x4	2 ft. 0 in.	2 in. by 2 in. by14ga ^k	2-inches	260
D1	cement-lime	4x4	2 ft. 8 in.	17ga. woven wire	2-inches	280
D2	cement-lime	4x4	2 ft. 0 in.	2 in. by 2 in. by14ga ^k	2-inches	380
E1	cement	4x4	2 ft. 8 in.	2 in. by 2 in. by14ga ^k	2-inches	480
E2	Cement ^m	4x4	2 ft. 0 in.	2 in. by 2 in. by14ga ^k	2-inches	640

- a. Plasters shall conform with Sections 507.6.7 through 508.6.12 for makeup and thickness, with Section 507.5.6.1 for straightness, and with Section 507.5.8 for support of plaster skins.
- b. Sill plates shall be Douglas fir-larch or southern pine and shall be preservative-treated where required by the *International Building Code*. Multiply allowable shear value by .82 for other species with specific gravity of .42 or greater, or by .65 for all other species.
- c. Anchor bolts shall be 5/8-inch diameter with 2-inch by 2-inch by 3/16-inch washers, with minimum 7-inch embedment in concrete or masonry foundation. Anchor bolts or other fasteners into framed floors shall be engineered.
- d. Mesh shall run continuous vertically from sill plate to top plate, roof or floor beam, or roof or floor bearing assembly, or shall lap a minimum 12-inches. Horizontal laps shall be a minimum of 4-inches. Steel mesh shall be galvanized. Galvanized steel mesh shall be separated from preservative treated wood by grade D paper, 15# roofing felt, or other approved barrier.
- e. Staples shall be gun staples, stainless steel or electro-galvanized, 16 gauge with 1 1/4-inch legs, 7/16-inch crown; or manually driven staples, galvanized 15 gauge with 7/8-inch legs, 3/16-inch inner spread and rounded shoulder. Other staples shall be permitted to be used as designed by an architect or engineer. Staples into pressure treated wood shall be stainless steel for shear panels only.
- f. Staples at spacing indicated to boundary conditions, including sill plate, and top plate, roof or floor beam, or roof or floor bearing assembly, and any vertical boundary framing.
- g. Staples shall be firmly driven diagonally across mesh intersections at spacing indicated.
- h. Values shown are for aspect ratios of 1:1 or less. Reduce values shown to 50% for the limit of a 2:1 aspect ratio. Linear interpolation shall be permitted for ratios between 1:1 and 2:1. The full value shown shall be used for aspect ratios greater than 1:1, where an additional layer of mesh is installed at the base of the wall to a height where the remainder of the wall has an aspect ratio of 1:1 or less, and the second layer of mesh is fastened to the sill plate with the required stapling, and the sill bolt spacing is decreased with linear interpolation between 1:1 and 2:1.
- i. For walls with a plaster Type A on one side and any other plaster type on the other side, the architect or engineer shall show transfer of the design lateral load into the stiffer Type B, C, D, or E plaster only, and 50% of the allowable shear value shown for that wall type shall be used.
- j. Minimum 1 1/2-inch thickness. The building official shall be permitted to require a compression test to demonstrate a minimum 150 psi compressive strength.
- k. 16 gauge mesh shall be permitted to be used with a reduction to .85 of the allowable shear values shown.
- l. Minimum 1 1/2-inch thickness. A compression test shall be provided that demonstrates a minimum 1000psi compressive strength.
- m. 1 1/2-inch thickness.

507.4.12 Resistance to out-of-plane lateral loads. Plastered strawbale walls shall be considered to be capable of withstanding out-of-plane design loads prescribed in the *International Building Code* with the following limitations and requirements, except where an engineered design is provided:

1. Walls with reinforced plasters shall not exceed a 6:1 ratio of stacked bale height to bale width in accordance with Section 507.4.2.
2. Walls with unreinforced plasters shall be not exceed a 4:1 ratio of stacked bale height to bale width.
3. Walls with unreinforced plasters or no plaster, and with internal or external pins, shall not exceed a 6:1 ratio of stacked bale height to bale width. Pins shall be 1/2 inch (13mm) diameter steel, wood or bamboo. Internal pins shall be installed vertically at a maximum 2 foot (610mm) spacing into the bales from top course to bottom course, with the bottom course being connected to its support similarly with pins or other approved means. Internal pins shall be continuous or shall overlap through one bale course. External pins shall be installed on both sides of the wall at a maximum 2 foot (610mm) spacing. External pins shall have full lateral bearing on the sill plate and the roof or floor bearing member, and shall be tightly tied through the wall to an opposing pin with polypropylene string at 30 inch (762mm) maximum spacing and maximum 15 inches (381mm) from each end.

507.4.13 Prescriptive design for plastered structural strawbale walls. Plastered strawbale walls shall be permitted to be used structurally, without engineered design, where such walls comply with Sections 507.4.13, 507.4.13.1, 507.4.13.2 and 507.4.13.3. Such walls shall also comply with Sections 507.4.3 through 507.4.9 and 507.4.12, and shall comply with other parts of Section 507 as applicable.

507.4.13.1 Loads and other limitations. Loads and other limitations shall be in accordance with Section 2308.2 Items 3 through 7 and Section 2308.2.2 of the *International Building Code*.

507.4.13.2 Gravity load bearing walls. Gravity load bearing walls shall be limited to wall types B, C, D, and E in Table 507.5(2), except that type A walls shall be permitted where they are demonstrated to support design loads no greater than the allowable load indicated in Table 507.4(2).

507.4.13.3 Braced panels. Strawbale shear walls shall be permitted to be used as braced panels in accordance with Sections 2308.9.3 and 2308.12 of the *International Building Code*. Strawbale shear panel types B, C, D, and E, as indicated in Table 507.4(3), shall be permitted to be used in situations where braced wall panel Types 2, 3, 4, 6, or 7 are permitted. Strawbale shear panel Type A shall be permitted to be used in situations where braced wall panel Types 1 or 5 are permitted.

507.4.14 Connection of framed walls to strawbale walls. Framed walls perpendicular to, or at an angle to a straw bale wall assembly, shall be fastened to the bottom and top wood members of the strawbale wall in accordance with requirements for framed wood walls in the *International Building Code*. Where such connection is not possible, the abutting stud shall be connected to alternating straw bale courses with a 1/2 inch (13mm) diameter steel, wood, or bamboo dowel with minimum 8 inch (203mm) penetration.

507.4.15 Alternate performance design criteria. Where plastered strawbale walls and other plastered strawbale elements are engineered, the engineered design shall be in accordance with the following performance based criteria:

1. The design of strawbale structural elements and systems shall be based on rational analysis in accordance with established principles of mechanics. A complete load path shall be provided, capable

of transferring all loads from their point of origin to all load-resisting elements based on a rational connection of the components.

2. For elements dominated by flexural deformation, principles of mechanics as applied to the analysis of under-reinforced (tension-controlled) reinforced concrete members shall be permitted to be used in the analysis of reinforced plasters, including those with binders other than cement. At regions of discontinuity, strut and tie models shall be permitted to be used in the analysis of reinforced plasters. The strength, stiffness, and deformation compatibility of any plaster, reinforcement, and strawbale components shall be considered in the analysis.
3. Suitable test data shall be permitted to be used to develop design values to achieve performance consistent with other materials, components, and systems recognized by the *International Building Code*.

507.5 Finishes. Finishes applied to strawbale walls shall be permitted to be of any type permitted by the *International Building Code* and shall comply with Sections 507.5.1 through 507.5.15 of this code and Chapters 14 and 25 of the *International Building Code*, except as otherwise stated in Sections 507.5.1 through 507.5.15. Strawbale walls and other strawbale elements shall be finished so as to provide mechanical protection, fire resistance, restrict the passage of air through the bales, and to protect them from weather in accordance with this section and the *International Building Code*.

Exception: Truth windows are permitted where a fire-resistive rating is not required and they are protected from the weather.

507.5.1 Vapor retarders. Vapor retarders shall not be used on a bale wall, nor shall any other material be used that has a vapor permeance rating less than 5 perms, except as permitted or required elsewhere in Sections 507.5.1 through 507.5.15, or as deemed to be necessary by an architect or engineer.

507.5.2 Plaster. Plaster applied to bales shall be of any type described in Sections 507.5.3 through 507.5.15.

507.5.3 Plaster and membranes. Plaster shall be permitted to be applied directly to strawbale walls and other strawbale elements, to facilitate transpiration of moisture from the bales, and to secure a mechanical bond between the skin and the bales, except where a membrane is allowed or required elsewhere in this section. Structural bale walls shall not have a membrane between straw and plaster, or shall have sufficient attachment through the bale wall from one plaster skin to the other in accordance with an engineered design.

507.5.4 Lath and mesh for plaster. The surface of the straw bales shall be considered to function as lath, and no other lath or mesh shall be necessary, except as required for tensile strength of the plaster or wall assembly in particular structural applications as required by Section 507.4 or an engineered design.

507.5.5 Plaster on non-structural walls. Plaster on walls that do not carry gravity loads, and are not designed to resist in-plane lateral forces, shall be permitted to be any plaster that is in accordance with Sections 507.5.7 through 507.5.12.

507.5.6 Plaster on structural walls. Plaster on structural walls shall comply with Sections 507.5.7 through 507.5.12. Plaster on walls that carry gravity loads shall comply with Table 507.4(2). Plaster on walls designed to resist in-plane lateral forces, shall comply with Table 507.4(3).

507.5.7 Clay, earth and earthen plaster. Clay, earth and earthen plaster shall be any plaster having a binder of clay. Such plaster shall also contain sand or other inert granular material, shall be in accordance with Sections 507.5.7.1 through 507.5.7.6, and shall be permitted to contain reinforcing fibers including, but not limited to, chopped straw and animal hair.

507.5.7.1 Mesh. Plasters with clay binders shall not be required to contain mesh except as required in Table 507.4(3). Where mesh is required, it shall be composed of natural fibers, corrosion-resistant metal, nylon, or high-density polypropylene.

507.5.7.2 Thickness. Clay plaster shall be a minimum 1- inch (25mm) thick, unless required to be thicker for structure or fire-resistance, as described elsewhere in Section 507.

507.5.7.3 Rain-exposed. Clay plaster, where exposed to rain, shall be finished with lime plaster, or other approved erosion resistant finish.

507.5.7.4 Prohibited finish coat. Cement plaster and cement-lime plaster shall be prohibited as a finish coat over clay plasters.

507.5.7.5 Additives. Additives shall be permitted to increase the plaster's workability, durability, strength, or water resistance.

507.5.7.6 Separation of wood and clay plaster. A separation or moisture barrier shall not be required between untreated wood and clay plaster.

507.5.8 Soil-cement plaster, earth-cement, stabilized earth or pise. Soil-cement plaster, earth-cement, stabilized earth or pise shall be in accordance with Sections 507.5.8.1 through 507.5.8.3.

507.5.8.1 General. Soil-cement plaster shall be comprised of earth (free of organic matter), Portland cement, and sand or other inert granular material, and shall be permitted to contain reinforcing fibers.

507.5.8.2 Mesh. Soil-cement plaster shall use any corrosion-resistant metal mesh permitted by the IBC, or as described in Section 507.5 where used on a structural wall.

507.5.8.3 Thickness. Soil-cement plaster shall be a minimum of 1- inch (25mm) thick.

507.5.9 Gypsum plaster. Gypsum plaster in accordance with Section 2511 of the *International Building Code* shall be limited to use on interior surfaces and on non-structural walls.

Exception: Gypsum plaster shall be permitted as a finish coat over a permitted structural plaster.

507.5.10 Lime plaster. Lime plaster shall be any plaster having a binder that is comprised primarily of calcium hydroxide (CaOH). This includes Type N or Type S hydrated lime, natural hydraulic lime, or quicklime. Lime plasters shall comply with ASTM Standards C5 and C206. The plaster shall be permitted to be applied in 2 coats, provided that the combined thickness is at least 7/8-inch (22mm), and each coat is not greater than 5/8-inch (16mm).

507.5.11 Cement-lime plaster. Cement-lime plaster shall comply with Section 2512 of the *International Building Code*, except that the plaster shall be permitted to be applied in 2 coats, provided that the combined thickness is at least 7/8 inch (22mm), and each coat is not greater than 5/8 inch (16mm).

507.5.12 Cement plaster. Cement plaster shall comply with Section 2512 of the *International Building Code*, except that the amount of lime in all plaster coats shall be a minimum of 1 part lime per 6 parts cement to allow a minimum acceptable vapor permeability and that the plaster shall be permitted to be applied in 2 coats, provided that the combined thickness is at least 7/8 inch (22mm) and each coat is not greater than 5/8 inch (16mm) thick. The combined thickness of all plaster coats shall be not more than 1 1/2 inch (38mm).

507.5.13 Finishes over plaster. Other finishes, as permitted elsewhere in Section 507 of this code or the *International Building Code*, shall be permitted to be applied over the plaster, except as prohibited in Section 507.5.14.

507.5.14 Prohibited plasters and finishes. Any plaster or finish with a singular or cumulative perm rating less than 5 perms is prohibited on straw bale walls or other bale elements, except where demonstrated to be necessary by an architect or engineer, or as required elsewhere in this section.

507.5.15 Separation of wood and plaster. Where wood framing or wood sheathing occurs in strawbale walls, such wood surfaces shall be separated from any plaster finish with No. 15 asphalt felt, grade 'D' paper, or other approved material in accordance with Section 1404.2 of the *International Building Code*, except where the wood is preservative-treated or naturally durable.

Exception: Clay plasters in accordance with Section 507.5.7.6.

507.6 Fire Resistance. Fire-resistance ratings for strawbale walls shall be established in accordance with Sections 507.6.1 through 507.6.3. Strawbale walls constructed with plaster finishes in accordance with Sections 507.6.1 through 507.6.3 shall be deemed to meet the conditions of acceptance as outlined in ASTM Method E119 for fire resistance of non-loadbearing walls.

507.6.1 Clay plaster. 1-hour fire-resistance-rated clay plastered strawbale walls shall comply with all of the following:

1. Bales shall be laid flat or on-edge in a running bond. Gaps shall be fire-stopped with a mixture of clay and straw or an approved equivalent.
2. Bales shall maintain an average dry density of 7.5 pounds per cubic foot (120 kg/cubic meter) and maintain a minimum width of 18- inches (457mm)
3. Plaster on each side of the wall shall attain a minimum thickness of 1- inch (25mm) with a mixture of 3 parts clay, 2 parts chopped straw and 6 parts sand.
4. Plaster application shall be consistent with Section 507.5.7 for the number of coats required and the thickness per coat.

507.6.2 Cement plaster. 2-hour fire-resistance-rated cement plastered strawbale walls shall comply with all of the following:

1. Bales shall be laid flat or on-edge in a running bond. Gaps shall be fire-stopped with a mixture of clay and straw or an approved equivalent.
2. Bales shall maintain an average dry density of 7.5 pounds per cubic foot (120 kg/cubic meter) and maintain a minimum width of 14- inches (381mm).
3. Plaster on each side of the wall shall attain a minimum thickness of 1- inch (25mm) with a mixture of 3 parts Portland cement, 1 part lime and 10 parts sand.
4. 1 ½-inch (38mm) by 17 gauge galvanized woven wire mesh shall be placed underneath the bottom course of bales, stretched vertically, and maintain a minimum 4-inch (101mm) overlap. 1 ½-inch (38mm) staples shall be fastened to the top plate at 6 inches (101mm). Mesh shall be attached to any side wood members with 1 ½-inch (38mm) staples at 16-inches (406mm) on center. 9 gauge U-pins with minimum 8- inch (203mm) legs shall be installed in the field at 18-inches (457mm) on center.

5. Plaster application shall be consistent with Section 507.5.12 for the number of coats required and the minimum or maximum thickness per coat.

507.6.3 Rating with other finishes. Strawbale walls shall be considered to have the same fire-resistive rating as wood-frame construction with the same wall-finishing system.

507.7 Permitted types of construction. Strawbale walls with a fire-resistance rating in accordance with Section 507.6.1 or 507.6.2 shall be permitted wherever combustible walls of the same fire-resistance are permitted by Chapter 6 of the *International Building Code*. Any finish allowed by Section 507 and the *International Building Code* shall be permitted wherever non-rated combustible walls are allowed by the *International Building Code*.

507.8 Openings in rated walls. Openings and penetrations in bale walls required to have a fire-resistance rating shall satisfy the same requirements for openings and penetrations as prescribed in the *International Building Code*.

507.9 Clearance to fireplaces and chimneys. Strawbale surfaces adjacent to fireplaces or chimneys shall have a minimum 1/4 inch (6mm) thick plaster coat of any type permitted by Section 507, and shall maintain the specified clearances to the plaster finish as required to combustibles in Sections 2111, 2112 and 2113 of the *International Building Code*, or as required by the manufacturer's installation instructions, whichever is more restrictive.

507.10 Electrical. Wiring and other elements of the electrical system within or on bale walls shall comply with NFPA 70 except as stated in Sections 507.10.1 through 507.10.4.

507.10.1 Wiring. Wiring methods shall be Type NM or UF cable, or metallic or non-metallic conduit. Wiring unprotected by conduit shall be installed a minimum of 2-inches (50mm) from the face of the bale, except as necessary to enter or exit a junction box. The wiring shall be pushed into joints between bales, or into the bale itself, or the bales shall be permitted to be channeled to receive the wire.

507.10.2 Wiring attachment. Where not held securely between bales or within a bale, and not attached via staples to a wood member, wiring on strawbale walls shall be attached with minimum 17 ga. wire in a 'U' configuration, with minimum 8-inch (203mm) long legs, as needed to comply with the attachment requirements of NFPA 70.

507.10.3 Attachment of electrical boxes. Electrical boxes on bale walls shall be securely fastened to framing members, or to wooden stakes driven a minimum of 10 inches (254mm) into the bales, or shall be secured by the combination of wire mesh and plaster, or by an approved equivalent method.

507.10.4 Attachment of service and subpanels. Electrical service equipment and panelboards on bale walls shall be securely fastened to framing members, or to other wood members that have been adequately fastened to the straw bales.

507.11 Thermal Insulation. R-values for strawbale walls shall be in accordance with Section 507.11.1 or 507.11.2.

507.11.1 Wall assembly R-value. Strawbale wall assemblies constructed with 2- or 3- string bales, laid flat or on-edge, and of any grain and with any finish allowed by this section shall be considered to have a thermal resistance of R-30.

507.11.2 Unit R-value. The unit R-value of a strawbale element with bales laid flat shall be R-1.3 per inch, and with bales on-edge shall be R-2 per inch.

SECTION 508 PROJECT ELECTIVES

508.1 General. Section 507 contains *project electives* related to material resource conservation and efficiency. *Project electives* shall not be mandatory unless selected by the owner and indicated in Table 303.1.

508.2 Waste management project elective. Projects seeking a waste management *project elective* in accordance with Table 303.1 and Section 303.4 shall comply with Section 502.1, except that the materials required to be diverted from landfills shall be increased by 20 percent.

508.3 Material selection project electives. Each of the following shall be considered a separate material selection *project elective*. The *project electives* are cumulative and compliance with each item shall be recognized individually.

1. Compliance with this *project elective* shall require compliance with Section 503.2, except that *buildings* and *structures* shall contain used, *recycled content*, recyclable, bio-based and indigenous materials that comply with Sections 503.2.1 through 503.2.5 such that the aggregate total materials compliant with those sections constitute at least 70 percent of the total *building* products and materials used, based on mass or cost, used singularly.
2. Compliance with Item 1 except that such materials shall be used for at least 85 percent of the total mass or cost of materials in the project.



508.4 Service life plan project electives. Service life *project electives* shall be in accordance with Sections 508.4.1 or 508.4.2.

508.4.1 Building service life plan project electives. Projects seeking building *service life plan project electives* in accordance with Table 303.1 and Section 303.4 shall comply with this section. A *building service life plan* (BSLP) in accordance with Section 505.1 shall be included in the *construction documents*. BSLP *project electives* shall be recognized in accordance with the criteria in Table 508.4.1.

TABLE 508.4.1

PROJECT ELECTIVES FOR BUILDING DESIGN LIFE CATEGORIES AND MINIMUM COMPONENT DESIGN LIFE

PROJECT ELECTIVES	2	1
BUILDING <u>DESIGN LIFE</u> CATEGORY	200 Years	100 Years
COMPONENT	COMPONENT <u>MINIMUM DESIGN LIFE</u> (Years)	
Structural elements and concealed materials and assemblies	200	100
Materials and assemblies where replacement is cost prohibitive or impractical	100	100
Major materials and assemblies that are replaceable	40	40
Mechanical, electrical and plumbing equipment and systems	25	25
Site hardscape	75	50

508.4.2 Interior adaptability project elective: Projects seeking an interior adaptability *project elective* in accordance with Table 303.1 and Section 303.4 shall comply with this section. The interior adaptability

plan required by Section 505.1.2.2 shall provide for use of at least 75 percent of interior *building* materials within the same *building* for a minimum of 35 years.

CHAPTER 6

ENERGY CONSERVATION, EFFICIENCY AND ATMOSPHERIC QUALITY

SECTION 601 GENERAL

601.1 Scope. This chapter shall regulate the design, construction, commissioning and operation of buildings and building sites for the effective use of energy.

601.2 Intent. The intent of this code is to ensure the effective use of energy by buildings and building sites. This chapter is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve the effective use of energy.

601.3 Minimum requirements. Buildings and building sites shall comply with Sections 502.4, 503.2, 504 and 505 of the *International Energy Conservation Code* regardless of the compliance path chosen.

SECTION 602 ENERGY PERFORMANCE, PEAK POWER AND REDUCED CO₂e EMISSIONS

602.1 Zero energy performance index (zEPI). The building shall be designed and constructed to have a zEPI not greater than the values shown in Table 602.1.

**TABLE 602.1
MINIMUM ZERO ENERGY PERFORMANCE INDEX**

Building Occupancy Types	zEPI Point of Entry ^a	zEPI of Jurisdictional Choice ^b
Assembly: Groups A-1, A-2, A-3, A-4, A-5	51	—
Business: Group B	51	—
Educational: Group E	51	—
Factory and Industrial: Groups F-1, F-2	51	—
High Hazard: Groups H-1, H-2, H-3, H-4, H-5	51	—
Institutional: Groups I-1, I-2, I-3, I-4	51	—
Mercantile: Group M	51	—
Groups R-1, R-2, R-3, R-4 (see note c)	51	—
Storage: Groups S-1, S-2	51	—
Utility and Miscellaneous: Group U	51	—

- a. Minimum acceptable performance for all *building* types and sizes.
- b. Where the *jurisdiction* elects to adopt a greater threshold for energy efficiency, a zEPI of Jurisdictional Choice shall apply only to *buildings* pursuing performance-based compliance in accordance with Section 602.2.2.
- c. Residential occupancies as regulated by this code in accordance with Section 101.2.

602.2 Compliance paths. New *buildings*, existing *building additions*, and *alterations* to existing *buildings* over 25,000 square feet in *total building floor area* and their associated *building sites* shall comply with Section 602.2.2.

or 602.2.3. All other *buildings, additions or alterations* shall comply with Sections 602.2.1, 602.2.2, 602.2.3 or 602.2.4.

602.2.1 Prescriptive-based compliance. *Buildings* designed on a prescriptive basis shall comply with the requirements of Sections 604, 605, 606, 607, 608, 609, 610, 611 and 612 of this code, and shall be deemed to have a zEPI in compliance with Section 602.1.

602.2.2 Performance-based compliance. *Buildings* designed on a performance basis shall comply with Sections 604, 605, 609.6, 610, 611 and 612 of this code.

602.2.2.1 Minimum performance. The *building* shall be designed and constructed to deliver a *zero energy performance index (zEPI)* not greater than the value shown in Table 602.1. The zEPI shall be calculated in accordance with Section 603.1.1. *Buildings* complying with the 2006 *International Energy Conservation Code* shall be deemed to have a zEPI of 73.

602.2.2.2 Building peak energy demand. *Buildings* shall be designed and constructed to limit peak energy demand during the *building's* anticipated peak consumption period in accordance with Section 603.1.2.

602.2.2.3 Annual direct and indirect CO₂e emissions. Where total annual *CO₂e emissions* limits are required in Table 302.1, *CO₂e emissions* calculations shall be performed in accordance with Sections 603.1.3 and 603.1.4. The emissions associated with the proposed design shall be less than or equal to the *CO₂e emissions* associated with the *standard reference design* in accordance with Equation 6-1.

$$CO_2e \text{ emissions associated with the proposed building design} \leq CO_2e \text{ emissions associated with the standard reference design} \times zEPI \text{ of proposed building}/100 \quad \text{(Equation 6-1)}$$

602.2.3 Outcome based compliance. *Buildings* that are intended to comply on an outcome basis shall comply with this section and Sections 604, 605 and 612 of this code.

602.2.3.1 Maximum energy use. The *building* shall be designed, constructed, commissioned, operated and maintained to have an *annual net energy performance* in accordance with Section 603.2.

602.2.3.2 Building peak energy demand. The *building* shall be designed, constructed, commissioned, operated and maintained to limit *peak net energy demand* during the *building's* anticipated peak consumption period in accordance with Section 603.2.

602.2.3.3 CO₂e Emissions. The *building* shall be designed, constructed, commissioned, operated and maintained to limit *annual direct and indirect CO₂e emissions* in accordance with Section 603.2.

602.2.4 Energy use intensity (EUI). The *building* shall be designed and constructed to deliver an energy use intensity (EUI) that would place the *building* in the top 10 percent of existing *buildings* in terms of energy performance. For *building* types eligible to receive a score in EPA's Target Finder (www.energy.gov/targetfinder), the *building EUI* shall be less than or equal to the source energy use intensity necessary for the building to achieve a score of 90 in Target Finder. For those *building* types not eligible for a score in Target Finder, the *building* shall be designed and constructed to deliver an EUI that is at least 50% lower than the average source EUI for similar space types in CBECS, found at

http://www.energystar.gov/ia/business/tools_resources/new_bldg_design/2003_CBECSPerformanceTargetsTable.pdf.

602.2.4.1 EUI determination. *Building* energy use intensity (EUI) shall be determined in accordance with Section 603.3 and Equation 6.2.

$$EUI = TAE/SF \quad \text{(Equation 6-2)}$$

Where:

TAE = Total annual energy projected to be consumed on site, including renewable energy generated on site, as determined in accordance with Section 603

SF = Gross square feet of the building

602.3 Documentation and verification for alterations to existing buildings. The energy performance associated with *alterations to existing buildings* shall be documented by the building owner in accordance with Section 602.3.1, 602.3.2 or 602.3.3. The energy used by the existing building after the alteration shall not exceed that of the building prior to the alteration. Additions shall comply with section 602.2.

602.3.1 Determination of energy savings. A comparison of the energy use and demand patterns of the *building* prior to the *alteration* for a continuous 12 month period to the estimated energy use and demand patterns of the *building* after and including the *alteration* for a continuous 12 month period.

602.3.2 Measurement-based compliance. Measurement-based compliance shall be performed by an *approved agency* that documents that the energy use and demand patterns of the *building* after *alterations* do not exceed the energy use and demand patterns of the *building* prior to alterations as measured in consistent units of energy.

Exception: Modeling-based compliance by an *approved agency* test in accordance with ASHRAE 140, class 1 procedures of section 5.

602.3.3 Third-party certification-based compliance. Certification-based compliance performed by an *approved agency* that by reason of measurement, simulation, comparative studies, or other *approved* means, document that the *building* as altered does not consume more energy or have a greater demand than the *building* prior to alterations.

SECTION 603 ENERGY USE AND ATMOSPHERIC IMPACTS

603.1 Determination of building annual energy use, peak energy demand and reduced CO₂e emissions. Where *buildings* are designed using the performance-based compliance path in accordance with Section 602.2.2, or are required to report *CO₂e* emissions in accordance with Section 602.2.2.3, the methods for calculating and verifying annual energy use, peak energy demand, and reduced *CO₂e emissions* shall be in accordance with this section.

603.1.1 Annual energy use. The annual energy use shall include all energy used for *building* functions covered by this code minus any renewable energy or *waste energy recovery* savings derived on the site.

603.1.1.1 zEPI determination. *Building zero energy performance index (zEPI)* shall be determined in accordance with Section 603.3 and Equation 6-3.

$$zEPI = 57 \times (PD - RE - WE) / RD \quad \text{(Equation 6-3)}$$

Where:

PD = Total annual energy delivered to the *proposed* design and consumed on site, as determined in accordance with Section 603.

RE = Total annual energy savings from renewable energy derived on site

RD = Total annual energy used by a *standard reference design*, determined in accordance with Section 603

WE = Total annual energy savings from *waste energy recovery*

PD, RE, RD and WE shall all be expressed in consistent units of energy in accordance with Section 603.1.1.

603.1.2 Documentation procedures. The annual energy use of the *building* and *building site* shall be documented in accordance with Section 506.4 of the *International Energy Conservation Code*.

603.1.3 Annual direct and indirect CO₂e emissions. Where *CO₂e* emissions limits are required by the *jurisdiction* in Table 302.1, the *CO₂e* emissions calculations for the *building* and *building site* shall be in

accordance with Sections 603.1.3.1 and 603.1.3.2 based on electric power delivered to the *building* at the utility *meter* for *building* functions covered by this code. Emissions associated with electric power use shall be calculated by multiplying the electric power delivered to the *building* at the electric utility *meter* by the CO_{2e} conversion factor in Table 603.1.3 based on the eGRID Sub-region in which the *building* is located.

603.1.3.1 On-site electricity. Emissions associated with use of electric power shall be based on electric power excluding any renewable or recovered waste energy covered under Section 602.1.2. Emissions shall be calculated by multiplying the electric power used by the *building* at the electric utility *meter* by the CO_{2e} conversion factor in Table 603.1.3 based on the eGRID Sub-region in which the *building* is located.

603.1.3.2 On-site non-renewable fuels. Emissions associated with the use of non-renewable fuels such as natural gas, fuel oil, and propane shall be calculated by multiplying the fossil fuel energy used by the *building* at the utility *meter* by the national emission factors in Table 603.1.4. Emissions associated with fossil fuels not listed shall be calculated by multiplying the fossil fuel used by the *building* at the utility *meter* by 250. Emissions associated with purchased district energy shall be calculated by multiplying the energy used by the *building* at the utility *meter* by 150 for hot water and steam, and for district cooling, the factors from Table 603.1.3 based on the eGRID Sub-region in which the *building* is located.

603.1.4 Annual direct and indirect CO_{2e} emissions associated with on-site use of fossil fuels and purchased district energy. Emissions associated with the use of natural gas, fuel oil and, propane shall be calculated by multiplying the natural gas, fuel oil, and propane delivered to the *building* at the utility *meter* by the corresponding emission factors in Table 603.1.4. Emissions associated with fossil fuels not listed shall be calculated by multiplying the fossil fuel delivered to the *building* at the utility *meter* by 250. Emissions associated with purchased district heating shall be calculated by multiplying the heating energy delivered to the *building* at the utility *meter* by 150 for hot water and steam, and for district cooling, the factors from Table 603.1.3 based on the eGRID Sub-region in which the *building* is located.

Where emissions calculations are required by the jurisdiction in Table 302.1, the emissions associated with the use of non-renewable fuels such as natural gas, fuel oil, and propane shall be calculated by multiplying the fossil fuel energy used by the building at the utility meter by the national emissions factors in Table 603.1.4.

**TABLE 603.1.1(1)
ELECTRICITY GENERATION ENERGY CONSERVATION FACTORS BY eGRID SUB REGION^a**

eGRID 2007 Sub-region Acronym	eGRID 2007 Sub-region Name	Energy Conversion Factor
AKGD	ASCC Alaska Grid	2.97
AKMS	ASCC Miscellaneous	1.76
ERCT	ERCOT All	2.93
FRCC	FRCC All	2.97
HIMS	HICC Miscellaneous	3.82
HIOA	HICC Oahu	3.14
MORE	MRO East	3.40
MROW	MRO West	3.41
NYLI	NPCC Long Island	3.20
NEWE	NPCC New England	3.01
NYCW	NPCC NYC/Westchester	3.32
NYUP	NPCC Upstate NY	2.51
RFCE	RFC East	3.15

eGRID 2007 Sub-region Acronym	eGRID 2007 Sub-region Name	Energy Conversion Factor
RFCM	RFC Michigan	3.05
RFCW	RFC West	3.14
SRMW	SERC Midwest	3.24
SRMV	SERC Mississippi Valley	3.00
SRSO	SERC South	3.08
SRTV	SERC Tennessee Valley	3.11
SRVC	SERC Virginia/Carolina	3.13
SPNO	SPP North	3.53
SPSO	SPP South	3.05
CAMX	WECC California	2.61
NWPP	WECC Northwest	2.26
RMPA	WECC Rockies	3.18
AZNM	WECC Southwest	2.95

^aSources: EPA eGrid2007 version 1.1, 2005 data; EPA eGrid regional gross grid loss factors; EIA Table 8.4a (Sum tables 8.4band 8.4c) and Table 8.2c (Breakout of Table 8.2b), 2005 data.

**TABLE 603.1.1(2)^a
U.S. AVERAGE BUILDING FUELS ENERGY
CONVERSION FACTORS BY FUEL TYPE**

Fuel Type	Energy Conversion Factor
Natural Gas	1.09
Fuel Oil	1.13
LPG	1.12

**TABLE 603.1.3
ELECTRICITY EMISSION RATE BY eGRID SUB-REGION^a**

eGRID 2007 Sub-region Acronym	eGRID 2007 Sub-region Name	2005 CO ₂ e Rate (lbs/MWh)
AKGD	ASCC Alaska Grid	1270
AKMS	ASCC Miscellaneous	515
ERCT	ERCOT All	1417
FRCC	FRCC All	1416
HIMS	HICC Miscellaneous	1595
HIOA	HICC Oahu	1891
MORE	MRO East	1971
MROW	MRO West	1957
NYLI	NPCC Long Island	1651
NEWE	NPCC New England	999
NYCW	NPCC NYC/Westchester	874

eGRID 2007 Sub-region Acronym	eGRID 2007 Sub-region Name	2005 CO ₂ e Rate (lbs/MWh)
NYUP	NPCC Upstate NY	774
RFCE	RFC East	1224
RFCM	RFC Michigan	1680
RFCW	RFC West	1652
SRMW	SERC Midwest	1966
SRMV	SERC Mississippi Valley	1094
SRSO	SERC South	1601
SRTV	SERC Tennessee Valley	1623
SRVC	SERC Virginia/Carolina	1220
SPNO	SPP North	2106
SPSO	SPP South	1780
CAMX	WECC California	768
NWPP	WECC Northwest	958
RMPA	WECC Rockies	1999
AZNM	WECC Southwest	1391

a. Sources: EPA eGRID2007 Version 1.1, 2005 data; EPA eGrid regional gross grid loss factor

**Table 603.1.4
Fossil Fuel Emission Factors**

Emission Rate ^{a, b} (lb/MMBtu HHV)	Natural Gas as Stationary Fuel	Fuel Oil as Stationary Fuel	Propane as Stationary Fuel
CO ₂ e	137.35	200.63	162.85

a. 1 MMBtu = 1,000,000 Btu = 10 therms.

b. HHV = High Heating Value. To convert to kg, multiply the pound value by 0.454.

603.2 Determination of and compliance with building annual net energy performance, peak net energy demand and CO₂e emissions requirements. Where buildings are designed using the outcome based compliance path in accordance with Section 602.2.3, the *annual net energy performance, peak net energy demand, and annual direct and indirect CO₂e emissions* shall meet the provisions of Table 603.2(1) through 603.2(3). *Annual net energy performance* and *peak net energy demand* shall be based on the estimated energy use of the *building* for all purposes for 12 continuous months prior to commissioning and based on actual utility consumption for 12 continuous months after commissioning. Energy uses shall be converted to consistent units in accordance with Section 603.1.1. *Annual direct and indirect CO₂e emissions* shall be based on conversion of the energy use in accordance with Sections 603.1.3 and 603.1.4.

Compliance shall be determined in accordance with Sections 603.2.1 through 603.2.4.

603.2.1 Design. For the purposes of plan review and approval to construct the *building*, compliance shall be based on submission of calculations and supporting data by a *registered design professional* indicating that the building as designed will comply with the provisions of Section 603.2 after construction and *commissioning*. Calculation software tools and procedures used to document compliance shall include the capabilities identified in accordance with Section 506.6 of the *International Energy Conservation Code*.

603.2.2 Construction. For the purposes of approval of the construction of the *building*, compliance shall be based on a statement from the building contractor or his authorized representative that the building was

constructed in accordance with the approved plans and specifications as submitted by the *registered design professional* and approved pursuant to Section 603.2.1.

603.2.3 Commissioning. For the purposes of approval of the *building* as constructed and initially operated, compliance shall be based on submission of a commissioning report by the building owner or his/her designated agent showing data necessary to validate compliance with Section 603.2 for one complete year of building operation as provided in Section 612.

603.2.4 Annual operations. For the purposes of approval of the *building* as meeting the provisions of Section 603.2 subsequent to submission of a commissioning report under Section 603.2.3, an operational report shall be submitted by the building owner or his/her designated agent showing data necessary to validate compliance with Section 603.2 on a calendar year basis in accordance with Section 612.

TABLE 603.2(1)
ANNUAL NET ENERGY PERFORMANCE

Building Occupancy Types ^a	ANEP ^b
Assembly: Groups A-1, A-2, A-3, A-4, A-5	
Business: Group B	
Educational: Group E	
Factory and Industrial Groups F-1, F-2	
High Hazard: Groups H-1, H-2, H-3, H-4, H-5	
Institutional: Groups I-1, I-2, I-3, I-4	
Mercantile: Group M	
Groups R-1, R-2, R-3, R-4 (see note c)	
Storage: Groups S-1, S-2	
Utility and Miscellaneous: Group U	

- a. *Building* occupancy types will have varying energy performance. It is recommended that the adopting entity further refine the list by naming specific *building* uses such as elementary school, middle school, high school, university for Group E or limiting the occupancy types to which the adopting entity would apply this compliance option such as government owned office *buildings*, police stations or fire stations.
- b. Minimum performance in Btu/sf/year, or other appropriate metric, to be filled in by adopting entity.
- c. Residential occupancies as regulated by this code in accordance with Section 101.2.

TABLE 603.2(2)
PEAK NET ENERGY DEMAND

Building Occupancy Types ^a	PNED ^b
Assembly: Groups A-1, A-2, A-3, A-4, A-5	
Business: Group B	
Educational: Group E	
Factory and Industrial: Groups F-1, F-2	
High Hazard: Groups H-1, H-2, H-3, H-4, H-5	
Institutional: Groups I-1, I-2, I-3, I-4	
Mercantile: Group M	
Groups R-1, R-2, R-3, R-4 (see note c)	
Storage: Groups S-1, S-2	

Utility and Miscellaneous: Group U	
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a. Building occupancy types will have varying energy performance. It is recommended that the adopting entity further refine the list by naming specific *building* uses such as elementary school, middle school, university for Group E or limiting the occupancy types to which the adopting entity would apply this compliance option such as government owned office *buildings*, police stations or fire stations.

b. Minimum performance in kW or other appropriate metric, to be fitted in by adopting entity.

c. Residential occupancies as regulated by this code in accordance with Section 101.2.

TABLE 603.2(3)
ANNUAL DIRECT AND INDIRECT CO₂e EMISSIONS

Building Occupancy Types ^a	ACO ₂ E ^b
Assembly: Groups A-1, A-2, A-3, A-4, A-5	
Business: Group B	
Educational: Group E	
Factory and Industrial: Groups F-1, F-2	
High Hazard: Groups H-1, H-2, H-3, H-4, H-5	
Institutional: Groups I-1, I-2, I-3, I-4	
Mercantile: Group M	
Groups R-1, R-2, R-3, R-4 (see note c)	
Storage: Groups S-1, S-2	
Utility and Miscellaneous: Group U	

- a. Building occupancy types will have varying energy performance and consequent emissions. It is recommended that the adopting entity further refine the list by naming specific *building* uses such as elementary school, middle school, high school, university for Group E or limiting the occupancy types to which the adopting entity would apply this compliance option such as government owned office *buildings*, police stations or fire stations.
- b. Minimum performance in pounds or other appropriate metric, to be filled in by adopting entity.
- c. Residential occupancies as regulated by this code in accordance with Section 101.2.

603.3 Calculation procedures. The annual energy use of the *building and building site* shall be calculated in accordance with Section 506.5 of the *International Energy Conservation Code*, except as required by Section 603.3.1 and the modifications to Table 506.5.1(1) of the *International Energy Conservation Code*.

Table 506.5.1(1) of the *International Energy Conservation Code* shall be modified as follows:

603.3.1 Electrical system efficiency performance path. The annual energy use calculation for *buildings and building sites* shall include electrical system efficiency in both the *proposed design* and the *standard reference design* in accordance with Equations 6-4, 6-5 and 6-6.

$$\text{Power delivered to the } \textit{building} = \text{Power delivered to load} / \text{ESE} \quad \text{(Equation 6-4)}$$

$$\text{ESE} = \sum (\text{FE}_1 \times \text{FL}_1/\text{TL}) + (\text{FE}_2 \times \text{FL}_2/\text{TL}) + \dots \quad \text{(Equation 6-5)}$$

$$\text{FE}_1 = 100\% - [0.525\% + (\text{VDF}_1 \times 0.35) + (100\% - \text{TE}_1)] \quad \text{(Equation 6-6)}$$

ESE = total electrical system efficiency, in percent.

FE_{1,2...} = efficiency of each feeder, in percent.

FL_{1,2...} = design load on each feeder.

TL = total design load on all feeders.

VDF_{1,2...} = *voltage drop* of each feeder, in percent, at design load.

TE_{1,2...} = efficiency of the distribution transformer powering the feeder.

603.4 Qualified software for determinations of annual energy use. Calculation software tools and procedures used to comply with Section 603 shall include the capabilities identified in accordance with Section 506.6 of the *International Energy Conservation Code*.

603.5 Design professional in responsible charge of building energy simulation. For purposes of this section, and where it is required that documents be prepared by a *registered design professional*, the *code official* shall be authorized to require the owner to engage and designate on the *building permit* application a *registered design professional* who shall act as the *registered design professional in responsible charge of building energy simulation*. If the circumstances require, the owner shall designate a substitute *registered design professional in responsible charge of building energy simulation* who shall perform the duties required of the original *registered design professional in responsible charge of building energy simulation*. The *code official* shall be notified in writing by the owner if the *registered design professional in responsible charge of building energy simulation* is changed or is unable to continue to perform the duties.

603.6 Minimum requirements for buildings pursuing performance compliance path. *Buildings* following the performance path to compliance shall meet the minimum requirements of a code compliant *standard reference design building* without regard to technology choice in the proposed design.

SECTION 604 ENERGY METERING, MONITORING AND REPORTING

604.1 Purpose. *Buildings* that consume energy shall comply with Section 604. The purpose of this section is to provide requirements that will ensure that *buildings* are constructed or altered in a way that will provide the capability for their energy use, production and reclamation to be measured, monitored and reported. This includes the design of energy distribution systems so as to isolate load types, the installation of or ability to install in the future *meters*, devices and a data acquisition system, and the installation of or the ability to provide for public displays and other appropriate reporting mechanisms in the future.

All forms of energy delivered to the *building* and *building site*, produced on the *building site* or in the building and reclaimed at the *building site* or in the *building* shall be *metered* and all energy load types measured in accordance with this section.

604.1.1 Buildings with tenants. In *buildings* with tenants, the *metering* required by Section 604.4 shall be collected for the entire *building* and for each tenant individually. Tenants shall have access to all data collected for their space.

604.2 Intent. The intent of these requirements is to provide for the ongoing *metering*, measuring, reporting and display of the energy use, energy demand and emissions associated with the energy use of the whole *building* and its systems as required in Section 612 and, where required by Section 613.2, to verify ongoing compliance with the provisions of Sections 602 and 603.

604.3 Energy distribution design requirements and load type isolation. Energy distribution systems within, on or adjacent to and serving a *building* shall be designed such that each primary circuit, panel, feeder, piping system or supply mechanism supplies only one energy use type as defined in Sections 604.3.1 through 604.3.6. The energy use type served by each distribution system shall be clearly designated on the energy distribution system with the use served, and adequate space shall be provided for installation of *metering* equipment or other data collection devices, temporary or permanent, to measure their energy use. The energy distribution system shall be designed to facilitate the collection of data for each of the *building* energy use categories in Section 604.4 and for each of the end use categories listed in Sections 604.3.1 through 604.3.6. Where there are multiple *buildings* on a *building site*, each *building* shall comply separately with the provisions of Section 604.

Exception: *Buildings* designed and constructed such that the total usage of each of the load types described in Sections 604.3.1 through 604.3.6 shall be permitted to be measured through the use of installed sub-*meters* or other equivalent methods as *approved*.

604.3.1 HVAC system total energy use. This category shall include all energy used to heat, cool, and provide *ventilation* to the *building* including, but not limited to, fans, pumps, boiler energy, chiller energy and hot water.

604.3.2 Lighting system total energy use. This category shall include all interior and exterior lighting used in occupant spaces and common areas.

604.3.3 Energy used for building operations. This category shall include all energy use by vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains and *fireplaces*, swimming pools, snow-melt systems, and all other *building* operations.

604.3.4 Plug loads. This category shall include all energy use by devices, appliances and equipment connected to convenience receptacle outlets.

604.3.5 Process loads. This category shall include the energy used by any single load associated with activities within the building—such as, but not limited to, data centers, manufacturing equipment and commercial kitchens—that exceeds 5% of the total energy use of the whole building.

604.3.6 Miscellaneous loads. Energy use for building operations and other operational loads.

604.4 Energy type metering. *Buildings* shall be provided with the capability to determine energy use and peak demand as provided in this section for each of the energy types specified in Sections 604.4.1 through 604.4.7. Utility energy *meters* shall be permitted to be used to collect whole *building* data, and shall be equipped with a local data port connected to a data acquisition system in accordance with Section 604.5.

604.4.1 Gaseous fuels. Gaseous fuels including, but not limited to, natural gas, LP gas, coal gas, hydrogen, landfill gas, digester gas and biogas shall be capable of being *metered* at the *building site* to determine the gross consumption and peak demand of each different gaseous fuel by the *building* and each *building* on a *building site*. The installation of gas *meters* and related piping shall be in accordance with the *International Fuel Gas Code*.

604.4.2 Liquid fuels. Liquid fuels including, but not limited, to fuel oil, petroleum based diesel, kerosene, gasoline, bio diesel, methanol, ethanol and butane shall be capable of being *metered* at the *building site* to allow a determination of the gross consumption and peak demand of each liquid fuel use by the *building* and each *building* on a *building site*. The installation of *meters* and related piping shall be in accordance with the *International Mechanical Code*.

604.4.3 Solid fuels. Solid fuels including, but not limited to coal, charcoal, peat, wood products, grains, and municipal waste shall be capable of having their use determined at the *building site* to allow a determination of

the gross consumption and peak demand of each solid fuel use by the *building* and each *building* on a *building site*.

604.4.4 Electric power. Electric power shall be capable of being *metered* at the *building site* to allow a determination of the gross consumption and peak demand by the *building* and each *building* on a *building site*. The installation of electric *meters* and related wiring shall be in accordance with NFPA 70.

604.4.5 District heating and cooling. Hot water, steam, chilled water, and brine shall be capable of being *metered* at the *building site*, or where produced on the *building site*, to allow a determination of the gross consumption of heating and cooling energy by each *building* on a *building site*. Energy use associated with the production of hot water, steam, chilled water or brine shall be determined based on the fuel used.

604.4.6 Combined heat and power. Equipment and systems with a connected load greater than 125,000 *Btu/hr* providing combined heat and power (CHP) shall be capable of being *metered* to allow a determination of the gross consumption of each form of delivered energy to the equipment. The output of CHP shall be *metered* in accordance with the applicable portions of Section 604 based on the form(s) of output from the CHP.

604.4.7 Renewable and waste energy. Equipment and systems providing energy from renewable or waste energy sources in accordance with Section 603.1.1.1, or from which energy is included in the determination of the *building* zEPI, shall be capable of being *metered* to allow a determination of the output of such equipment and systems in accordance with Sections 604.4.7.1 through 604.4.7.5.

604.4.7.1 Solar electric. Equipment and systems providing electric power through conversion of solar energy directly to electric power shall be capable of being *metered* such that the peak electric power (kW) provided to the *building* and its systems or to off-site entities can be determined at 15 minute intervals and the amount of electric power (kWh) provided to the *building* and its systems can be determined at a minimum of hourly intervals.

604.4.7.2 Solar thermal. Equipment and systems providing heat to fluids or gases through the capture of solar energy shall be capable of being *metered* such that the peak thermal energy (*Btu/hr*) provided to the *building* and its systems or to off-site entities can be determined at 15 minute intervals and the amount of heat captured (*Btu*) for delivery to the *building* and its systems can be determined at a minimum of hourly intervals.

604.4.7.3 Waste heat. Equipment and systems providing energy through the capture of waste heat shall be capable of being *metered* such that the amount of heat captured and delivered to the *building* and its systems can be determined at a minimum of hourly intervals.

604.4.7.4 Wind power systems. Equipment and systems providing electric power through conversion of wind energy directly to electric power shall be capable of being *metered* such that the peak electric power (kW) provided to the *building* and its systems or to off-site entities can be determined at 15 minute intervals and the amount of electric power (kWh) provided to the *building* and its systems can be determined at a minimum of hourly intervals.

604.4.7.5 Other renewable energy electric production systems. Equipment and systems providing electric power through conversion of other forms of renewable energy directly to electric power shall be capable of being *metered* such that the peak electric power (kW) provided to the *building* and its systems or to off-site entities can be determined at 15 minute intervals and the amount of electric power (kWh) provided to the *building* and its systems can be determined at a minimum of hourly intervals.

604.5 Energy load type sub-metering. For *buildings* that are 25,000 square feet in *total building floor area* and larger, all of the Energy Load Types as defined in Section 604.3 shall be *metered* through the use of sub-*meters* or other *approved*, equivalent methods meeting the capability requirements of section 604.4.

604.5.1 Buildings less than 25,000 square feet. For *buildings* that are less than 25,000 square feet in *total building floor area*, the energy distribution system shall be designed and constructed in such a way as to accommodate the future installation of sub-*meters* and other *approved* devices in accordance with Section 604.5. This includes, but is not limited to, providing access to distribution lines and ensuring adequate space for the installation of sub-*meters* and other *approved* devices.

604.6 Minimum energy measurement and verification. *Meters, sub-meters, and other approved devices installed in compliance with Sections 604.4 and 604.5 shall be connected to a data acquisition and management system capable of storing not less than 36 months worth of data collected by all meters and other approved devices and transferring the data in real time to a display as required in Section 604.7.*

604.6.1 Annual emissions. The data acquisition and management system shall be capable of providing the data necessary to calculate the annual *CO₂e emissions* associated with the operation of the *building* and its systems using the results of annual energy use measured in accordance with Section 604.6. The calculation shall be based on energy measured for each form of energy delivered to the site on an annual basis. Where reporting of emissions is required, the determination of emissions shall be in accordance with Section 603.

604.7 Energy display. A permanent, readily accessible and visible display shall be provided adjacent to the main *building* entrance or on a publicly available internet website. The display shall be capable of providing all of the following:

1. The current energy demand for the whole *building* level measurements, updated for each fuel type at the intervals specified in 604.4
2. The average and peak demands for the previous day and the same day the previous year,
3. The total energy usage for the previous eighteen (18) months.

SECTION 605 AUTOMATED DEMAND RESPONSE (AUTO-DR) INFRASTRUCTURE

605.1 Establishing an open and interoperable automated demand response (Auto-DR) infrastructure. Buildings that contain HVAC or lighting systems shall comply with this section. A *building energy management and control system (EMCS)* shall be provided and integrated with *building* HVAC systems controls and lighting systems controls to receive an open and interoperable *automated demand response (Auto-DR)* relay or internet signal. *Building* HVAC and lighting systems and specific *building* energy-using components shall incorporate preprogrammed demand response strategies that are automated with a *demand response automation internet software* client.

Exceptions:

1. *Buildings* located where the electric utility or regional *Independent System Operator (ISO)* or Regional Transmission Operator (RTO) does not offer a demand response program to *buildings* covered by this code.
2. *Buildings* with a peak energy demand not greater than 0.50 times that of the *standard reference design*.
3. *Buildings* that have incorporated on-site renewable energy generation to provide 20% or more of the building's energy demand.

605.2 Software clients. *Demand response automation internet software* clients shall be capable of communicating with a *demand response automation server (DRAS)*.

605.3 Heating ventilating and air-conditioning (HVAC) systems. The *Auto-DR* strategy for HVAC systems shall be capable of reducing the *building* peak cooling or heating HVAC demand by not less than 10 percent when signaled from the electric utility, regional *Independent System Operator (ISO)* or Regional Transmission Operator (RTO), through any combination of the strategies and systemic adjustments, including, but not limited to the following:

1. Space temperature setpoint reset;
2. Increasing chilled water supply temperatures or decreasing hot water supply temperatures;
3. Increasing or decreasing supply air temperatures for VAV systems;
4. Limiting capacity of HVAC equipment that has variable or multiple stage capacity control;

5. Cycling of HVAC equipment or turning off non-critical equipment;
6. Disabling HVAC in unoccupied areas;
7. Limiting the capacity of chilled water, hot water, and refrigerant control valves;
8. Limiting the capacity of supply and exhaust fans, without reducing the outdoor air supply below the minimum required by Chapter 4 of the *International Mechanical Code*, or the minimum required by ASHRAE 62.1;
9. Limiting the capacity of chilled water or hot water supply pumps;
10. Anticipatory control strategies to pre-cool or pre-heat in anticipation of a peak event.

Exceptions:

1. Hospitals and critical emergency response facilities
2. Life safety ventilation for hazardous materials storage
3. Building smoke exhaust systems
4. Manufacturing process systems

605.3.1 Rebound avoidance. The *Auto-DR* strategy shall include logic to prevent a rebound peak. When the signal for *Auto-DR* is ended, a gradual return to normal HVAC equipment operations shall be part of the *Auto-DR* strategy, through any combination of the strategies and systemic adjustments, including, but not limited to the following:

1. If close to the unoccupied period, the *Auto-DR* period shall be extended using a *rebound avoidance, extended Auto-DR control* strategy until the initiation of the unoccupied period.
2. *Rebound avoidance, slow recovery* control strategies, gradually increasing or decreasing space temperature setpoints or a variance in the timing by cooling or heating zone.
3. *Rebound avoidance, slow recovery* control strategies, gradually increasing or decreasing zone supply air temperatures.
4. *Rebound avoidance, slow recovery* control strategies, gradually increasing or decreasing chilled water temperatures or decreasing hot water temperatures.
5. *Rebound avoidance, sequential equipment* recovery strategies, gradually restoring *demand limited* equipment capacity.
6. *Rebound avoidance, sequential equipment* recovery strategies, gradually restoring equipment that was turned off during the *Auto-DR* period.
7. *Rebound avoidance, slow recovery control* strategies, gradually increasing capacity for air moving and pumping systems.
8. *Rebound avoidance, sequential equipment* recovery or *rebound avoidance, slow* recovery control where chilled water or hot water and other capacity control valves are sequentially or gradually allowed to return to normal operation, respectively.

605.4 Lighting. The *Auto-DR* system shall be capable of reducing total connected power of lighting in Group B, office spaces by not less than 15 percent.

Exceptions:

1. Buildings or portions associated with lifeline services.
2. Luminaires on emergency circuits.
3. Luminaires located in emergency and life safety areas of a *building*.
4. Lighting in *buildings* that are less than 5,000 square feet in total area.

5. Luminaires located within a *daylight zone* that are dimmable and connected to *automatic daylight controls*.
6. Signage used for emergency, life safety or traffic control purposes.



SECTION 606 BUILDING ENVELOPE SYSTEMS

606.1 Prescriptive Compliance. Where buildings are designed using the prescriptive-based compliance path in accordance with Section 602.2.1, *building thermal envelope* systems shall comply with the provisions of the International Energy Conservation Code Section 502 and the provisions of this section.

606.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall exceed the requirements of Tables 502.1.2, 502.2(1), and 502.3 of the *International Energy Conservation Code* by not less than 10%. In Sky Type ‘C’ locations as shown in Figure 609.5, the building roof area for skylights shall not exceed five percent.

606.1.1.1 Permanent shading devices for fenestration. Vertical fenestration within 45 degrees of the nearest west, south, and east cardinal ordinate shall be shaded by permanent horizontal exterior projections with a *projection factor* greater than or equal to 0.25. Where different windows or glass doors have different *projection factor* values, they shall each be evaluated separately, or an area-weighted *projection factor* value shall be calculated and used for all windows and glass doors. Horizontal projections shall extend laterally beyond the edge of the glazing not less than one-half of the height of the glazing, except at *building corners*.

Exceptions:

1. *Buildings* located in *hurricane-prone regions* in accordance with Section 1609.2 of the *International Building Code* or on any other building with a mean roof height exceeding that permitted by Table 1504.8 of the *International Building Code* based on the exposure category and basic wind speed at the *building site*.
2. Windows located in a *building* wall that is within 18 inches of the *lot* line.
3. Where equivalent shading of the fenestration is provided by *buildings, structures*, geological formations, or permanent exterior projections that are not horizontal, as determined by sun angle studies at the peak solar altitude on the spring equinox, and three hours before and after the peak solar altitude on the spring equinox.



606.1.2 Air leakage. Air leakage mitigation measures shall be provided in accordance with this section.

606.1.2.1 Sealing of the building envelope. The *building thermal envelope* shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, and weather-stripped and additionally sealed with an air barrier film or *approved* solid material in accordance with Section 606.1.4.1.1.

1. All joints, seams and penetrations.
2. Site-built windows, doors and *skylights*.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the *building thermal envelope*.
6. Knee walls.
7. Walls and ceilings separating unconditioned spaces from conditioned spaces.
8. Behind tubs and showers on exterior walls.

9. Common walls between *dwelling units*.
10. Roof access openings.
11. Spandrel areas and junctions.
12. Electrical and phone boxes on exterior walls except where the air barrier extends behind boxes or air-sealed-type boxes are installed.
13. HVAC register boots that penetrate the *building thermal envelope* except where sealed to subfloor or drywall.
14. Other sources of infiltration.
15. Where lighting fixtures with ventilation holes or other similar objects penetrate the continuous air barrier, provisions shall be made to maintain the integrity of the continuous air barrier.

606.1.2.1.1 Air barrier installation. The air barrier material shall be installed, free from holes and breaks, over all exterior walls. Where joints occur horizontally, the upper layer shall be lapped over the lower layer not less than 2 inches (51 mm). Where joints occur vertically, the layers shall be lapped not less than 6 inches (152 mm). The air barrier material shall be continuous to the top of walls, terminated at penetrations and *building* appendages, and taped in accordance with manufacturer's installation instructions.

606.1.2.2 Testing requirement. The building envelope air tightness shall be considered to be acceptable where the tested air leakage is less than 0.25 cfm/ft² (4.57 m³/hr/m²) when tested at a pressure of .30 in w.c. (75 Pa). Testing shall occur after rough-in and after installation of penetrations of the *building* envelope, including penetrations for utilities, HVAC, plumbing, and electrical equipment and appliances. Testing shall be done in accordance with ASTM E779.

606.1.2.3 Outdoor air intakes and exhaust openings. Stair and elevator shaft vents and other outdoor air intakes and exhaust openings integral to the *building* envelope shall comply with Section 502.4.5 of the *International Energy Conservation Code*.

606.1.2.4 Fireplaces. Wood-burning masonry *fireplaces* shall be provided with combustion air directly from the outdoors and with a means to tightly close off the chimney flue and combustion air outlets when the *fireplace* is not in use.

606.1.2.5 Vestibules. Doors that separate *conditioned space* from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time.

Exceptions:

1. Doors to mechanical or electrical equipment rooms.
2. Doors opening directly from a *sleeping unit* or *dwelling unit*.
3. Revolving doors.
4. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
5. Doors required by code for egress that are not main entry doors.



**SECTION 607
BUILDING MECHANICAL SYSTEMS**

607.1 Prescriptive compliance. Where buildings are designed using the prescriptive-based compliance path in accordance with Section 602.3.1, *building* mechanical systems shall meet the provisions of the *International Energy Conservation Code* for such systems and the provisions of this section.

607.2 HVAC equipment performance requirements. HVAC equipment shall comply with sections 607.2.1 through 607.2.3.

607.2.1 Equipment covered by federal standards. Equipment covered by Federal minimum efficiency standards shall meet the minimum efficiency requirements of the *International Energy Conservation Code*.

607.2.2 Equipment not covered by federal standards. Equipment not covered by Federal minimum efficiency standards shall meet the minimum efficiency requirements of this section.

607.2.2.1 Ground source heat pumps. The efficiency of ground source heat pumps shall meet the provisions of Table 607.2.2.1 based on the applicable referenced test procedure.

607.2.2.2 Multi-stage ground source heat pumps. The efficiency of multi-stage ground source heat pumps shall meet the provisions of Table 607.2.2.1 based on the applicable referenced test procedure.

**TABLE 607.2.2.1
ENERGY-EFFICIENCY CRITERIA FOR GROUND SOURCE HEAT PUMPS**

Product Type	Minimum EER	Minimum COP	Test Procedure
Water-to-Air Closed loop	14.1	3.3	ISO 13256-1
Water-to-Air Open loop	16.2	3.6	ISO 13256-1
Water-to-Water Closed loop	15.1	3.0	ISO 13256-2
Water-to-Water Open loop	19.1	3.4	ISO 13256-2
Direct Expansion (DX) or Direct GeoExchange (DGX)	15.0	3.5	AHRI 870

607.2.2.3 Ventilating fans. Ventilating fans shall comply with the requirements of the ENERGY STAR program.

607.2.3 HVAC system controls. HVAC System Controls shall meet the requirements of the *International Energy Conservation Code* except as noted herein.

607.2.3.1 Programmable thermostats. Programmable thermostats shall be labeled as meeting the minimum performance requirements of the Energy Star Program in effect on the date of adoption of this code.

607.3 Ventilation. *Ventilation*, either natural or mechanical, shall be provided in accordance with Chapter 4 of the *International Mechanical Code*. Where mechanical *ventilation* is provided, the system shall provide the capability to reduce the outdoor air supply to the minimum required by Chapter 4 of the *International Mechanical Code*, or the minimum required by Section 6.3 of ASHRAE 62.1.

607.4 Duct and plenum insulation, sealing and testing. Supply and return air ducts and plenums, and air handlers and filter boxes shall be insulated and sealed in accordance with the *International Energy Conservation Code* except as noted herein.

607.4.1 Duct Air Leakage Testing. Ductwork that is designed to operate at static pressures exceeding 3 inches water column and all ductwork located outdoors shall be leak-tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual*. Representative sections totaling not less than 25% of the total installed duct area for the designated pressure class shall be tested. Positive pressure testing is acceptable for negative pressure ductwork. Duct systems with pressure ratings in excess of 3 inches water column shall be identified on the construction documents. The maximum permitted duct leakage shall be in accordance with Equation 6-7.

$$F = C \square P^{0.65} , \quad \text{(Equation 6-7)}$$

Where

F = maximum permitted leakage in cfm/100 ft² duct surface area;

C \square = 4, duct leakage class, cfm/100 ft² at 1 inch water column..

P = test pressure, which shall be equal to the design duct pressure class rating inches of water column.

607.5 HVAC piping insulation. Piping, including valves, fittings and piping system components, in HVAC systems shall be thermally insulated in accordance with Table 607.5. *Building* cavities and interstitial framing spaces shall be large enough to accommodate the combined diameter of the pipe plus the insulation, plus the full thickness of the insulation plus any other objects in the cavity that the piping must cross.

Exceptions:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with Section 607.2.
2. Piping conveying fluids having a design operating temperature range between 60°F and 105°F.
3. Piping conveying fluids not heated or cooled such as roof and condensate drains, cold water supply, and natural gas piping.
4. Where heat gain or heat loss will not increase energy usage such as liquid refrigerant piping.
5. Piping having an outside diameter or 1 inch or less, associated with strainers, control valves, and balancing valves.

**TABLE 607.5
MINIMUM PIPE INSULATION THICKNESS^a**

Fluid	Conductivity Btu-in./(h-ft ² -F)	Wall Thickness ^d of Pipe Insulation Relative to Nominal Pipe Diameter ^{b,c}
Steam	0.27 – 0.34	At Least Double
Hot Water	0.22 – 0.29	At least the Same
Chilled Water	0.22 – 0.28	At least the Same

- a. Piping with a nominal diameter larger than ¼ inch shall be insulated.
- b. The proportions in this column apply to all nominal pipe diameters greater than ¼ inch and less than or equal to 2 inches. For nominal pipe diameters larger than 2 inches, outside diameter, the minimum wall thickness of the insulation shall be equal to the wall thickness required for 2 inch pipe.
- c. For insulation outside the stated conductivity range, the minimum thickness shall be determined as follows: $T = r[(1 + t/r)K/k - 1]$.
Where:
T = minimum insulation thickness inches.
r = actual outside radius of pipe inches.
t = insulation thickness listed in the table for applicable fluid temperature and pipe size.
K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu-in./h-ft²-°F)
k = the upper value of the conductivity range listed in the table for the applicable fluid temperature.
- d. These thicknesses are based on energy efficiency considerations only.

607.6 Economizers. Economizers shall meet the requirements of the *International Energy Conservation Code*, except as noted herein.

607.6.1 Air Economizer systems. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Section 607.6.1.1 or 607.6.1.2, respectively.

Exception: Economizers are not required for the following.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table 607.6.1(1).
➔
2. In Group I-2, Hospitals, and Group B, Ambulatory health care facilities, where more than 75 percent of the air designed to be supplied by the system is to spaces that are required to be humidified above 35° F dew-point temperature to comply with applicable codes or accreditation standards. In all other occupancies, where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F dew-point temperature to satisfy process needs.

3. Systems that include a condenser heat recovery system that is designed to utilize sixty percent of the peak heat rejection load at design conditions and there is a documented need for that rejected heat for either service hot water or space heating during peak heat rejection design conditions.
4. Systems that serve spaces estimated as having a sensible cooling load at design conditions, excluding transmission and infiltration loads, of less than or equal to transmission and infiltration losses at the temperature and relative humidity design conditions in accordance with section 6.1 of ASHRAE 55.
5. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling *efficiency* meets or exceeds the *efficiency* improvement requirements in Table 607.6.1(2).

TABLE 607.6.1(1) ECONOMIZER REQUIREMENTS

CLIMATE ZONES As established in the IECC	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems having a capacity \geq 33,000 Btu/h ^a

For SI: 1 British thermal unit per hour = 0.293 W.

a. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per *building* or 20 percent of the building's air economizer capacity, whichever is greater.

607.6.1.1 Air economizers. Air economizers shall be designed in accordance with Sections 607.6.1.1.1 through 607.6.1.1.4.

607.6.1.1.1 Design capacity. Air economizer systems shall be capable of modulating *outdoor air* and return air dampers to provide up to 100 percent of the design supply air quantity as *outdoor air* for cooling.

607.6.1.1.2 Control signal. Economizer dampers shall be capable of being sequenced with the mechanical cooling equipment and shall not be controlled by only mixed air temperature.

Exception: The use of mixed air temperature limit control shall be permitted for systems controlled from space temperature, such as single-zone systems.

607.6.1.1.3 High-limit shutoff. Air economizers shall be capable of automatically reducing *outdoor air* intake to the design minimum *outdoor air* quantity when the *outdoor air* intake will no longer reduce cooling energy usage. High-limit shutoff control types for specific climates shall be chosen from Table 607.6.1.1.3(1). High-limit shutoff control settings for these control types shall be those listed in Table 607.6.1.1.3(2).

607.6.1.1.4 Relief of excess outdoor air. Systems shall provide a means to relieve excess *outdoor air* during air economizer operation to prevent over-pressurizing of the *building*. The relief air outlet shall be located to avoid recirculation into the *building*.

TABLE 607.6.1(2)
EQUIPMENT EFFICIENCY PERFORMANCE EXCEPTION FOR ECONOMIZERS

CLIMATE ZONES	COOLING EQUIPMENT EFFICIENCY IMPROVEMENT ^a
2A	17% Efficiency Improvement
2B	21% Efficiency Improvement
3A	27% Efficiency Improvement
3B	32% Efficiency Improvement
4A	42% Efficiency Improvement
4B	49% Efficiency Improvement

^a Where a unit is rated with an IPLV, IEER, or SEER, the minimum values for these metrics must be increased by the percentage listed in the table in order to eliminate the required air or water economizer. Where a unit is rated only with a full load metric such as EER or COP cooling, these metrics must be increased by the percentage shown.

TABLE 607.6.1.1.3(1)
HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS

CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8	Fixed dry bulb Differential dry bulb Electronic enthalpy ^a Differential enthalpy Dew-point and dry-bulb temperatures	Fixed enthalpy
1a, 2a, 3a, 4a	Fixed enthalpy Electronic enthalpy ^a Differential enthalpy Dew-point and dry-bulb temperatures	Fixed dry bulb Differential dry bulb
All other climates	Fixed dry bulb Differential dry bulb Fixed enthalpy Electronic enthalpy ^a Differential enthalpy Dew-point and dry-bulb temperatures	

a. Electronic enthalpy controllers are devices that use a combination of humidity and dry-bulb temperature in their switching algorithm.

TABLE 607.6.1.1.3(2)
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS

DEVICE TYPE	CLIMATE	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN)	
		EQUATION	DESCRIPTION
Fixed dry bulb	1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8 5a, 6a, 7a All other zones	$T_{OA} > 75^{\circ}\text{F}$	Outdoor air temperature exceeds 75°F
		$T_{OA} > 70^{\circ}\text{F}$	Outdoor air temperature exceeds 70°F
		$T_{OA} > 65^{\circ}\text{F}$	Outdoor air temperature exceeds 65°F
Differential dry bulb	1b, 2b, 3b, 3c, 4b, 4c, 5a, 5b, 5c, 6a, 6b, 7, 8	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature
Fixed enthalpy	All	$h_{OA} > 28 \text{ Btu/lb}^a$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air ^a

**TABLE 607.6.1.1.3(2)
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS**

Electronic Enthalpy	All	$(T_{OA}, RH_{OA}) > A$	Outdoor air temperature/RH exceeds the "A" setpoint curve ^b
Differential enthalpy	All	$h_{OA} > h_{RA}$	Outdoor air enthalpy exceeds return air enthalpy
Dew-point and dry bulb temperatures	All	$DP_{OA} > 55^{\circ}\text{F}$ or $T_{OA} > 75^{\circ}\text{F}$	Outdoor air dry bulb exceeds 75°F or outside dew point exceeds 55°F (65 gr/lb)

- a. At altitudes substantially different than sea level, the Fixed Enthalpy limit shall be set to the enthalpy value at 75°F and 50 percent relative humidity. As an example, at approximately 6000 ft elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.
- b. Setpoint "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40 percent relative humidity and is nearly parallel to dry-bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.

607.6.2 Water Economizer systems for HVAC Equipment. Economizer systems for HVAC equipment shall be designed in accordance with Sections 607.6.2.1 through 607.6.2.4.

607.6.2.1 Design capacity. Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at *outdoor air* temperatures of 50°F dry bulb / 45°F wet bulb and below.

Exception: Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb/ 45°F wet bulb must satisfy 100 percent of the expected system cooling load at 45°F dry bulb/40°F wet bulb.

607.6.2.2 Maximum pressure drop. Pre-cooling coils and water-to-water heat exchangers used as part of a water economizer system shall have a water-side pressure drop of less than 15 ft of water column including the control valve or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling non-economizer mode.

607.6.2.3 Integrated economizer control. Economizer systems shall be integrated with the mechanical cooling system and shall be capable of providing partial cooling whether or not additional mechanical cooling is required to meet the remainder of the cooling load.

607.6.2.4 Economizer heating system impact. HVAC system design and economizer controls shall be such that economizer operation does not increase the *building* heating energy use during normal operation.

Exception: Economizers on VAV systems that cause zone level heating to increase because of reduction in supply air temperature.

607.7 Variable air volume (VAV) fan control. Individual fans with motors equal to or greater than 1.0 horsepower (0.746 kW) shall be one of the following:

1. Driven by a mechanical or electrical variable speed drive.
2. Driven by a vane-axial fan with variable-pitch blades.
3. Provided with controls or devices that will result in fan motor demand of not more than 30 percent of its design wattage at 50 percent of design airflow when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data.

Static pressure sensors used to control VAV fans shall be placed in a position such that the controller set point is not greater than one-third of the total design fan static pressure, except for systems with direct digital control. If this results in the sensor being located downstream of major duct splits, multiple sensors shall be installed in each major branch to ensure that the static pressure can be maintained in each branch.

For systems with direct digital control of individual *zone* boxes reporting to the central control panel, the static pressure set point shall be reset based on the *zone* requiring the most pressure. The set point shall be reset lower until one *zone* damper is wide open.

Exception: Systems without zone dampers are exempt from the static pressure reset requirements.

607.8 Kitchen exhaust systems. Kitchen exhaust systems shall meet the provisions of the *International Energy Conservation Code* except as noted herein.

607.8.1 Kitchen exhaust systems. Replacement air introduced directly into the exhaust hood cavity shall not exceed 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space containing a kitchen hood shall not exceed the greater of the *ventilation* rate required to meet the space heating or cooling load or the hood exhaust flow minus the available transfer air from adjacent spaces where available transfer air is considered to be that portion of outdoor *ventilation* air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.

Where the total kitchen hood exhaust airflow rate is greater than 5,000 cfm (2360 L/s) each hood shall have a maximum exhaust rate in accordance with Table 607.8.1 and shall meet one of the following:

1. Not less than 50 percent of all replacement air is transfer air that would otherwise be exhausted.
2. Demand *ventilation* system(s) are provided for not less than 75 percent of the exhaust air that are capable of not less than 50 percent reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and when idle.
3. *Listed* energy recovery devices with a sensible heat recovery effectiveness of not less than 40 percent shall provided for at least 50 percent of the total exhaust airflow.

Where a single hood, or hood section, is installed over appliances with different duty ratings, the maximum allowable flow rate for the hood or hood section shall be based on the requirements for the highest appliance duty rating under the hood or hood section.

Exception: Where not less than 75 percent of all the replacement air is transfer air that would otherwise be exhausted.

**TABLE 607.8.1
MAXIMUM NET EXHAUST FLOW RATE (CFM PER LINEAR FOOT)**

Type of Hood	Light Duty Equipment	Medium Duty Equipment	Heavy Duty Equipment	Extra Heavy Duty Equipment
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	Not allowed	Not allowed
Backshelf/Passover	210	210	280	Not allowed

For SI: 1CFM/linear foot (1.55 L/s per meter)

607.9 Laboratory exhaust systems. Laboratory exhaust systems shall meet the provisions of the *International Energy Conservation Code* except as noted herein.

607.9.1 Laboratory exhaust systems. *Buildings* with laboratory exhaust systems having a total exhaust rate greater than 5,000 cfm shall be provided at least one of the following features:

1. A VAV laboratory exhaust and room supply system capable of reducing exhaust and makeup air flow rates to the minimum required in the *International Mechanical Code*

2. A heat recovery system to precondition makeup air from laboratory exhaust such that the percentage that the exhaust and makeup air flow rates can be reduced from design conditions plus the *sensible recovery effectiveness percentage* totals at least 50 percent.
3. Direct makeup auxiliary air supply equal to at least 75 percent of the exhaust air flow rate capable of being heated and cooled to the design temperatures specified in Section 302.1 of the *International Energy Conservation Code*.

607.10 Control of HVAC in hotel/motel guest rooms. A dedicated system to automatically control HVAC system energy shall be installed to control guest room HVAC energy consumption during unoccupied periods. Such controls shall be designed to raise cooling and lower heating temperature set points by at least 4 °F (2 °C) during unoccupied periods.

Exception: Group R-1, Hotels and Motels, with fewer than 20 guest rooms.

SECTION 608 BUILDING SERVICE WATER HEATING SYSTEMS

608.1 Prescriptive compliance. Where buildings are designed using the prescriptive-based compliance path in accordance with Section 602.3.1 service water heating systems shall meet the provisions of the *International Energy Conservation Code* for such systems and the provisions of this section.

608.2 Service water heating (SWH) equipment performance requirements. Service water heating equipment shall comply with Sections 608.2.1 and 608.2.2.

608.2.1 Equipment covered by Federal standards. Equipment covered by Federal minimum efficiency standards shall meet the minimum efficiency requirements of the *International Energy Conservation Code*.

608.2.2.1 Water heater controls for dwelling units. Water heaters installed in *dwelling units* in buildings covered by this code shall be equipped with external water temperature thermostat controls. The controls shall allow the occupant to set the water temperature at a setting that is below 100 °F and greater than or equal to 50 °F.

608.3 Pools, hot tubs and spas. Pools, hot tubs and spas shall meet the efficiency requirements of the *International Energy Conservation Code*.

608.3.1 Pools in conditioned space. For pools that are located within the conditioned space, not less than 25 percent of the annual energy consumption of pool operation and not less than 50 percent of the peak design space heating, *ventilation*, and cooling requirements for the space in which the pool is located shall be met by at least one of the following:

1. An on-site renewable energy system(s)
2. A heat recovery system.

608.3 Snowmelt systems. Snow melt systems shall comply with the requirements of the *International Energy Conservation Code*. Hydronic systems shall supplement not less than 25 percent of the design snow melting total annual consumption measured in *Btu/ft²*, energy per unit area. Electric systems shall supplement not less than 50 percent of the design snow melt peak load demand. These requirements shall be met by one or more of the following:

Exception: Emergency service ingress and egress.

1. An on-site renewable energy system(s)
2. A heat recovery system.

608.4 Rough-ins for future solar hot water pre-heat. Plumbing, electrical and control systems shall be designed and constructed in accordance with Sections 608.5.1 and 608.5.2 to provide for the future installation of a solar

water heating system that will be capable of providing not less than 50 percent of the energy needed for all systems listed below:

1. Service Water Heating for kitchen, laundry and bathing.
2. Pool Water Heating.
3. Spa Water Heating.
4. Hot Tub Water Heating.

Exception: Solar water heating equipment is not required at building sites where solar insolation totals not more than 3.5 (kW/m²/day) in accordance with Table 611.4.

608.5.1 Solar thermal hot water system piping rough-in. Conduit, sleeve or other pathway shall be installed not less than two runs of piping from the future site for *solar thermal* to the location of the service water heating equipment. The conduit(s), sleeve(s) or other pathway(s) shall have internal dimensions large enough to allow the piping and insulation to be easily installed, removed and replaced. The minimum diameter of the piping shall be ¾ inch nominal and the tubing shall be certified to handle sustained temperatures above 180F. Insulation shall be sized in accordance with Section 607.5.

608.5.2 Solar electric hot water system electrical rough-in. Conduit not less than ¾ inch in size shall be installed from the future site for solar electric to the electric service panel or room that provides the electric service to the water heating equipment that will be served by the solar electric hot water system. Conduit not less than ¾ inches in size shall be installed to provide for control wiring.

608.5.2.1 Conduit size. Conduit not less than ¾ inch in size shall be installed from the future *solar thermal* or solar electric site to the location of the service water heating equipment and the *storage tank* to provide for control wiring.

608.5.2.2 Terminations. Conduits, sleeves and pathways installed in accordance with this section shall terminate near the *solar thermal* or solar electric sites and shall be readily accessible.

608.5.2.3 Space for future storage tank. Space for a future storage tank shall be identified and reserved. This space shall be large enough to accommodate storage for a *solar thermal* system sized to provide 50 percent solar fraction, with an area of not less than ten square feet.

608.6 Waste water energy recovery system. The following *building* types shall be provided with a waste water heat recovery system that will preheat all of the incoming water used for all hot water functions by not less than 10 °F (5.6 C):

1. Group A-2, Restaurants and Banquet halls;
2. Group F, Laundries;
3. Group R-1, Boarding houses (transient), Hotels (transient), Motels (transient);
4. Group R-2 *buildings*; and
5. Group A-3, Health Clubs and Spas
6. Group I-2, Hospitals, Mental hospitals and Nursing homes.

Exception: Single-story, slab-on grade and single-story, on crawl-space *buildings*.

608.7 Service water heating piping insulation. Service water heating piping shall be thermally insulated in accordance with Table 607.5. Where hot water *distribution piping* is installed within attics and crawlspaces, the insulation shall continue to cover the pipe for a distance of at least 6 inches (152 mm) beyond the *building thermal envelope*. Where hot water *distribution piping* is installed within walls, the insulation must completely surround the pipe with not less than 1 inch of insulation. Where hot water piping is installed in a wall of insufficient width to accommodate the pipe and insulation levels of Table 607.5, the insulation thickness shall be permitted to have the maximum thickness that the wall can accommodate, but not less than ½-inch thick.

Exceptions:

1. Factory-installed piping within service water heating equipment tested and rated in accordance with Section 607.5.
2. Piping conveying fluids not heated or cooled such as cold water supply, and natural gas piping.
3. Hot water supply piping exposed under sinks, lavatories and similar fixtures.
4. Hot water *distribution piping* buried within blown-in or sprayed roof/ceiling insulation, such as fiberglass or cellulose, where the insulation completely and continuously surrounds the pipe.

608.7.1 Buried piping. Service hot water piping installed within a slab or below grade shall be insulated in accordance with Section 608.7 and shall be placed within a physically protective, waterproof channel or sleeve having internal dimensions large enough such that the piping and insulation can be removed and replaced, and maintain its dimensional integrity during and after construction.

Exception: Where the insulation manufacturer stipulates that the pipe insulation will maintain its insulating value in underground applications in damp soil where installed according to the manufacturer's instructions. This exception does not apply to piping that runs under *building* slabs.

608.8 Circulating hot water systems. Circulating hot water systems shall be provided with an *automatic* or readily accessible *manual* switch to turn off the hot water circulating pump when not in use. Controls that allow continuous, timer, or water temperature-initiated operation of a circulating pump are prohibited. Gravity or thermosyphon circulation loops are prohibited. Pumps on circulating hot water systems shall be activated on demand by either a hard-wired or wireless activation control of one of the following types:

1. A normally-open, momentary contact switch.
2. Motion sensors that make momentary contact when motion is sensed. After the signal is sent, the sensor shall go into a lock out mode for not less than 5 minutes to prevent sending a signal to the electronic controls while the circulation loop is still hot.
3. A flow switch.
4. A door switch.

The controls for the pump shall be electronic and operate on the principal of shutting off the pump with a rise in temperature. Electronic controls shall have a lock-out to prevent operation exceeding 105°F degrees in the event of failure of the device that senses temperature rise. The electronic controls shall have a lock out mode for not more than 5 minutes that prevents extended operation of the pump if the sensor fails or is damaged.

SECTION 609 BUILDING ELECTRICAL POWER AND LIGHTING SYSTEMS

609.1 General. Where buildings are designed using the prescriptive-based compliance path in accordance with Section 602.3.1, building electrical power and lighting systems shall meet the provisions of the *International Energy Conservation Code* for such systems and the provisions of Section 609.

609.2 Sleeping unit controls. *Sleeping units* in hotels, motels, boarding houses or similar *buildings* shall have a control system for detecting occupancy to shut off all permanently wired luminaires and switched receptacles, except those in bathrooms, when the unit is not occupied.

Exception: Sleeping unit controls are not required *in sleeping units* where all lighting and switched receptacles are controlled by an *occupant sensor* that requires *manual* intervention to energize circuits.

609.2.1 Sleeping unit bathroom controls. All permanently wired luminaires located in bathrooms within *sleeping units* in hotels, motels, boarding houses or similar *buildings* shall be equipped with *occupant sensors* that require manual intervention to energize circuits.

Exception: Up to 5 watts of lighting in each bathroom shall be permitted to be connected to the *captive key control* at the main room entry instead of being connected to the *occupant sensor control*.

609.3 Interior light reduction controls. *Occupant sensor controls* shall be provided to automatically reduce connected lighting power by not less than 45 percent during periods when occupants are not present in all of the following locations.

1. Corridors and enclosed stairwells.
2. Storage and stack areas not open to the public.
3. Parking garages.

Lighting in means of egress shall comply with the luminance or uniformity criteria required by the *International Building Code*.

Exception: Automatic power reduction shall not be required where *occupant sensor controls* are overridden by *time switch controls* that keep lights on continuously during peak occupancy periods.

609.4 Exterior lighting controls. Exterior lighting shall comply with the requirements of Sections 609.4.1 and 609.4.2.

609.4.1 Exterior light reduction. Exterior lighting shall be controlled by a *time switch* and configured so that the total exterior lighting power is automatically reduced by not less than 30 percent within two hours after *facility operations* conclude.

Exception: Exterior lighting controls need not be controlled for the following occupancies and conditions:

1. Group H occupancies.
2. Group I-3 occupancies.
3. Lighting which is connected to *occupant sensor controls*.
4. Lighting within means of egress.
5. Solar powered luminaires that are not connected to a centralized power source.

609.4.2 Exterior lighting and signage shutoff. The lighting of *building* facades, signage, and landscape features shall be controlled by a *time switch* and configured so that it automatically shuts off within one hour after *facility operations* conclude or as established by the *jurisdiction*. Where *facility operations* are continuous, decorative lighting of *building* facades and landscape features shall automatically shut off at midnight.

609.5 Automatic daylight controls. *Automatic daylight controls* shall be provided in all *daylight zones* with minimum *fenestration* as specified in Table 609.5 and Figure 609.5.

Exceptions: Automatic daylight controls are not required for the following spaces and equipment:

1. *Toplight daylight zones* where the *skylight* is located in an *obstructed roof*.
2. *Sidelight daylight zones* where the vertical *fenestration* is located in an *obstructed exterior wall*.
3. Spaces with less than 90 watts of lighting installed in the *daylight zone*.
4. Spaces where medical care is directly provided.
5. Spaces within *dwelling units* or *sleeping units*.

**TABLE 609.5
MINIMUM FENESTRATION**

Sky Type	Minimum effective aperture (percentage)	
	Side lighting (see equation 6-8)	Top lighting (see equation 6-9)
A ^a	14.0	0.6
B ^b	16.0	1.2
C ^c	22.0	2.2

^aSky Type A – more than 75% mean sunshine, in accordance with the NOAA Annual Mean Sunshine Percentage Table.

^bSky Type B – 45% to 75% mean sunshine, in accordance with the NOAA Annual Mean Sunshine Percentage Table.

^cSky Type C – less than 45% mean sunshine, in accordance with the NOAA Annual Mean Sunshine Percentage Table.

$$EAs = (AF \times VT) / (H \times W) \quad \text{(Equation 6-8)}$$

EAs = Sidelighting effective aperture.

AF = area of vertical *fenestration* in the exterior wall 30 inches or higher above the floor.

VT = visible *transmittance* of the *fenestration*.

H = height of top of *fenestration* above the floor.

W = *daylight zone* width (see Figures 202.1, 202.2, 202.3, and 202.4)

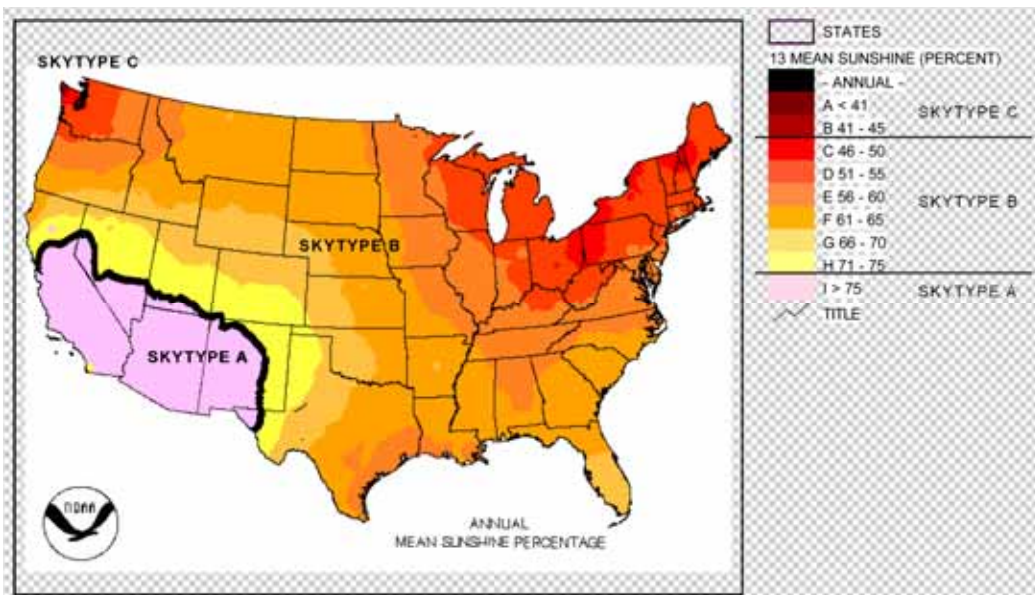
$$EA_T = (AF \times VT) / DA \quad \text{(Equation 6-9)}$$

EA_T = Top lighting effective aperture.

AF = area of the *skylight*.

VT = visible *transmittance* of the *skylight*

DA = area of the *daylight zone*.



**FIGURE 609.5
NOAA ANNUAL MEAN SUNSHINE PERCENTAGE TABLE BY SKY TYPE**

609.6 Plug load controls. Receptacles and electrical outlets in the following spaces shall be controlled by an *occupant sensor* or *time switch* as follows:

1. In Group B office spaces without furniture systems incorporating wired receptacles, at least one switched receptacle shall be provided for each 50 square feet.
2. In Group B office spaces with furniture systems incorporating wired receptacles, at least one switched circuit shall be provided at each electrical outlet used for powering furniture systems.
3. In classrooms in Group B and Group E occupancies, not less than four switched receptacles shall be provided in each classroom.
4. In copy rooms, print shops, and computer labs, not less than one switched receptacle shall be provided for each data jack.
5. In spaces with an overhead cabinet above a counter or work surface, not less than one switched receptacle shall be provided for each work surface.

609.6.1 Distribution and marking. Controlled receptacles and electrical outlets shall be distributed in a reasonably uniform pattern throughout each space. Controlled receptacles shall be marked to differentiate them from uncontrolled receptacles.

609.6.2 Furniture systems. Furniture systems incorporating wired receptacles shall include not less than two receptacles at each workstation that are connected to a controlled circuit.

609.6.3 Computer office equipment. Computer monitors, plug in space heaters, air purifiers, radios, computer speakers, coffee makers, fans, and task lights located in spaces with controlled receptacles shall be plugged into controlled receptacles.

609.6.4 Audio and visual systems. Displays, projectors, and audio amplifiers in Group B and Group E classrooms, conference and meeting rooms, and multipurpose rooms shall be controlled by an *occupant sensor*.

609.6.5 Water dispensers. Water dispensers that utilize energy to cool or heat drinking water shall be controlled by *time switch controls*.

609.6.6 Refrigerator and freezer cases. Lighting integral to vending machines and refrigerator and freezer cases shall be controlled by an *occupant sensor* or a *time switch*.

609.7 Fuel gas lighting systems. Fixtures that generate illumination by combustion of fuel gas shall be included in lighting power calculations required under Sections 505.5 and 505.6 of the *International Energy Conservation Code* by converting the maximum rated *btu/hr* of the luminaire into watts using Equation 6-10.

Wattage Equivalent = Maximum *btu/hr* rating of the fuel gas lighting system / 3.413. **(Equation 6-10)**

Exception: *Historic buildings* in accordance with Section 101.4.2 of the *International Energy Conservation Code*.

609.7.1 Continuously burning pilot lights. Fixtures that generate illumination by combustion of fuel gas shall not contain continuously burning pilot lights.

609.8 Electrical system efficiency. Electrical systems shall comply with Section 609.8.1.

609.8.1 Prescriptive compliance. Prescriptive compliance for electrical systems shall be in accordance with Sections 609.8.1.1 through 609.8.1.3.

609.8.1.1 Transformer efficiency. Distribution transformers installed on the load side of the service disconnecting means shall comply with the provisions of Tables 609.8.1.1(1), 609.8.1.1(2) and 609.8.1.1(3), the Energy Policy Act of 2005 as applicable.

Exceptions:

1. Transformers not covered by the Energy Policy Act of 2005.

2. Transformers for special purpose applications, and not used in general purpose applications.
3. Transformers with multiple voltage taps where the highest tap is not less than 20 percent more than the lowest tap.
4. Drive transformers, rectifier transformers, auto-transformers, uninterruptible power supply transformers, impedance transformers, regulating transformers, sealed and non-ventilating transformers, machine tool transformers, welding transformers, grounding transformers, and testing transformers.

609.8.1.2 Voltage drop in feeders. The *voltage drop* in *feeder* conductors shall not exceed 1.5 percent at design load.

609.8.1.3 Voltage drop in branch circuits. The *voltage drop* in *branch circuit* conductors shall not exceed 1.5 percent at design load.

609.9 Exterior lighting. All exterior lighting shall comply with Section 505.6 of the *International Energy Conservation Code*.

609.10 Verification of lamps and ballasts. Prior to issuance of a *certificate of occupancy*, the field inspector shall confirm the installation of luminaires, type and quantity; lamps, type, wattage and quantity, and ballasts, type and performance for not less than one representative luminaire of each type, for consistency with the approved *construction documents*. Where a discrepancy is found, energy calculations shall be revised and resubmitted.

TABLE 609.8.1.1(1)
LOW-VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS
(Maximum 600 Volt Primary)

Single Phase		Three Phase	
kVA Rating	Minimum Efficiency (%)	kVA Rating	Minimum Efficiency (%)
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
--	--	750	98.8
--	--	1000	98.9

1. Dry-type distribution transformers are air-cooled, and do not use oil as a coolant.
2. All efficiency values for low-voltage transformers are at 35 percent of nameplate-rated load, determined according to the DOE test procedure. 10 CFR Part 431, Sub-part K, Appendix A.
3. All efficiency values for medium-voltage transformers are at 50 percent of nameplate-rated load, determined according to the DOE test procedure. 10 CFR Part 431, Sub-part K, Appendix A.
4. Basic impulse insulation level (BIL).

Table 609.8.1.1(2)
MEDIUM-VOLTAGE, DRY-TYPE DISTRIBUTION TRANSFORMERS
(Maximum 34,500 Volt Primary, Maximum 600 Volt Secondary)

Single Phase				Three Phase			
kVA Rating	20-45 kV BIL Minimum Efficiency (%)	46-95 kV BIL Minimum Efficiency (%)	>96 kV BIL Minimum Efficiency (%)	kVA Rating	20-45 kV BIL Minimum Efficiency (%)	46-95 kV BIL Minimum Efficiency (%)	>96 kV BIL Minimum Efficiency (%)
15	98.10	97.86	--	15	97.50	97.18	--
25	98.33	98.12	--	30	97.90	97.63	--
37.5	98.49	98.30	--	45	98.10	97.86	--
50	98.60	98.42	--	75	98.33	98.12	--
75	98.73	98.57	98.53	112.5	98.49	98.30	--
100	98.82	98.67	98.63	150	98.60	98.42	--
167	98.96	98.83	98.80	225	98.73	98.57	98.53
250	99.07	98.95	98.91	300	98.82	98.67	98.63
333	99.14	99.03	98.99	500	98.96	98.83	98.80
500	99.22	99.12	99.09	750	99.07	98.95	98.91
667	99.27	99.18	99.15	1000	99.14	99.03	98.99
833	99.31	99.23	99.20	1500	99.22	99.12	99.09
--	--	--	--	2000	99.27	99.18	99.15
--	--	--	--	2500	99.31	99.23	99.20

- a. Dry-type distribution transformers are air-cooled, and do not use oil as a coolant.
- b. All efficiency values for low-voltage transformers are at 35 percent of nameplate-rated load, determined according to the DOE test procedure. 10 CFR Part 431, Sub-part K, Appendix A.
- c. All efficiency values for medium-voltage transformers are at 50 percent of nameplate-rated load, determined according to the DOE test procedure. 10 CFR Part 431, Sub-part K, Appendix A.
- d. Basic impulse insulation level (BIL).

TABLE 609.8.1.1(3)
MEDIUM-VOLTAGE, LIQUID-IMMERSED DISTRIBUTION TRANSFORMERS
(Maximum 34,500 Volt Primary, Maximum 600 Volt Secondary)

Single Phase		Three Phase	
kVA Rating	Minimum Efficiency (%)	kVA Rating	Minimum Efficiency (%)
10	98.62	15	98.36
15	98.76	30	98.62
25	98.91	45	98.76
37.5	99.01	75	98.91
50	99.08	112.5	99.01
75	99.17	150	99.08
100	99.23	225	99.17
167	99.25	300	99.23
250	99.32	500	99.25

Single Phase		Three Phase	
kVA Rating	Minimum Efficiency (%)	kVA Rating	Minimum Efficiency (%)
333	99.36	750	99.32
500	99.42	1000	99.36
667	99.46	1500	99.42
883	99.49	2000	99.46
--	--	2500	99.49

- a. Dry-type distribution transformers are air-cooled, and do not use oil as a coolant.
- b. All efficiency values for low-voltage transformers are at 35 percent of nameplate-rated load, determined according to the DOE test procedure. 10 CFR Part 431, Sub-part K, Appendix A.
- c. All efficiency values for medium-voltage transformers are at 50 percent of nameplate-rated load, determined according to the DOE test procedure. 10 CFR Part 431, Sub-part K, Appendix A.
- d. Basic impulse insulation level (BIL).

609.11 Verification of lighting controls. Prior to issuance of a certificate of occupancy, the field inspector shall confirm the installation of lighting controls shown on the approved construction documents. Where a discrepancy is found, the installation shall be reviewed for conformance with the *International Energy Conservation Code* and Sections 609.2, 609.3, 609.4, 609.5, and 609.6 of this code as applicable.

SECTION 610 SPECIFIC APPLIANCES AND EQUIPMENT

610.1 General. This section provides requirements for appliances and equipment installed in the *building* or on the *building site*. Permanent appliances and equipment shall meet the provisions of Section 610.2, and portable appliances and equipment shall meet the provisions of Section 610.3.

Exception: Appliances and equipment in compliance with Sections 606 through 609 and those listed in Table 610.1.

**TABLE 610.1
APPLIANCES AND EQUIPMENT COVERED BY FEDERAL EFFICIENCY STANDARDS**

Residential products	Commercial products
Battery chargers ^a	Beverage vending machines ^a
Clothes dryers	Commercial clothes washers
Clothes washers	Ice makers
Dehumidifiers	Refrigerators and freezers (packaged)
Dishwashers	Supermarket refrigerators
Refrigerators, refrigerator-freezers, and freezers	Walk-in coolers and freezers
Microwave ovens ^a	
Room air conditioners	
Ranges and ovens	

^a These products currently have no Federal standard(s). NOTE: U.S. Department of Energy rulemakings are underway or scheduled.

610.2 Permanent appliances and equipment. Appliances and equipment that are permanently connected to the *building* energy supply system(s) shall meet the provisions of Sections 610.2.1 through 610.2.4 as applicable. Such appliances and equipment shall be *listed* and *labeled* and installed in accordance with the manufacturer’s installation instructions and the provisions and terms of their listing, the *International Energy Conservation Code*, *International Fuel Gas Code*, *International Mechanical Code*, *International Plumbing Code* and *International Building Code*, and shall be provided with controls and energy monitoring systems as required by this code.

610.2.1 Elevators. Elevator systems shall comply with sections 610.2.1.1 through 610.2.1.2.3.

610.2.1.1 Lighting. Light sources for the cab interior shall have an efficacy greater than or equal to 50 lumens/watt.

610.2.1.2 Power conversion system. *Power conversion systems for traction elevators shall comply with Sections 610.2.1.2.1 through 610.2.1.2.3.*

610.2.1.2.1 Motor. Induction motors with a Class IE2 efficiency rating, as defined by IEC EN 60034-30, or alternative technologies, such as permanent magnet synchronous motors that have equal or better efficiency, shall be used.

610.2.1.2.2 Transmission. Transmissions shall not reduce the efficiency of the combined motor/transmission below that shown for the Class IE2 motor. Gearless machines shall be assumed to have a 100 percent transmission efficiency.

610.2.1.2.3 Drive. Potential energy released during motion shall be recovered.

610.2.1.3 Ventilation. Cab *ventilation* fans shall have an efficacy greater than or equal to 3.0 CFM per watt (0.085 m³/min./watt).

610.2.1.4 Standby mode. When the elevator is stopped, not occupied, and with doors closed, lighting, *ventilation*, and car displays shall be capable of being de-energized within 5 minutes of stopping, and re-energized prior to opening the doors. Power shall cease to be applied to the door motor after the elevator is stopped, lighting is de-energized, and no one is in the car, and re-energized upon the next passenger arrival. In *buildings* with multiple elevators serving the same floors, not less than half of the elevators shall be capable of switching to sleep, low power mode during periods of low traffic.

610.2.1.5 Guides. All elevator car guides shall be of the roller type, in order to reduce frictional energy losses. Counterweights with sliding guides shall be balanced in order to minimize frictional losses associated with the counterweight guides.

610.2.2 Escalators and moving walkways. Escalators and moving walkways shall comply with Sections 610.2.2.1 through 610.2.2.5.

610.2.2.1 Lighting. Light sources, including, but not limited to, balustrade lighting, comb-plate lighting and step demarcation lighting, shall have an efficacy of not less than 50 lm/W.

610.2.2.2 Drive system. Induction motors with a class IE3 efficiency rating, as defined by IEC EN 60034-30, or permanent magnet synchronous motors shall be used.

610.2.2.3 Energy recovery. Down-running escalators equipped with direct variable frequency drives shall use regenerative drives and return recovered energy to the building electrical power system.

610.2.2.4 Handrails. Handrails shall use friction-reducing measures, such as, but not limited to, rollers in newels.

610.2.2.5 Standby mode. During *standby mode*, escalators and moving walkways shall be capable of being automatically slowed to not greater than 50 percent of nominal speed. Escalators and moving walkways shall be capable of being automatically turned off when the *building* is unoccupied or outside of *facility operations*. In locations where multiple escalators serve the same passenger load, not less than 50% of the escalators shall have the capability of being turned off in response to reduced occupant traffic.

610.2.3 Commercial food service equipment. Not less than 50 percent of the aggregate rated power allocated to commercial food service equipment shall be ENERGY STAR-eligible food service equipment including, but not limited to, open deep-fat fryers, hot food holding cabinets, reach-in refrigerators and freezers, solid door refrigerators and freezers defined by ENERGY STAR. Steam cookers, dishwashers, griddles, and convection gas and electric ovens, shall be ENERGY STAR qualified.

610.2.4 Conveyors. Motors associated with conveyors shall be sized to meet the expected load and designed to run within 90 percent of capacity at all times the conveyor is expected to operate. Conveyor motors shall be provided with sleep mode controls. Two-speed motors and adjustable-speed drives shall be provided where load weights are expected to vary. *Readily accessible* controls shall be provided to allow for *manual* shut off of the

conveyor when it is not needed. Conveyor systems shall be designed to use gravity feed when conditions allow and arranged such that long straight runs are provided with as few drives as possible.

610.3 Portable appliances and equipment. Appliances and equipment not exempted in Section 610.1 and that are not permanently connected to the *building* energy supply systems shall meet the provisions of Section 610.3.1. Such appliances and equipment shall be *listed* and *labeled*, installed in accordance with the manufacturer's installation instructions, and provided with controls and energy monitoring systems as required by this code. Compliance shall be documented and verified by the *approved agency* designated by the adopting agency, during the *commissioning* or operational phase of the *building*.

610.3.1 ENERGY STAR appliances and equipment. The *building* owner or, in tenant-occupied *buildings*, each tenant, shall maintain on site a list of installed portable ENERGY STAR-eligible appliances and equipment indicating the corresponding rated power of each of the following items and whether each such item is an ENERGY STAR-qualified item:

1. Residential service appliances, including, but not limited to, humidifiers and room air cleaners.
2. Commercial service appliances, including, but not limited to, clothes washers and dryers.
3. Consumer electronics, including, but not limited to, battery charging systems, audio and video appliances, cordless phones, digital to analog converters, set top boxes, televisions, and external power adaptors.
4. Office machines and equipment, including, but not limited to, computers, copiers, digital duplicators, displays, multi-function devices, network equipment servers, voice-mail systems, fax machines, mailing machines, desktop monitors, printers, scanners and water coolers;

610.3.2 Aggregate rated power. The aggregate rated power of all ENERGY STAR-qualified portable appliances and equipment in the *building* or, in tenant-occupied *buildings*, in each tenant space, as identified by Section 610.3.1 shall constitute not less than 50 percent of the aggregate rated power of all portable appliances and equipment in the *building* or tenant space, respectively. Such a list shall be made available to the *code official upon request*.

SECTION 611 BUILDING RENEWABLE ENERGY SYSTEMS

611.1 Renewable energy systems requirements. *Buildings* that consume energy shall comply with this section. Each *building* or surrounding lot or *building site* where there are multiple *buildings* on the *building site* shall be equipped with one or more renewable energy systems in accordance with this section.

Renewable energy systems shall meet the requirements of Section 611.2 for *solar photovoltaic* systems, Section 611.3 for wind systems, or Section 611.4 for solar water heating systems, and Section 611.5 for performance monitoring and *metering* of these systems as *approved* by the code official. These systems shall be commissioned according to the requirements of Section 612.

Exceptions:

1. *Buildings* or *building sites* where there are multiple *buildings* on the *building site* providing at least two percent of the total estimated annual energy use of the *building*, or collective *buildings* on the site, with on-site renewable energy using a combination of renewable energy generation systems meeting the requirements of Section 611.2, 611.3, or 611.4.
2. Where not less than four percent of the total annual *building* energy consumption from renewable generation takes the form of a ten-year commitment to *renewable energy credit* ownership, confirmed by the code official.
3. Where the combined application of on-site generated renewable energy and a commitment to *renewable energy credit* ownership as confirmed by the code official, totals not less than four percent of the total annual *building* energy consumption from renewable generation.

611.1.1 Building performance-based compliance. *Buildings* and surrounding property or *building sites* when there are multiple *buildings* on the *building site*, that seek compliance with this code in accordance with Section 602.3.2, performance-based compliance, shall be equipped with one or more renewable energy systems that have the capacity to provide not less than two percent of the total calculated annual energy use of the *building*, or collective *buildings* on the site, with on-site renewable energy in accordance with Section 603.

611.1.2 Building prescriptive compliance. *Buildings* and surrounding property or *building sites* where there are multiple *buildings* on the *building site*, that seek compliance with this code in accordance with Section 602.3.1, Prescriptive compliance, shall be equipped with one or more renewable energy systems that have the capacity to provide not less than two percent of the total estimated annual energy use of the *building*, or collective *buildings* on the *building site*, with on-site renewable energy by calculation demonstrating that on-site renewable energy production has a rating of not less than 1.75 Btu/hr or not less than 0.50 watts per square foot of conditioned floor area, and using any single or combination of renewable energy generation systems meeting the requirements of Sections 611.2, 611.3, or 611.4.

611.2 Solar photovoltaic systems. *Solar photovoltaic* systems shall be designed, constructed and sized to provide not less than two percent of the total estimated annual electric energy consumption of the *building*, or collective *buildings* on the *building site* in accordance with Section 611.1.1 or 611.1.2.

Exception: Solar photovoltaic systems are not permitted to be used to comply with section 611.1 where building sites with total global insolation levels lower than 2.00 kWh/m²/day as calculated in accordance with NREL SERI TR-642-761.

611.2.1 Requirements. The installation, inspection, maintenance, repair and replacement of *solar photovoltaic systems* and all system components shall comply with the manufacturer's instructions, Sections 611.2.1.1 through 611.2.1.4, and NFPA 70.

611.2.1.1 Roof-mounted solar photovoltaic systems. Where *solar photovoltaic systems* are installed on roofs, the roof shall be constructed to support the loads imposed by such modules. Solar photovoltaic systems and supporting structure shall be constructed of noncombustible materials or fire-retardant-treated wood equivalent to that required for the roof construction. Not less than four feet of clearance shall be provided between any portion of a roof mounted *solar photovoltaic* array and roof mounted equipment, *skylights*, access hatches and similar *building* components that could hinder access to the *solar photovoltaic* array.

611.2.2 Performance verification. *Solar photovoltaic* systems shall be tested upon installation to verify that the installed performance meets the design specifications. A report of the tested performance shall be provided to the *building* owner.



611.3 Wind energy systems. Wind energy systems shall be designed, constructed and sized to provide not less than two percent of the total estimated annual electric energy consumption of the *building*, or collective *buildings* on the *building site* in accordance with Section 611.1.1 or 611.1.2.

611.3.1 Installation, location and structural requirements. Wind energy systems shall be located on the *building*, adjacent to the *building*, or on the *building site*.

611.3.1.1 Roof top set back. Roof-top wind turbine installations shall be set back from the edge of the *building* a distance not less than two times tip height where tip height is defined as the height from the base of the tower to the top of one blade in the 12 o'clock position.

611.3.1.2 Roof and wall penetrations. Roof and wall penetrations shall be flashed and sealed to prevent entry of water, rodents and insects.

611.3.1.3 Solar photovoltaic modules. Solar photovoltaic modules shall be listed and labeled in accordance with UL 1703.

611.3.1.4 Inverters. Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction.

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611.4 Solar water heating equipment. Not less than ten percent of the *building's* annual estimated hot water energy usage shall be met by on-site solar water heating equipment.

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611.5 Renewable energy system performance monitoring and metering. Renewable energy systems shall be *metered* and monitored in accordance with Sections 611.5.1 and 611.5.2.

611.5.1 Metering. Renewable energy systems shall be metered separately from the *building's* electrical and fossil fuel meters. Renewable energy systems shall be *metered* to measure the amount of renewable electric or thermal energy generated on the *building site* in accordance with Section 604.

611.5.2 Monitoring. Renewable energy systems shall be monitored to measure the peak electric or thermal energy generated by the renewable energy systems during the *building's* anticipated peak electric or fossil fuel consumption period in accordance with Section 604.

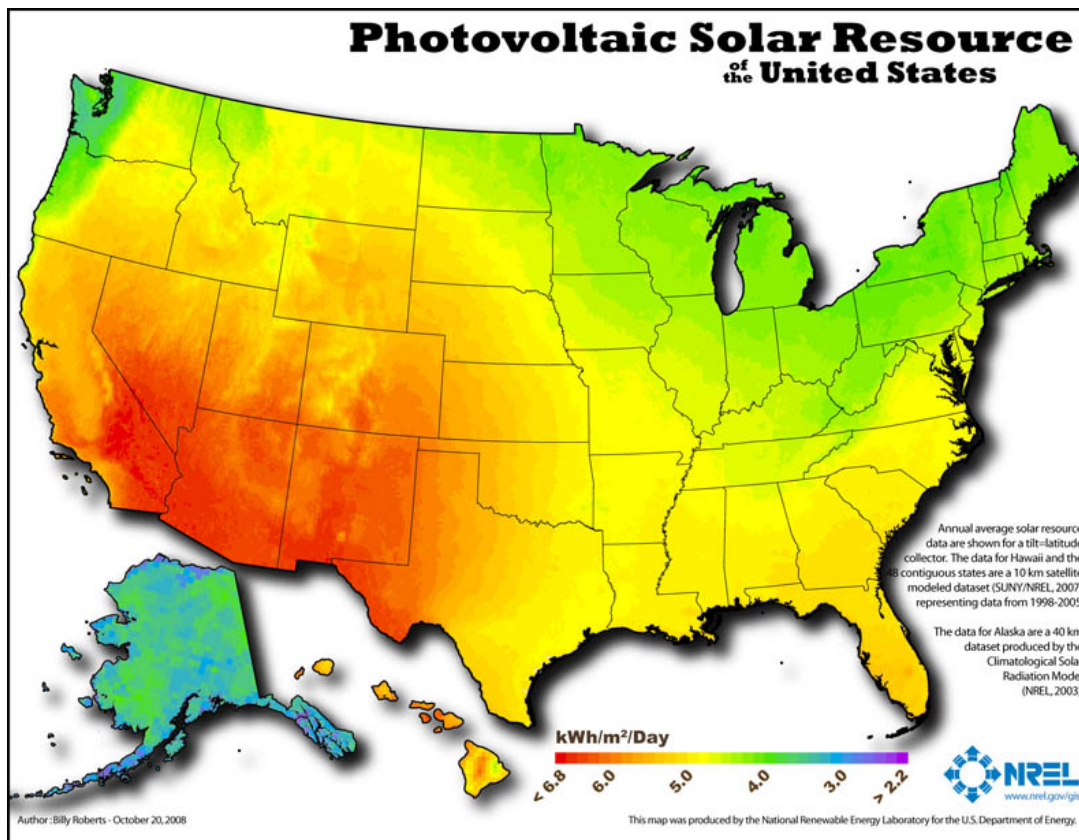


FIGURE 611.4 PHOTOVOLTAIC RESOURCE MAP (kWh/m²/day)

SECTION 612 ENERGY SYSTEMS COMMISSIONING AND COMPLETION

612.1 Mechanical systems commissioning and completion requirements. Within 60 days from approval conducting the final mechanical inspection, the registered design professional shall provide evidence of mechanical systems commissioning and completion of the mechanical system installation to the code official and in accordance with the *International Energy Conservation Code*.

Drawing notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request.

612.1.1 Commissioning plan. A *commissioning* plan shall be developed by a *registered design professional* or approved *agency* and shall include as a minimum all of the following items:

1. A narrative describing the activities that will be accomplished during each phase of *commissioning*, including guidance on who accomplishes the activities and how they are completed.
2. Equipment and systems to be tested including, but not limited to, the specific equipment, appliances or systems to be tested and the number and extent of tests.
3. Functions to be tested including, but not limited to, calibrations and economizer controls.
4. Conditions under which the test shall be performed including, but not limited to, affirmation of winter and summer design conditions and full outside air.
5. Measurable criteria for performance.

612.1.2 Systems adjusting and balancing. HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the product specifications. Test and balance activities shall include as a minimum, the provisions of Sections 612.1.2.1 and 612.1.2.2.

612.1.2.1 Air systems balancing. Each supply air outlet and zone terminal device shall be equipped with a means for air balancing in accordance with the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors of 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

Exception: Fans with fan motor horsepower of 1 hp or less.

612.1.2.2 Hydronic systems balancing. Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the capability to measure pressure across the pump, or shall have test ports at each side of each pump.

Exceptions:

1. Pumps with pump motors of 5 hp or less.
2. Where throttling results in not greater than five percent of the nameplate horsepower draw above that required if the impeller were trimmed.

612.1.3 Functional performance testing. Functional performance testing shall be in accordance with the requirements of Sections 612.1.3.1, 612.1.3.2 and 612.1.3.3.

612.1.3.1 Equipment. Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with *approved* plans and specifications such that operation, function, and maintenance serviceability for each of

the commissioned systems is confirmed. Testing shall include all specified modes of control and *sequence of operation*, including under full-load, part-load and all of the following emergency conditions:

1. Each mode as described in the *sequence of operation*.
2. Redundant or *automatic* back-up mode.
3. Performance of alarms.
4. Mode of operation upon a loss of power and restoration of power.

612.1.3.2 Controls. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated adjusted and operate in accordance with the *approved* plans and specifications. *Sequences of operation* shall be functionally tested to document that they operate in accordance with the *approved* plans and specifications.

612.1.3.3 Economizers. Air economizers shall undergo a functional test to determine that they operate in accordance with manufacturer's specifications.

612.1.4 Preliminary commissioning report. A preliminary report of *commissioning* test procedures and results shall be completed and certified by the *registered design professional* or *approved agency* and provided to the *building owner*. The report shall be identified as "Preliminary Commissioning Report" and shall identify all of the following:

1. Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation.
2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.

612.1.4.1 Acceptance. *Buildings*, or portions thereof, shall not pass the final mechanical inspection until such time as the *code official* has received a letter of transmittal from the *building owner* acknowledging that the *building owner* has received the Preliminary Commissioning Report.

612.1.4.2 Copy. At the request of the *code official*, a copy of the Preliminary Commissioning Report shall be made available for review.

612.1.4.3 Certification. A certification, signed and sealed by the *registered design professional*, documenting that the mechanical and service water heating systems comply the *International Energy Conservation Code* Sections 503 and 504, respectively, shall be provided to the *code official*.

612.1.5 Completion requirements. The *construction documents* shall specify that the requirements described in this section be provided to the *building owner* within 90 days of the date of receipt of the *certificate of occupancy*.

612.1.5.1 Drawings. *Construction documents* shall include the location of and performance data pertaining to each piece of equipment.

612.1.5.2 Manuals. An operating and maintenance manual in accordance with industry-accepted standards shall be provided and shall include all of the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the *building* project. Required routine maintenance shall be clearly identified.
3. Names and addresses of not less than one *service agency*.

A Systems Manual shall be provided and shall include all of the following:

1. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined set-points shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
2. A complete narrative of how each system is intended to operate, including recommended set-points, seasonal change-over information and emergency shutdown operation.
3. Control sequence descriptions for lighting, domestic hot water heating and all renewable energy systems complete with a description of how these systems connect to, and are controlled in conjunction with, the overall building system.

612.1.5.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section 612.1.2 shall be provided.

612.1.5.4 Final commissioning report. A complete report of test procedures and results identified as “Final Commissioning Report” shall be completed and provided to the building owner. The report shall include all of the following:

1. Results of all functional performance tests.
2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.
3. All functional performance test procedures used during the *commissioning* process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests that were not performed at the time of report preparation because of climatic conditions.

612.1.5 Post occupancy re-commissioning. The *commissioning* activities specified in Sections 612.1.2 through 612.1.5 shall be repeated 18 to 24 months after certificate of occupancy. Systems and control devices that are not functioning properly shall be repaired or replaced. Adjustments to calibration settings shall be documented. This documentation shall be provided to the *building owner*.

612.2 Sequence of operation. A *sequence of operation* shall be developed and finalized upon *commissioning*, when the operational details are initialized and validated. A *sequence of operation* shall be the final record of system operation, and shall be included on the control diagram ‘as-builts’, or as part of the education and operation and maintenance document that is provided to the owner.

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612.3 Lighting and electrical systems commissioning and completion requirements. Prior to issuance of *certificate of occupancy*, the *registered design professional* shall provide evidence of lighting and electrical systems *commissioning* and completion in accordance with the *International Energy Conservation Code* and the provisions of this section.

Drawing notes shall specify the provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections 612.2.4 and 612.2.5

612.3.1 Pre-construction documentation, lighting. Construction and owner education documents shall include floor plans, diagrams and notations of sufficient clarity describing the types of, location and operational requirements of all lighting controls including a *sequence of operation* and preliminary intended set points for

all dimming systems and *automatic daylight controls*, demonstrating conformance to the provisions of this code, relevant laws, ordinances, rules and regulations, as *approved* by the *code official*.

612.3.2 Verification. The *approved agency* conducting *commissioning* shall verify that controls have been installed in accordance with the *approved construction documents*. Any discrepancies shall be reviewed for compliance with Section 609 and the requirements of Section 505.2 of the *International Energy Conservation Code*.

612.3.3 Commissioning. Lighting controls shall be commissioned in accordance with this Section.

612.3.3.1 Occupant sensors. It shall be verified that the functional testing in accordance with *International Energy Conservation Code* Section 505.2 has been performed.

612.3.3.2 Automatic daylight controls. *Automatic daylight controls* shall be commissioned in accordance with all of the following:

1. It shall be verified that the placement and orientation of each sensor is consistent with the manufacturer's installation instructions. If not, the sensor shall be relocated or replaced.
2. Control systems shall be initially calibrated to meet settings and design intent established in the *construction documents*;
3. Prior to calibration of systems controlling dimmable luminaires, all lamps shall be seasoned in accordance with the recommendations of the lamp manufacturer.
4. Where located inside *buildings*, calibration of open-loop *daylight controls*, which receive illumination from natural light only, shall not occur until fenestration shading devices such as blinds or shades have been installed and commissioned;
5. Calibration of closed-loop *daylight controls*, that receive illumination from both natural and artificial light, shall not occur until furniture systems and interior finishes have been installed, and any fenestration shading devices such as blinds or shades have been installed and commissioned; and
6. Calibration procedures shall be in accordance with the manufacturer's installation instructions.

612.3.3.3 Time switch and programmable schedule controls. Lighting controls installed in accordance with Section 609 shall be programmed. Scheduling shall incorporate weekday, weekend and holiday operating times, including leap year and daylight savings time corrections. It shall be verified that system overrides work and are located in compliance with Section 505.2 of the *International Energy Conservation Code*.

612.3.3.4 Dimming systems with preset scenes. For programmable dimming systems it shall be verified that *automatic* shutoff and *manual* overrides are working and that programming is complete. Prior to programming, all lamps shall be seasoned in accordance with the recommendations of the lamp manufacturer.

612.3.4 Post-commissioning documentation. The following documentation shall be provided to the *building* owner in accordance with Section 903.

1. Settings determined during *commissioning* activities outlined in Section 612.2.3.
2. A narrative describing the intent and functionality of all controls including any capability for users to override a schedule or master command.
3. Specification sheets for all lighting equipment and controls.
4. Operation manuals for each lighting control device. Required maintenance and maintenance schedules shall be clearly identified. Documentation and instructions necessary for *building* maintenance personnel to maintain and re-calibrate lighting systems and controls.
5. An annual inspection schedule for lighting controls.

6. Troubleshooting information for fluorescent dimming systems and the remediation of switching issues such as false-ons and false-offs.

612.3.5 Post occupancy re-commissioning. The *commissioning* activities in Section 612.2.3 shall be repeated 18 to 24 months after issuance of the certificate of occupancy. Control devices that are not functioning properly shall be repaired or replaced. Adjustments to calibration settings shall be documented. This documentation shall be provided to the *building* owner.

612.4 Building envelope systems commissioning and completion requirements. Prior to issuance of a *certificate of occupancy*, the *registered design professional* shall provide evidence of *building thermal envelope* systems *commissioning* and completion to the building owner in accordance with the *International Energy Conservation Code* and the provisions of this section.

Construction documents shall specify the provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the building owner and made available to the *code official* upon request in accordance with Sections 612.4.1 and 612.4.2.

612.4.1 Pre-construction documentation, building thermal envelope. Construction and owner education documents shall indicate the location, nature and extent of the work proposed and show the functional requirements and operation of all *building thermal envelope* systems demonstrating conformance to the provisions of this code, relevant laws, ordinances, rules and regulations, as *approved* by the *code official*.

612.4.2 Verification. The *approved agency* conducting *commissioning* shall verify that *building thermal envelope* systems have been installed in accordance with the *approved construction documents*. Any discrepancies shall be reviewed for compliance with requirements of the *International Energy Conservation Code* and this code.

SECTION 613 JURISDICTIONAL REQUIREMENTS & PROJECT ELECTIVES

613.1 General. Section 613 provides *jurisdictional requirements* and *project electives* related to energy conservation and efficiency and atmospheric quality. *Project electives* shall not be mandatory unless selected by the owner or *design professional in responsible charge* and indicated in the Project Elective Checklist in accordance with Section 303.4.

613.2 Post certificate of occupancy zEPI, energy demand, and CO₂e emissions reporting. Where the jurisdiction indicates in Table 302.1 that ongoing post certificate of occupancy zEPI, energy demand and *CO₂e emissions* reporting is required, and where the jurisdiction has indicated in Tables 302.1 and 602.1 that enhanced energy performance in accordance with Section 602.1 or *CO₂e emissions* in accordance with Section 602.2.2.3 are required, zEPI, energy demand, and *CO₂e emissions* reporting shall be provided in accordance with this section.

613.2.1 Purpose. The purpose of this section is to provide for the uniform reporting and display of the *total annual net energy use*, peak demand for each energy form and emissions associated with *building* operations and *building sites*.

613.2.2 Intent. The intent of these requirements is to provide for the ongoing reporting and display of the *total annual net energy use*, peak energy demand and emissions associated with operation of the *building* and its systems to document ongoing compliance with the provisions of Sections 602 and 603.

613.2.3 Reporting. Reports in accordance with Sections 613.2.3.1 through 613.2.3.3 shall be generated.

613.2.3.1 Annual net energy use. The zEPI associated with the operation of the *building* and the *buildings* on the site, as determined in accordance with Section 603.1.1, shall be reported by the *building* owner or the owner's registered agent to the [insert name of appropriate state or local government agency to be responsible for collecting reported information].

Where there are multiple *buildings* on a *building site*, each *building* shall have its zEPI reported separately. Where there are energy uses associated with the *building site* other than the *buildings* on the site, the zEPI for the *building site* shall be reported separately.

Energy use for the previous year shall cover the complete calendar year and be reported on, or before, March 1st of the following year.

613.2.3.2 Peak monthly energy demand reporting. The peak demand of all energy forms serving each *building* and the *building site*, as determined in accordance with Section 603.1.2, shall be reported by the *building* owner or the owner's registered agent to the [insert name of appropriate state or local government agency to be responsible for collecting reported information].

Where there are multiple *buildings* on a *building site* each *building* shall have its energy demand reported separately. Where there are energy uses associated with the *building site* other than the *buildings* on the site, the energy demand for the *building site* shall be reported separately.

Monthly energy demand data for the previous year shall cover the complete calendar year and be reported on, or before, March 1st of the following year.

613.2.3.3 Annual CO₂e emissions reporting. The annual emissions associated with the operation of the *building* and its systems, as determined in accordance with Section 603.1.3, shall be reported by the *building* owner or the owner's registered agent to the [insert name of appropriate state or local government agency to be responsible for collecting reported information].

Where there are multiple *buildings* on a *building site* each *building* shall have its annual emissions reported separately. Where there are energy uses associated with the *building site* other than the *buildings* on the site, the annual *CO₂e emissions* for the *building site* shall be reported separately.

Emissions reported for the previous year shall cover the complete calendar year and be reported on, or before, March 1st of the following year.

613.3 zEPI reduction project electives. *Project electives* for *buildings* pursuing performance-based compliance in accordance with Section 602.3.2 shall be in accordance with the portions of Table 302.1 that reference section 613.3, Equation 6-2 and the calculation procedures specified in Section 603.3.

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613.4 Mechanical systems project elective. *Buildings* seeking a mechanical systems project elective in accordance with Table 303.1 and Section 303.4 shall comply with Sections 613.4.1 through 613.4.5.

613.4.1 Prescriptive path. The *building* shall be designed prescriptively in accordance with Section 602.2.1.

613.4.2 Mechanical equipment. Mechanical equipment shall comply with Sections 613.4.2.1 through 613.4.2.4 to achieve the mechanical systems *project elective*:

613.4.2.1 Heating equipment. For heating equipment, the part-load efficiency of the equipment shall be not less than 10 percent greater than the part-load efficiencies shown in the applicable tables of Section 606, the *International Energy Conservation Code*, or ASHRAE 90.1, or the equipment shall meet ENERGY STAR criteria, as applicable.

613.4.2.2 Cooling equipment. For cooling equipment, the part-load efficiency of the equipment shall be not less than 10 percent greater than the part-load efficiencies shown in the applicable tables of Section 606, the *International Energy Conservation Code*, or ASHRAE 90.1, or the equipment shall meet ENERGY STAR criteria.

613.4.2.3 Geothermal heat pumps. Geothermal heat pumps shall meet the provisions of Table 613.4.2.3 based on the applicable referenced test procedure.

613.4.2.4 Multi-stage geothermal heat pumps. The efficiency of multi-stage geothermal heat pumps shall meet the provisions of Table 613.4.2.3 based on the applicable referenced test procedure.

**TABLE 613.4.2.3
ENERGY-EFFICIENCY CRITERIA FOR GEOTHERMAL SOURCE HEAT PUMPS**

Product Type	Minimum EER	Minimum COP	Test Procedure
Water-to-Air Closed loop	14.1	3.3	ISO 13256-1
Water-to-Air Open loop	16.2	3.6	ISO 13256-1
Water-to-Water Closed loop	15.1	3.0	ISO 13256-2
Water-to-Water Open loop	19.1	3.4	ISO 13256-2
Direct Expansion (DX) or Direct GeoExchange (DGX)	15.0	3.5	AHRI 870

613.4.3 Duct insulation. Ducts shall be insulated to R-8 or greater where located in unconditioned spaces and R-11 minimum where located outside of the *building structure*. Where located within a *building* envelope assembly, the duct or plenum shall be separated from the *building* exterior or unconditioned or exempt spaces by R-8 insulation or greater.

613.4.4 Duct system testing. Duct systems shall be leak-tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual* and shall have a rate of air leakage (CL) less than or equal to 4 as determined in accordance with equation 5-2 of the *International Energy Conservation Code*.

606.4.4.1 Documentation. Documentation shall be furnished by the designer demonstrating that representative sections totaling not less than 50 percent of the duct area have been tested and that all tested sections meets the requirements of Section 613.4.4.

613.4.5 Service water heating equipment. The efficiency of the service water heating equipment shall be not less than 10 percent greater than the efficiencies shown in the *International Energy Conservation Code* and ASHRAE 90.1 or the service water heating equipment shall be ENERGY STAR qualified.

613.5 Service Water heating project elective. Buildings seeking a service water heating project elective in accordance with Table 303.1 and Section 303.4 shall comply with Sections 613.5.1 through 613.5.3.

613.5.1 Prescriptive path. The building shall be designed prescriptively in accordance with Section 602.3.1.

613.5.2 Occupancy. The building shall be designed to serve one of the following occupancies:

1. Group A-2, Restaurants and Banquet halls;
2. Group F, Laundries;
3. Group R-1, Boarding houses (transient), Hotels (transient), Motels (transient);
4. Group R-2 *buildings*; and
5. Group A-3, Health Clubs and Spas
6. Group I-2, Hospitals, Mental hospitals and Nursing homes.

613.5.3 Service water heating efficiency. The efficiency of the service water heating equipment shall be at least 10 percent greater than the efficiencies shown in the *International Energy Conservation Code* and ASHRAE 90.1 or the service water heating equipment shall be ENERGY STAR qualified.

613.6 Lighting system efficiency project elective. Buildings seeking a lighting system efficiency project elective in accordance with Table 303.1 and Section 303.4 shall comply with Sections 613.6.1 through 613.6.3.

613.6.1 Prescriptive path. The building shall be designed prescriptively in accordance with Section 602.3.1.

613.6.2 Interior lighting system efficiency. The interior connected lighting power shall be 10 percent less than the allowance determined in accordance with Section 505.5 of the *International Energy Conservation Code*.

613.6.3 Exterior lighting system efficiency. The exterior connected lighting power shall be 10 percent less than the allowance determined in accordance with Section 505.6 of the *International Energy Conservation Code*.

613.7 Passive design project elective. *Buildings* seeking a passive design *project elective* in accordance with Table 303.1 and Section 303.4 shall comply with Sections 613.7.1 and 613.7.2.

613.7.1 Performance path. The building shall be designed using the performance path in accordance with Section 602.2.2.

613.7.2 Passive design provisions. The simulation of energy use performed pursuant to Section 603 shall document that not less than 40 percent of the annual energy use reduction realized by the *proposed design* has been achieved through passive heating, cooling, and ventilation design, as compared to the *standard reference design*. Passive heating and cooling shall use strategies including, but not limited to, *building* orientation, fenestration provisions, material selection, insulation choices, overhangs, shading means, microclimate vegetation and water use, passive cooling towers, natural heat storage, natural *ventilation*, and thermal mass.

CHAPTER 7

WATER RESOURCE CONSERVATION AND EFFICIENCY

SECTION 701 GENERAL

701.1 Scope. The provisions of this chapter shall establish the means of conserving water used indoors, outdoors and in wastewater conveyance.

SECTION 702 FIXTURES, FITTINGS, EQUIPMENT AND APPLIANCES

702.1 Fitting and fixture consumption. A schedule of plumbing fixtures and fixture fittings shall be provided that demonstrates compliance with all of the following:

1. The maximum water consumption of fixtures and fittings shall comply with the flow rates specified in Table 702.1 for the fixtures and fittings listed therein.
2. The aggregate *potable* water consumption of fixtures and fittings shall be at least 20 percent less than the reference value calculated in accordance with Section 702.1.1.

Exceptions: The following fixtures and devices shall not be required to comply with the reduced flow rates of this section.

1. Blowout design water closets having a maximum water consumption of 2.8 gallons (10.4 L) per flush.
2. Clinical sinks having a maximum water consumption of 4.5 gallons (17 L) per flush.
3. Service sinks, bath valves, pot fillers, laboratory faucets, utility faucets, and other fittings designed primarily for filling operations.

702.1.1 Aggregate fixture and fitting water consumption calculation. The aggregate consumption of all fixtures and fittings shall be calculated in accordance with Tables 702.1.1(1) and 702.1.1(2) for the purpose of demonstrating compliance with the aggregate consumption requirement in Sections 702.1 and 702.1.2. Table 702.1.1(1) is to be used first to calculate the reference water use and Table 702.1.1(2) is then to be used to calculate the required reduction in that reference water use. The percentage of reduction of the total water use shall be calculated in accordance with equation 7-1.

Consumption for each fixture or fitting type = (flow rate) x (duration) x (daily uses per occupant) x (number of occupants). The aggregate fixture and fitting consumption is equal to the sum of the consumption values for each fixture and fitting located in the occupancy.

$$\text{Percent reduction} = [(R-D)/R] \times 100 \quad \text{(Equation 7-1)}$$

Where:

R= Total reference water use determined from Table 702.1.1(1)

D= Total design water use determined from Table 702.1.1(2)

**TABLE 702.1
MAXIMUM FIXTURE AND FITTING FLOW RATES
FOR REDUCED WATER CONSUMPTION**

FIXTURE OR FIXTURE FITTING TYPE	MAXIMUM FLOW RATE
Showerhead ^e	2.0 gpm ^b and WaterSense labeled
Lavatory faucet and bar sink -private	1.5 gpm ^c and WaterSense labeled
Lavatory faucet-public (metered)	0.25 gpc ^d
Lavatory faucet-public (nonmetered)	0.5 gpm ^c
Kitchen faucet-private	2.2 gpm ^c
Kitchen and bar sink faucets in other than dwelling units and guest rooms	2.2 gpm ^c
Urinal	0.5 gpf and WaterSense labeled or nonwater urinal
Water closet	1.6 gallons per flush ^a
Water closet-private	1.28 gpf and WaterSense labeled
Prerinse Spray Valves	1.3 gpm ^c
Drinking Fountains (manual)	0.7 gpm ^c
Drinking Fountains (metered)	0.25 gpc ^d

- a. The effective flush volume of a dual-flush water closet is defined as the composite, average flush volume of two reduced flushes and one full flush.
- b. Flow rate at a pressure of 45 and 80 psi.
- c. Flow rate at a pressure of 60 psi.
- d. Gallons per cycle
- e. Includes hand showers, body sprays, rainfall panels and jets. Showerhead(s) shall be supplied by *automatic* compensating valves that comply with ASSE 1016 or ASME A112.18.1/CSA B125.1 and that are specifically designed to function at the flow rate of the showerheads being used.

**TABLE 702.1.1(1)
REFERENCE FIXTURE AND SUPPLY FITTING WATER CONSUMPTION
To Calculate Baseline Water Use Projections**

Plumbing Fixture or Supply Fitting	Flow Rate or Volume ^b	Duration	Daily Uses Per Occupant	Occupants ^h	Daily Volume Gallon per day
Shower head ^a in dwelling units and guest rooms	2.5 gpm ^e	8.5 min.	1	Note c	
Lavatory faucet, private and in dwelling units and guest rooms	2.2 gpm ^d	0.25 min.	3		
Lavatory, public (metered)	0.25 gpc ^f	1 cycle	3		
Lavatory, public (nonmetered)	0.5 gpm ^d	0.25 min.	3		
Kitchen and bar sink faucets	2.2 gpm ^d	4 min.	1		
Urinal	1.0 gpc ^f	1 cycle	2/male		
Water closet in other than dwelling units and guest rooms	1.6 gpc ^f	1 cycle	1/male ^g	males	
			3/female	females	
Water closet in dwelling units and guest rooms ⁱ	1.6 gpc ^f	1 cycle	6/male	males	
			6/female	females	
				Total Reference Water Use (R) (gal/day)	

For SI: 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

- a. A hand-held shower spray is considered to be a showerhead.
- b. Consumption tolerances shall be determined from referenced standards.
- c. For shower heads, the number of occupants shall be based upon the anticipated number of shower users. Residential and hotels shall presume 1 shower per occupant per day. Residential occupancy as regulated by the code in accordance with Section 101.2.
- d. Flow at 60 psi
- e. Flow at 80 psi
- f. Gallons per cycle (gpc)
- g. The daily use per male occupant shall be 3 where urinals are not installed

- h. The number of occupants shall be that number used to determine the required number of plumbing fixtures in accordance with the International Plumbing Code.
- i. Residential occupancies as regulated by this code in accordance with Section 101.2

TABLE 702.1.1(2)
DESIGN FIXTURE AND SUPPLY FITTING WATER CONSUMPTION
To Calculate Water Use Reduction Compared to Baseline Projections

Plumbing Fixture or Supply Fitting	Flow Rate or Volume ^b	Duration	Daily Uses Per Occupant	Occupants	Daily Volume Gallon per day
Shower head or shower spa ^a		8.5 min.	1	Note c	
Lavatory faucet, private in dwelling units and guest rooms ^g		0.25 min.	3		
Lavatory, public (metered)		1 cycle	3		
Lavatory, public (nonmetered)		0.25 min.	3		
Kitchen and bar sink faucets		4 min.	1		
Urinal		1 cycle	2/male		
Water closet ^d In other than dwelling units and guest rooms ^g	1.6 gpc	1 cycle	1/male ^e	males	
			3/female	females	
Water closet ^d In dwelling units and guest rooms ^g	1.28 gpc	1 cycle	6/male	males	
			6/female	females	
				Total Design Water Use (D)(gal/day)	

For SI: 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

- a. Includes hand showers, body sprays, rainfall panels and jets. Showerhead(s) shall be supplied by automatic compensating valves that comply with ASSE 1016 or ASME A112.18.1/CSA B125.1 and that are specifically designed to function at the flow rate of the showerheads being used.
- b. Consumption tolerances shall be determined from referenced standards.
- c. For shower heads, the number of occupants shall be based upon the anticipated number of shower users.
- d. Tank type and and pressure assist High-Efficiency Water Closets (HETs) shall be certified to the current WaterSense High-Efficiency Toilet Specification.
- e. The daily use per male occupant shall be 3 where urinals are not installed.
- f. The number of occupants shall be that number used to determine the required number of plumbing fixtures in accordance with the *International Plumbing Code*.
- g. Residential occupancies as regulated by this code in accordance with Section 101.2.

702.1.2 Additional reductions. The provisions for Tier 1 and Tier 2 maximum fixture flow rates shall be applicable where indicated in Table 302.1. The specific requirements for Tier 1 and Tier 2 fixture and fitting consumption shall be as follows:

Tier 1. A schedule of plumbing fixtures and fixture fittings shall be provided that demonstrates that fixture and fitting consumption meets the applicable reduced flow rates specified in Table 702.1 and that demonstrates a 30 percent reduction in the reference aggregate fixture and fitting *potable* water consumption calculated in accordance with Section 702.1.1.

Tier 2. A schedule of plumbing fixtures and fixture fittings shall be provided that demonstrates that fixture and fitting consumption meets the applicable reduced flow rates specified in Table 702.1 and that demonstrates a 40 percent reduction in the reference aggregate fixture and fitting *potable* water consumption calculated in accordance with Section 702.1.1.

702.1.3 Reduction prohibited. The flow rates for emergency and decontamination fixtures and fittings shall not be reduced below the specifications of ANSI/ISEA Z358.1.

702.2 Combination tub and shower valves. Tub spout leakage from combination tub and shower valves that occurs when the outlet flow is diverted to the shower shall be not more than 0.1 gpm, measured in accordance with the requirements of ASME A112.18.1/CSA B125.1.

702.3 Food establishment pre-rinse spray heads. Food establishment pre-rinse spray heads shall have a maximum flow rate in accordance with Table 702.1 and shall shut off *automatically* when released.

702.4 Drinking fountain controls. Drinking fountains equipped with *manually* controlled valves shall shutoff *automatically* upon the release of the valve. *Metered* drinking fountains shall comply with the flow volume specified in Table 702.1.

702.5 Nonwater urinal connection. The fixture drain for nonwater urinals shall connect to a branch drain that serves one or more lavatories, water closets or water-using urinals that discharge upstream of such urinals.

702.6 Appliances. Sections 702.6.1 through 702.6.4 shall regulate appliances that are not related to space conditioning.

702.6.1 Clothes washers. Clothes washers shall be Energy Star *labeled*.

702.6.2 Ice makers. Ice makers shall not be water cooled. Ice makers shall comply with the requirements of the Energy Star Program for commercial ice machines.

702.6.3 Food steamers. Food steamers shall consume not more than 2.0 gal (7.5 L) per hour in the full operational mode.

702.6.4 Dishwashers. Dishwashers shall be Energy Star *labeled* or shall be in accordance with Table 702.6.4.

**TABLE 702.6.4
MAXIMUM WATER CONSUMPTION FOR
COMMERCIAL DISHWASHERS**

DISHWASHER TYPE	SANITATION METHOD	
	HIGH TEMPERATURE (gallons per rack)	CHEMICAL (gallons per rack)
Conveyor	0.7	0.62
Door	0.95	1.16
Under Counter	0.9	0.98

702.7 Municipal reclaimed water. Where required by Table 302.1 and where *municipal reclaimed water* is accessible and allowed for such use by the laws, rules and ordinances applicable in the *jurisdiction*, it shall be supplied to water closets, water-supplied urinals, water-supplied trap primers and applicable industrial uses.

702.8 Efficient hot water distribution systems. The volume of water in the piping between the source of hot water and the hot water outlets of individual showers, combination tub-showers, sink, lavatory fixture fittings and hose bibbs delivering hot water shall not exceed 80 ounces (2.35 L). The volume of water contained in fixture branch piping that connects to a hot water circulation loop or electrically heat-traced pipe shall not exceed 24 ounces (0.7 L). The volume shall be calculated in accordance with Section 702.8.2.

702.8.1 Circulating hot water systems. Circulating hot water systems shall be provided with an *automatic* or readily accessible *manual* switch to turn off the hot water circulating pump when hot water is not required by users.

702.8.2 Volume calculation. The volume of water between the source of hot water and a given outlet shall be calculated by adding the internal volume of all piping, fittings, valves, *meters*, and manifolds between the source and the connection to unit shutoff valves, shower valves, or combination tub-shower valves, as applicable. The volume contained within flexible water supply connectors installed between the supply pipe and the fixture fitting and the volume within the fixture fitting shall not be included in the volume calculation. Piping volumes shall be calculated using Table 702.8.2. Where water is supplied by a circulating hot water system or an electrically heat-traced pipe, the hot water source shall be considered to be the loop or the heat -traced pipe, and the volume shall include the fitting on the loop that supplies the fixture branch.

**TABLE 702.8.2
INTERNAL VOLUME OF
VARIOUS TYPES OF WATER DISTRIBUTION PIPE AND TUBING**

Nominal Pipe or Tube Size (inch)	PIPE OR TUBING MATERIAL								
	COPPER (Type)			CPVC			PE	PEX	
	M	L	K	CTS SDR 11	SCH 40	SCH 80	AL-PE	CTS SDR 9	-AL-PEX
	LIQUID OUNCES PER FOOT OF LENGTH								
3/8	1.06	0.97	0.84	NA	1.17	0.86	0.63	0.64	0.63
1/2	1.69	1.55	1.45	1.25	1.89	1.46	1.31	1.18	1.31
3/4	3.43	3.22	2.90	2.67	3.38	2.74	3.39	2.35	3.39
1	5.81	5.49	5.17	4.43	5.53	4.56	5.56	3.91	5.56
1 1/4	8.70	8.36	8.09	6.61	9.66	8.24	8.49	5.81	8.49
1 1/2	12.18	11.83	11.45	9.22	13.20	11.38	13.88	8.09	13.88
2	21.08	20.58	20.04	15.79	21.88	19.11	21.48	13.86	21.48

702.9 Trap priming water. Potable water shall not be used for trap priming purposes where a *municipal reclaimed water* distribution system or a *graywater* distribution system is provided.

702.9.1 Filtration required. Non-potable water utilized by pressurized trap primer devices shall be filtered by a 100 micron or finer filter.

702.9.2 Labeling and signage. Each trap primer device utilizing non-potable water shall be provided with signage in accordance with Section 706.2.

702.10 Makeup water supply. Onsite non-potable water supply systems, such as on-site *reclaimed water*, *graywater* and rain water harvest systems, shall be supplied with municipal-reclaimed makeup water except that *potable* water shall be supplied where *municipal reclaimed water* is not accessible or is not allowed for such use by the laws, rules and ordinances applicable in the *jurisdiction*.

702.11 Water powered pumps. Water-powered pumps shall not be used as the primary means of removing ground water from sumps. Where used as an emergency backup pump for the primary pump, the primary pump shall be an electrically-powered pump and the water-powered pump shall be equipped with an auditory alarm that indicates when the water-powered pump is operating. The alarm shall have a minimum sound pressure level rating of 85 dB measured at a distance of ten feet.

702.12 Food service handwashing faucets. Faucets for handwashing sinks in food service preparation and serving areas shall be of the self-closing type.

702.13 Dipper wells. The water supply to a dipper well shall have a shutoff valve and flow control valve. Water flow into a dipper well shall not exceed 1 gpm (3.78 lpm) at a supply pressure of 60 psi (413.7 kPa).

702.14 Automated vehicle wash facilities. Not less than 50 percent of the water used for the rinsing phase of the wash cycle at automated vehicle wash facilities shall be collected to be reused for the washing phase. Towel and chamois washing machines shall have high-level water cut-offs.

702.15 Self-service vehicle wash facilities. Spray wand nozzles used at self-service vehicle wash facilities shall discharge not more than 3 gpm (11.4 lpm). Faucets for chamois wringer sinks shall be of the self closing type.

702.16 Vehicle washing facilities. Wastewater from reverse osmosis water treatment systems installed in vehicle washing facilities shall discharge to the washing phase water holding tank.

702.17 Covers. Spas shall be provided with vapor-retardant covers. Installed covers shall be in continuous contact with the rim surface of the spa.

702.18 Splash troughs. Swimming pool splash troughs shall discharge to the pool water system.

702.19 Covers. Swimming pools shall be provided with vapor-retardant covers.

702.20 Food water disposers. The water flow into a commercial food waste disposer in a food establishment shall be controlled by a load sensing device such that the water flow does not exceed 1 gpm under no-load operating conditions and 8 gpm under full-load operating conditions.

702.21 Combination ovens. Combination ovens shall consume not more than 10 gallons per hour (38 Lph) in any operational mode. Water consumption shall be tested in accordance with the requirements of ASTM F1639.

702.22 Autoclaves and sterilizers. Autoclaves and sterilizers requiring condensate tempering systems shall be of the type that does not require potable water to be blended with the discharge water to reduce the temperature of discharge.

702.22.1 Vacuum autoclaves and sterilizers. Vacuum sterilizers shall be prohibited from utilizing venturi-type vacuum mechanisms using water.

702.23 Liquid ring vacuum pumps. Except where the discharge is contaminated with hazardous materials or pathogens, the discharge water from liquid ring vacuum pumps shall be recovered for reuse within the pump or for other onsite applications.

702.24 Film processors. The cooling water discharge from water-cooled film processors shall be recovered and reused within the processor or for other onsite applications.

SECTION 703 HVAC SYSTEMS AND EQUIPMENT

703.1 Hydronic closed systems. Closed loop hydronic heating and cooling systems, and ground-source heat pump systems shall not be connected to a *potable* makeup water supply.

703.2 Humidification systems. Except where greater humidity is required for medical, agricultural, archival or scientific research purposes, humidification systems shall be disabled and locked-out when the relative humidity in the space served is greater than 55 percent.

space served is 55% and higher.

703.3 Condensate coolers and tempering. Potable water shall not be used to reduce the temperature of waste water such as steam condensate and boiler blow-down water.

703.4 Condensate drainage recovery. Where a *non-potable* water source, such as a *graywater* or rain water collection system, is installed on site, or water features or fountains are installed within the *building*, cooling system condensate shall be collected and discharged to such collection system, water feature or fountain.

703.5 Heat exchangers. Potable water shall not be used as a coolant in any heat exchanger except where the *potable* water is recirculated.

703.6 Humidifier discharge. Water discharge from flow-through type humidifiers and from the draining and flushing operations of other types of humidifiers shall be collected for reuse where a collection and reuse system exists.

703.7 Cooling Towers, Evaporative Condensers and Fluid Coolers. Cooling towers, evaporative condensers, and fluid coolers shall be installed in accordance with the requirements of Section 908 of the *International Mechanical Code*.

703.7.1 Location. Cooling towers, evaporative condensers and fluid coolers shall be located on the property as required for buildings in accordance with the *International Building Code* and shall be located so as to prevent the discharge vapor plumes from entering occupied spaces. Plume discharges shall be not less than 5 feet (1524 mm) above and 20 feet (6096 mm) away from any ventilation inlet to a building.

703.7.2 Once-Through Cooling. The use of potable water for once-through or single-pass cooling operations is prohibited.

703.7.3 Metering. The metering of mechanical systems, system components, equipment and appliances shall be conducted in accordance with Section 705.2.

703.7.4 Controllers and Alarms. Cooling towers, evaporative condensers, and fluid coolers shall be equipped with conductivity controllers and overflow alarms.

703.7.5 Drift. Cooling towers, evaporative condensers and fluid coolers shall produce drift losses of not greater than 0.002 percent of the recirculated water volume for counter-flow systems, and not greater than 0.005 percent of the recirculated water for cross-flow systems.

703.7.6 Water Quality. Where non-potable water is used within cooling towers, evaporative condensers and fluid coolers, it shall conform to the water quality and treatment requirements of the jurisdiction having authority and the water chemistry guidelines recommended by the equipment manufacturers.

703.7.7 Discharge. The discharge water from cooling towers used for air conditioning systems shall meet the requirements for cycles of concentration in Table 703.7.7. Where the discharge water is not captured for reuse, it shall be discharged and treated in accordance with jurisdictional requirements, if applicable.

Exception: Discharge water with total dissolved solids in excess of 1,500 mg (1,500 ppm/L), or silica in excess of 120 ppm (120 mg/L) measured as silicon dioxide shall not be required to meet the minimum cycles of concentration specified in Table 703.7.7.

TABLE 703.7.7

MINIMUM CYCLES OF CONCENTRATION FOR DISCHARGE WATER

MAKEUP WATER TOTAL HARDNESS (mg/L)*	MINIMUM CYCLES OF CONCENTRATION
< 200	5
>200	3.5

*Total hardness concentration expressed as calcium carbonate.

703.8 Wet-Hood Exhaust Scrubber Systems. Where wet-hood exhaust scrubber systems are used, they shall incorporate a water recirculation system. The makeup water supplies for such systems shall be metered in accordance with Section 705.2.

703.8.1 Washdown Systems. Hoods incorporating washdown or rinsing systems for perchloric acid and similar chemicals shall utilize self-closing valves. Such systems shall be designed to drain automatically after each washdown process has been completed.

703.8.2 Water Sources. Where suitable non-potable water is available, makeup water supplies to the recirculation system of wet-hood exhaust scrubbers shall utilize non-potable water of a water quality appropriate for the application.

**SECTION 704
WATER TREATMENT DEVICES AND EQUIPMENT**

704.1 Water softeners. Water softeners shall comply with Sections 704.1.1 through 704.1.4.

704.1.1 Demand initiated regeneration. Water softeners shall be equipped with demand- initiated regeneration control systems. Such control systems shall automatically initiate the regeneration cycle after determining the depletion, or impending depletion of softening capacity.

704.1.2 Water consumption. Water softeners shall have a maximum water consumption during regeneration of 5 gal (18.9 L) per 1000 grains of hardness removed as measured in accordance with NSF 44.

704.1.3 Waste connections. Waste water from water softener regeneration shall not discharge to *reclaimed water* collection systems and shall discharge in accordance with the *International Plumbing Code*.

704.1.4 Efficiency and listing. Water softeners that regenerate in place, that are connected to the water system they serve by piping not exceeding 1 ¼ inch in diameter, or that have a volume of 3 cubic feet (0.085 m³) or more of cation exchange media shall have a rated salt efficiency of not less than 4,000 grains of total hardness exchange per pound of salt (477 g of total hardness exchange per kg of salt), based on sodium chloride equivalency and shall be listed as compliant with NSF/ANSI 44. All other water softeners shall have a rated salt efficiency of not less than 3,500 grains of total hardness exchange per pound of salt (477 g of total hardness exchange per kg of salt), based on sodium chloride equivalency.

704.2 Reverse osmosis water treatment systems. Point-of-use reverse osmosis treatment systems shall comply with NSF 58. The discharge pipe from a reverse osmosis drinking water treatment unit shall connect to the *building* drainage system in accordance with Section 611.2 of the *International Plumbing Code*. Point-of-use reverse osmosis systems shall be equipped with an automatic shutoff valve that prevents the production of reject water when there is no demand for treated water.

**SECTION 705
SPECIFIC WATER CONSERVATION MEASURES**

705.1 Indoor ornamental fountains and water features. Where indoor ornamental fountains, indoor water features or permanent indoor irrigation systems are supplied by *potable water*, the *building* that contains them shall comply with one additional *project elective* from Section 710. This shall be in addition to the requirements of Table 302.1.

705.2 Metering. Water *meters* shall be required for *building* water consumed from any source. Each *potable* and reclaimed source, and each onsite water system, shall be *metered* separately. *Meters* shall be installed in accordance with the requirements of the *International Plumbing Code*. Each *meter* shall be required to be capable of communicating water consumption data remotely.

705.2.1 Metering. All *potable* and *non-potable* water supplied to the applications listed in Table 705.2.1 shall be individually *metered* in accordance with the requirements indicated in Table 705.2.1. Similar appliances and equipment shall be permitted to be grouped and supplied from piping connected to a single *meter*.

**SECTION 706
NON-POTABLE WATER REQUIREMENTS**

706.1 Scope. The provisions of this section shall govern the use of *non-potable* water and the construction, installation, and design of systems utilizing *non-potable* water. The use and application of *non-potable* water shall comply with laws, rules and ordinances applicable in the *jurisdiction*.

706.2 Signage required. Where *non-potable* water is used for a water use application, signage shall be provided that reads as follows: “Non-potable water is utilized for [application name]. Caution: non-potable water. DO NOT DRINK.” The words shall be legibly and indelibly printed on a sign constructed of corrosion-resistant waterproof material. The letters of the words shall be not less than 0.5 inches in height and of a color in contrast to the background on which they are applied. In addition to the required wordage, the pictograph shown in Figure 706.2 shall appear on the signage required by this section. The required location of the signage and pictograph shall be in accordance with the applicable section of this code that requires the use of *non-potable* water.

706.3 Water quality. *Non-potable* water for each end use application shall meet the minimum water quality requirements as established for the application by the laws, rules and ordinances applicable in the *jurisdiction*.

**TABLE 705.2.1
METERING REQUIREMENTS**

APPLICATION	REQUIREMENTS
Irrigation	Irrigation systems that are automatically controlled shall be <i>metered</i> .
Tenant Spaces	Tenant spaces that consume water shall be <i>metered</i> individually.
Onsite Water Collection Systems	The makeup water lines supplying onsite water collection systems shall be <i>metered</i> .
Ornamental Water Features	Ornamental water features with a permanently installed water supply shall be required to utilize a <i>meter</i> on makeup water supply lines.
Pools and Spas	Indoor and outdoor pools and spas shall be required to utilize a <i>meter</i> on makeup water supply lines.
Cooling Towers	Cooling towers or groups of towers shall be required to utilize a <i>meter</i> on makeup water and blow-down water supply lines.
Steam Boilers	The makeup water supply line to steam boilers having a rating of 1,000,000 BTU/h or greater shall be <i>metered</i> .
Industrial Processes	Industrial processes consuming more than 1,000 gallons per day on average shall be <i>metered</i> individually.
Evaporative Coolers	Evaporative coolers supplying in excess of 0.6 gpm, on average, makeup water shall be.
Fluid Coolers and Chillers	Water-cooled fluid coolers and chillers that do not utilize closed-loop

APPLICATION	REQUIREMENTS
	recirculation shall be <i>metered</i> .
Roof Spray Systems	Roof spray systems for irrigating vegetated roofs or thermal conditioning shall be <i>metered</i> .



Figure 706.2 Pictograph – DO NOT DRINK

**SECTION 707
RAINWATER COLLECTION AND DISTRIBUTION SYSTEMS.**

707.1 Scope. The provisions of this section shall govern the construction, installation, *alteration*, and *repair* of *rainwater collection and conveyance systems*.

707.2 Permits. *Permits* shall be required for the construction, installation, *alteration*, and *repair* of *rainwater collection and conveyance systems*. *Construction documents*, engineering calculations, diagrams, and other such data pertaining to the *rainwater collection and conveyance system* shall be submitted with each application for *permit*.

707.3 Potable water connections. Where a *potable* system is connected to a *rainwater collection and conveyance system*, the *potable* water supply shall be protected against backflow in accordance with Section 608 of the *International Plumbing Code*.

707.4 Non-Potable water connections. Where *non-potable* water from different sources is combined in a system, the system shall comply with the most stringent of the requirements of this code that are applicable to such sources.

707.5 Installation. Except as provided for in this section, all systems shall be installed in compliance with the provisions of the *International Plumbing Code* and manufacturer's instructions.

707.6 Applications. Untreated *rainwater* shall be utilized in accordance with Section 702 and local codes. Treated *rainwater* shall be utilized in accordance with Section 706 or *potable* water provisions of the *International Plumbing Code*, as applicable, and as permitted by local codes.

707.7 Approved components and materials. Piping, plumbing components, and materials used in the collection and conveyance systems shall be manufactured of material *approved* for the intended application and compatible with any disinfection and treatment systems used.

707.8 Insect and vermin control. Inlets and vents to the system shall be protected to prevent the entrance of insects and vermin into *storage tanks* and piping systems. Screens installed on vent pipes, inlets, and overflow pipes shall have an aperture of not greater than 1/16 inch and shall be close-fitting. Screen materials shall be compatible with contacting system components and shall not accelerate corrosion of system components.

707.9 Drainage. Water drained from the *roof washer* or debris excluder shall not be drained to the sanitary sewer. Such water shall be diverted from the *storage tank* and discharge in a location that will not cause erosion or damage to property. *Roof washers* and debris excluders shall be provided with an automatic means of self draining between rain events, and shall not drain onto roof surfaces.

707.10 Freeze protection. Where sustained freezing temperatures occur, provisions shall be made to keep *storage tanks* and the related piping from freezing.

707.11 Trenching requirements. All water service piping, including piping containing *rainwater*, shall be separated from the *building* sewer by 5 feet (1524 mm) of undisturbed or compacted earth. Water service pipes, *potable* and *non-potable*, shall not be located in, under or above cesspools, septic tanks, septic tank drainage fields or seepage pits. Buried *rainwater* collection and *distribution piping* shall comply with the requirements of Section 306 of the *International Plumbing Code* for support, trenching, bedding, backfilling, and tunneling.

Exceptions:

1. The required separation distance shall not apply where the bottom of the water service pipe within 5 feet (1524 mm) of the sewer is a minimum of 12 inches (305 mm) above the top of the highest point of the sewer and the pipe materials shall comply with the *International Plumbing Code* for such applications.
2. Water service pipe is permitted to be located in the same trench with a *building* sewer, provided such sewer is constructed of materials that comply with the *International Plumbing Code* for such installations.
3. The required separation distance shall not apply where a *potable* or *non-potable* water service pipe crosses a sewer pipe provided the water service pipe is sleeved to at least 5 feet (1524 mm) horizontally from the sewer pipe centerline on both sides of such crossing with pipe materials that comply with the *International Plumbing Code* for such applications.
4. Irrigation piping located outside of a *building* and downstream of the backflow preventer is not required to meet the trenching requirements where *rainwater* is used for outdoor applications.

707.12 Rainwater catchment and collection systems. The design of *rainwater collection and conveyance systems* shall conform to accepted engineering practice.

707.12.1 Collection surface. *Rainwater* shall be collected only from above-ground impervious roofing surfaces constructed from *approved* materials. Collection of water from vehicular parking or pedestrian surfaces shall be prohibited except where the water is used exclusively for landscape irrigation. Overflow and bleed-off pipes from roof-mounted appliances including but not limited to evaporative coolers, water heaters, and solar water heaters shall not discharge onto *rainwater* collection surfaces.

707.12.1.1 Potable water applications. Where collected water is to be treated to *potable* water standards, wood or cedar shake roofing materials, roofing materials treated with biocides, and lead flashing is prohibited on collection surfaces. Painted surfaces are acceptable only where paint has been certified to ensure that the toxicity level of the paint is acceptable for drinking water contact.

Lead, chromium or zinc based paints are not permitted on *rainwater* collection surfaces. Flat roofing products shall be certified to NSF P151. *Rainwater* shall not be collected from vegetated roof systems.

707.12.2 Debris excluders. Downspouts and leaders shall be connected to a *roof washer* and shall be equipped with a debris excluder or equivalent device to prevent the contamination of collected *rainwater* with leaves, sticks, pine needles and similar material. Debris excluders and equivalent devices shall be self-cleaning.

707.12.3 Roof gutters and downspouts. Gutters and downspouts shall be constructed of materials that are compatible with the collection surface and the *rainwater* quality for the desired end use. Joints shall be made water-tight. Where the collected *rainwater* is to be used for *potable* applications, gutters and downspouts shall be constructed of materials *approved* for drinking water applications and flashing and joints shall not be made of lead.

707.12.3.1 Slope. Roof gutters, leaders, and *rainwater* collection piping shall slope continuously toward collection inlets and shall be free of leaks. Gutters and downspouts shall have a slope of not less than 1/8 inch per foot along their entire length, and shall not permit the collection or pooling of water at any point.

Exception: Siphonic drainage systems installed in accordance with the manufacturer's installation instructions shall not be required to have slope.

707.12.3.2 Size. Gutters and downspouts shall be installed and sized in accordance with Section 1106.6 of the *International Plumbing Code* and local rainfall rates.

707.12.3.3 Cleanouts. Cleanouts shall be provided in the water conveyance system so as to allow access to all filters, flushes, pipes and downspouts.

707.12.4 Collection pipe materials. In *buildings* where *rainwater collection and conveyance systems* are installed, drainage piping *approved* for use within plumbing drainage systems shall be utilized to collect *rainwater* and convey it to the *storage tank*. Vent piping *approved* for use within plumbing venting systems shall be utilized for all vents within the *rainwater* system. Drains to a storm water discharge shall use *approved* waste piping.

707.12.4.1 Joints. Collection piping conveying *rainwater* shall utilize joints *approved* for use with the *distribution piping* and appropriate for the intended applications as specified in the *International Plumbing Code*.

707.12.4.2 Size. Collection piping conveying *rainwater* from collection surfaces shall be sized in accordance with local Chapter 11 of the *International Plumbing Code* and local rainfall rates.

707.12.4.3 Labeling and marking. Additional marking of *rainwater* collection piping shall not be required beyond that required for sanitary drainage, waste, and vent piping by the *International Plumbing Code*.

707.12.5 Filtration. Collected *rainwater* shall be filtered to the level required for the intended end use. Filters shall be accessible for inspection and maintenance.

707.12.6 Disinfection. Where the intended application and initial quality of the collected *rainwater* requires disinfection or other treatment or both, the collected *rainwater* shall be treated as needed to ensure that the required water quality is delivered at the point of use.

707.12.7 Storage tank. The design of the *storage tank* shall be in accordance with Sections 707.12.7.1 through 707.12.7.11.

707.12.7.1 Location. *Storage tanks* shall be installed either above or below grade. Above grade *storage tanks* shall be protected from direct sunlight and shall be constructed using opaque, UV resistant materials including, but not limited to, heavily tinted plastic, lined metal, concrete, wood, or painted to prevent algae growth, or shall have specially constructed sun barriers including but not limited to installation in garages, crawlspaces, or sheds. *Storage tanks* and their manholes shall not be located directly under any soil or waste piping or any source of contamination. *Rainwater storage tanks* shall be located with a minimum horizontal distance between various elements as indicated in Table 707.12.7.1.

**TABLE 707.12.7.1
LOCATION OF RAINWATER STORAGE TANKS**

Element	Minimum Horizontal Distance from Storage Tank (feet)
Critical root zone (CRZ) of protected trees	2
Lot line adjoining private lots	5
Seepage pits	5
Septic tanks	5

707.12.7.2 Materials. Where water is collected onsite, it shall be collected in an *approved* tank constructed of durable, nonabsorbent and corrosion-resistant materials. Where collected water is to be treated to *potable* water standards, tanks shall not be constructed of recycled materials and shall be constructed of materials in accordance with the *International Plumbing Code*. *Storage tanks* shall be constructed of materials compatible with the type of disinfection system used to treat water upstream of the tank and used to maintain water quality within the tank.

707.12.7.2.1 Wooden tanks. *Wooden storage tanks* shall not be required to have a liner. Where a tank is lined and used for potable water, the liner shall be NSF approved. Where unlined tanks are used, the species of wood shall be decay resistant and untreated.

707.12.7.3 Foundation and supports. *Storage tanks* shall be supported on a firm base capable of withstanding the storage tank's weight when filled to capacity. Where earthquake loads are applicable in accordance with the *International Building Code*, above-ground collection tank supports shall be designed and installed for the seismic forces in accordance with the *International Building Code*.

707.12.7.3.1 Ballast. Where the soil can become saturated, an underground *storage tank* shall be ballasted, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined weight of the tank and hold down ballast shall meet or exceed the buoyancy force of the tank. Where the installation requires a foundation, the foundation shall be flat and shall be designed to support the *storage tank* weight when full, consistent with bearing capability of adjacent soil.

707.12.7.3.2 Structural support. When installed below grade, *storage tank* installations shall be designed to withstand earth and surface structural loads without damage and with minimal deformation when filled with water or empty.

707.12.7.4 Makeup water. Where an uninterrupted supply is required for the intended application, *potable* or municipally supplied reclaimed or recycled water shall be provided as a source of makeup water for the *storage tank*. The *potable* or reclaimed or recycled water supply shall be protected

against backflow by means of an air gap not less than 4 inches (102 mm) above the overflow or an *approved* backflow device in accordance with the *International Plumbing Code*. There shall be a full-open valve located on the makeup water supply line to the *storage tank*. Inlets to *storage tank* shall be controlled by fill valves or other automatic supply valves installed so as to prevent the tank from overflowing and to prevent the water from dropping below a predetermined level.

707.12.7.5 Overflow. The *storage tank* shall be equipped with an overflow pipe having the same or larger area as the sum of the areas of all tank inlet pipes. The overflow pipe shall be trapped and shall be discharged in a manner consistent with storm water runoff requirements of the *jurisdiction* and at a sufficient distance from the tank to avoid damaging the tank foundation. The overflow drain shall not be equipped with a shutoff valve. A minimum of one cleanout shall be provided on each overflow pipe in accordance with Section 708 of the *International Plumbing Code*.

707.12.7.6 Access. A minimum of one access opening shall be provided to allow inspection and cleaning of the tank interior. All access openings to *storage tanks* and other vessels shall have an *approved* locking device or shall otherwise be protected from unauthorized access. Below grade *storage tanks*, located outside of the *building*, shall be provided with either a manhole not less than 24 inches (610 mm) square or a manhole with an inside diameter of not less than 24 inches (610 mm). Manholes shall extend not less than 4 inches above ground or shall be gasketed and bolted to prevent water infiltration. Finish grade shall be sloped away from the manhole to divert surface water from the manhole. Each manhole cover shall have an effective locking device. Service ports in manhole covers shall be not less than 8 inches (203 mm) in diameter and shall be a minimum of 4 inches (102 mm) above the finished grade level. The service port shall have an effective locking cover or a brass cleanout plug.

Exception: *Storage tanks* having a volume of less than 800 gallons and installed below grade shall not be required to be equipped with a manhole where provided with a service port that is not less than 8 inches (203 mm) in diameter.

707.12.7.7 Venting. Tanks shall be provided with a vent sized in accordance with the *International Plumbing Code* and based on the diameter of the tank influent pipe. Tank vents shall not be connected to sanitary drainage system vents.

707.12.7.8 Inlets. *Storage tank* inlets shall be designed to introduce water into the tank with minimum turbulence, and shall be located and designed to avoid agitating the contents of the *storage tank*.

707.12.7.9 Outlets. Outlets shall be located at least 4 inches (102 mm) above the bottom of the *storage tanks* and shall not skim water from the surface.

707.12.7.10 Drain. A drain shall be located at the lowest point of aboveground storage tanks and shall discharge in a manner consistent with the storm water runoff requirements of the *jurisdiction* and at a sufficient distance from the tank to avoid damaging the tank foundation. A minimum of one cleanout shall be provided on each drain pipe in accordance with Section 708 of the *International Plumbing Code*.

707.12.7.11 Labeling and signage. Each *storage tank* shall be *labeled* with its rated capacity and the location of the upstream bypass valve. *Storage tanks* shall bear signage that reads as follows: "CAUTION: NON-POTABLE WATER – DO NOT DRINK." Where an opening is provided that could allow the entry of personnel, the opening shall bear signage that reads as follows: "DANGER – CONFINED SPACE." Markings shall be indelibly printed on a tag or sign constructed of corrosion-resistant waterproof material mounted on the tank or shall be indelibly printed on the tank. The letters of words shall be not less than 0.5 inches in height and shall be of a color that contrasts with the background on which they are applied.

707.12.8 Valves. Valves shall be supplied in accordance with Sections 707.12.8.1 and 707.12.8.2.

707.12.8.1 Influent diversion. A means shall be provided to divert *storage tank* influent to allow maintenance and *repair* of the *storage tank* system.

707.12.8.2 Backwater valve. *Backwater valves* shall be installed on each overflow and tank drain pipe. *Backwater valves* shall be installed so that access is provided to the working parts for service and *repair*.

707.12.9 Roof washer. A sufficient amount of *rainwater* shall be diverted at the beginning of each rain event, and not allowed to enter the *storage tank*, to wash accumulated debris from the collection surface. The amount of rainfall to be diverted shall be field adjustable as necessary to minimize *storage tank* water contamination. The *roof washer* shall not rely on *manually* operated valves or devices, and shall operate automatically. Diverted *rainwater* shall not be drained to the roof surface, and shall be discharged in a manner consistent with the storm water runoff requirements of the *jurisdiction*. *Roof washers* shall be accessible for maintenance and service.

707.12.10 Vent piping. *Storage tanks* shall be provided with a vent in accordance with the requirements of Section 707.12.7.7. Vents shall be sized in accordance with the *International Plumbing Code*, based on the aggregate diameter of *storage tank* influent pipe(s). Vents shall be protected from contamination by means of a U-bend installed with the opening directed downward or an *approved* cap. Vent outlets shall extend a minimum of 4" above grade, or as necessary to prevent surface water from entering the *storage tank*. Vent openings shall be protected against the entrance of vermin and insects in accordance with the requirements of Section 707.8.

707.12.11 Pumping and control system. Mechanical equipment including pumps, valves and filters shall be easily accessible and removable in order to perform *repair*, maintenance and cleaning. Where collected *rainwater* is to be treated to *potable* water standards, the pump and all other pump components shall be *listed* and *approved* for use with *potable* water systems. Pressurized water shall be supplied at a pressure appropriate for the application and within the range specified by the *International Plumbing Code*. Where water could be supplied at an excessive pressure, a pressure-reducing valve shall be installed in accordance with the requirements of the *International Plumbing Code*.

707.12.11.1 Standby power. Where required for the intended application, automatically activated standby power, capable of powering all essential treatment and pumping systems under design conditions shall be provided.

707.12.11.2 Inlet control valve alarm. Make-up water systems shall be fitted with a warning mechanism that alerts the user to a failure of the inlet control valve to close correctly. The alarm shall activate before the water within the *storage tank* begins to discharge into the overflow system.

707.12.11.3 Water-pressure reducing valve or regulator. Where the *rainwater* pressure supplied by the pumping system exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the *rainwater* distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section 604.8 of the *International Plumbing Code*.

707.12.12 Distribution pipe. *Distribution piping* shall comply with Sections 707.12.12.1 through 707.12.12.4.

707.12.12.1 Materials. *Distribution piping* conveying *rainwater* shall conform to the standards and requirements specified by the *International Plumbing Code* for *non-potable* or *potable* water, as applicable.

707.12.12.2 Joints. *Distribution piping conveying rainwater shall utilize joints approved for use with the distribution piping and appropriate for the intended applications as specified in the International Plumbing Code.*

707.12.12.3 Size. *Distribution piping conveying rainwater water shall be sized in accordance with the International Plumbing Code for the intended application or.*

707.12.12.4 Labeling and marking. *Non-potable rainwater distribution piping shall be of the color purple and shall be embossed or integrally stamped or marked with the words: “CAUTION: NONPOTABLE WATER – DO NOT DRINK” or shall be installed with a purple identification tape or wrap. Identification tape shall be at least 3 inches wide and have white or black lettering on purple field stating “CAUTION: NON-POTABLE WATER – DO NOT DRINK”. Identification tape shall be installed on top of non-potable rainwater distribution pipes, fastened at least every 10 feet to each pipe length and run continuously the entire length of the pipe. Lettering shall be readily observable within the room or space where the piping is located.*

Exception: Piping located outside of the *building* and downstream of the backflow preventer is not required to be purple where *rainwater* is used for outdoor applications.

707.13 Tests and inspections. Tests and inspection shall be performed in accordance with Sections 707.13.1 through 707.13.10.

707.13.1 Drainage and vent tests. The testing of *rainwater* collection piping, overflow piping, vent piping and *storage tank* drains shall be conducted in accordance with Section 312 of the *International Plumbing Code*.

707.13.2 Drainage and vent final test. A final test shall be applied to the *rainwater* collection piping, overflow piping, *storage tank*, and tank vent piping in accordance with Section 312.4 of the *International Plumbing Code*.

707.13.3 Water supply system test. The testing of makeup water supply piping and *rainwater distribution piping* shall be conducted in accordance with Section 312.5 of the *International Plumbing Code*.

707.13.4 Inspection and testing of backflow prevention assemblies. The testing of backflow preventers and *backwater valves* shall be conducted in accordance with Section 312.10 of the *International Plumbing Code*.

707.13.5 Inspection vermin and insect protection. All inlets and vents to the system shall be inspected to ensure that each is protected to prevent the entrance of insects or vermin into *storage tank* and piping systems in accordance with Section 707.8.

707.13.6 Roof gutter inspection and test. Roof gutters shall be inspected to verify that the installation and slope is in accordance with Section 707.12.3. Gutters shall be tested by pouring a minimum of one gallon of water into the end of the gutter opposite the collection point. The gutter being tested shall not leak and shall not retain standing water.

707.13.7 Roofwasher test. Roofwashers shall be tested by introducing water into the gutters. Proper diversion of the first quantity of water in accordance with the requirements of Section 707.12.9 shall be verified.

707.13.8 Storage tank tests. *Storage tanks* shall be tested in accordance with the following:

1. *Storage tanks* shall be filled with water to the overflow line prior to and during inspection. All seams and joints shall be left exposed and the tank shall remain water tight without leakage for a period of 24 hours.
2. After 24 hours, supplemental water shall be introduced for a period of 15 minutes to verify proper drainage of the overflow system and verify that there are no leaks.
3. Following a successful test of the overflow, the water level in the tank shall be reduced to a level that is at 2 inches below the makeup water trigger point by using the tank drain. The tank drain shall be observed for proper operation. The makeup water system shall be observed for proper operation, and successful automatic shutoff of the system at the refill threshold shall be verified. Water shall not be drained from the overflow at any time during the refill test.

707.13.9 Supply pressure test. The static water pressure at the point of use furthest from the supply shall be verified to be within the range required for the application, in accordance with Section 707.12.11.

707.13.10 Water quality test. The quality of the water for the intended application shall be verified at the point of use in accordance with the requirements of the *jurisdiction*.

707.14 Operation and maintenance manuals. Operations and maintenance materials shall be supplied in accordance with 707.14.1 through 707.14.4.

707.14.1 Manual. A detailed operations and maintenance manual shall be supplied in hardcopy form with all *rainwater* collection systems.

707.14.2 Schematics. The manual shall include a detailed system schematic, the locations of all system components, and a list of all system components including manufacturer and model number.

707.14.3 Maintenance procedures. The manual shall provide a maintenance schedule and procedures for all system components requiring periodic maintenance. Consumable parts including filters shall be noted along with part numbers.

707.14.4 Operations procedures. The manual shall include system startup and shutdown procedures. The manual shall include detailed operating procedures for the system.

707.15 System abandonment. If the owner of a *rainwater collection and conveyance system* elects to cease use of, or fails to properly maintain such system, the system shall be abandoned and shall comply with the following:

1. All system piping connecting to a utility-provided water system shall be removed or disabled.
2. The *rainwater distribution piping* system shall be replaced with an *approved potable* water supply piping system. Where an existing *potable* pipe system is already in place, the fixtures shall be connected to the existing system.
3. The storage tank shall be secured from accidental access by sealing or locking tank inlets and access points, or filling with sand or equivalent.

707.16 Potable water applications. Where collected *rainwater* is to be used for *potable* water applications, all materials contacting the water shall comply with NSF 61.

707.16.1 Water quality testing. Collected *rainwater* water shall be tested. Accumulated water to be tested shall be the result of not less than two rainfall events. Testing shall be in accordance with Sections 707.16.1.1 through 707.16.1.3.

707.16.1.1 Test methods. Water quality testing shall be performed in accordance with the latest edition of *Standard Methods for the Examination of Water and Wastewater* published by the American Public Health Association.

707.16.1.1.1 Tests required. Accumulated *rainwater* shall be tested for *Escherichia coli*, total coliform, heterotrophic bacteria and cryptosporidium.

707.16.1.2 Test frequency. The testing of accumulated *rainwater* shall be performed prior to the *rainwater* system being connected to *potable rainwater* distribution system and annually thereafter.

707.16.1.3 Test records. Test records shall be retained for not less than two years.

SECTION 708 GRAYWATER SYSTEMS

708.1 Scope. The provisions of this section shall govern the construction, installation, *alteration*, and *repair* of *graywater* reuse systems.

708.2 Permits. *Permits* shall be required for the construction, installation, *alteration*, and *repair* of *graywater* systems. *Construction documents*, engineering calculations, diagrams, and other such data pertaining to the *graywater* system shall be submitted with each application for *permit* in accordance with the laws, rules and ordinances applicable in the *jurisdiction*.

708.3 Potable water connections. Where a *potable* water system is connected to a *graywater* system, the *potable* water supply shall be protected against backflow in accordance with Section 608 of the *International Plumbing Code*.

708.4 Non-potable water connections. Where *non-potable* water from different sources is combined in a system, the system shall comply with the most stringent of the requirements of this code that are applicable to such sources.

708.5 Installation. Except as provided for in this section, all systems shall be installed in compliance with the provisions of the *International Plumbing Code* and manufacturer's instructions, as applicable.

708.6 Applications. Untreated *graywater* shall be utilized in accordance with Section 702 and local codes. Treated *graywater* shall be utilized in accordance with Section 706 and as permitted by local codes.

708.7 Approved components and materials. The piping, plumbing components, and materials used in *graywater* systems shall be manufactured of material *approved* for the intended application and compatible with any disinfection and treatment systems used.

708.8 Insect and vermin control. The inlets and vents to the system shall be protected to prevent insects and vermin from entering *storage tanks* and piping systems. Screens installed on vent pipes and overflow pipes shall have an aperture not greater than 1/16 inch and shall be close-fitting. Screen materials shall be compatible with contacting system components and shall not accelerate corrosion of system components

708.9 Freeze protection. Where sustained freezing temperatures occur, provisions shall be made to keep *storage tanks* and the related piping from freezing.

708.10 Trenching requirements. Water service piping, including piping containing *graywater*, shall be separated from the *building sewer* by 5 feet (1524 m) of undisturbed or compacted earth. *Graywater* piping shall be separated from *potable* water piping underground by 5 feet (1524 m) of undisturbed or compacted earth. *Non-potable* water service pipes shall not be located in, under or above cesspools, septic tanks, septic tank drainage fields or seepage pits. Buried *graywater* piping shall comply with the requirements of Section 306 of the *International Plumbing Code* for support, trenching, bedding, backfilling, and tunneling.

Exceptions:

1. The required separation distance shall not apply where the bottom of the *graywater* service pipe within 5 feet (1524 mm) of the sewer is a minimum of 12 inches (305 mm) above the top of the highest point of the sewer and the pipe materials comply with the requirements of the *International Plumbing Code* for such applications.
2. The required separation distance shall not apply where the bottom of the *potable* water service pipe within 5 feet (1524 mm) of the *graywater* pipe is a minimum of 12 inches (305 mm) above the top of the highest point of the *graywater* pipe and the pipe materials comply with the requirements of the *International Plumbing Code* for such applications.
3. Water service pipe is permitted to be located in the same trench with a *building* sewer, provided that such sewer is constructed of materials that comply with the requirements of the *International Plumbing Code* for such applications.
4. The required separation distance shall not apply where a *potable* or *non-potable* water service pipe crosses a sewer pipe provided that the water service pipe is sleeved to at least 5 feet (1524 mm) horizontally from the sewer pipe centerline on both sides of such crossing with pipe materials that comply with the requirements of the *International Plumbing Code* for such applications.
5. The required separation distance shall not apply where a *potable* water service pipe crosses a *graywater* pipe provided that the *potable* water service pipe is sleeved for a distance of at least 5 feet (1524 mm) horizontally from the centerline of the *graywater* pipe on both sides of such crossing with pipe materials that comply with the requirements of the *International Plumbing Code* for such applications.
6. Irrigation piping located outside of a *building* and downstream of the backflow preventer is not required to meet the trenching requirements where *graywater* is used for outdoor applications.

708.11 System abandonment. If the owner of a *graywater* system elects to cease use of, or fails to properly maintain such system, the system shall be abandoned and shall comply with the following:

1. All system piping connecting to a utility-provided water system shall be removed or disabled.
2. *Storage tanks* shall be secured against accidental access by sealing or locking tank inlets and access points, or filling with sand or equivalent.

708.12 Graywater systems. The design of the *graywater* system shall conform to accepted engineering practice.

708.12.1 Graywater sources. *Graywater* reuse systems shall collect waste discharge from only the following sources: bathtubs, showers, lavatories, clothes washers, and laundry trays. Water from other *approved non-potable* sources including swimming pool backwash operations, air conditioner condensate, *rainwater*, cooling tower blow-down water, foundation drain water, steam system condensate, fluid cooler discharge water, food steamer discharge water, combination oven discharge water, industrial process water, and fire pump test water shall also be permitted to be collected for reuse by *graywater* systems, as *approved* by the *code official* and as appropriate for the intended application.

708.12.1.1 Prohibited graywater sources. Wastewater containing urine or fecal matter shall not be diverted to *graywater* systems and shall discharge to the sanitary drainage system of the *building* or premises in accordance with the *International Plumbing Code*. Water from reverse osmosis system reject water, water softener discharge water, kitchen sink wastewater, dishwasher wastewater, and wastewater discharged from wet-hood scrubbers shall not be collected for reuse within a *graywater* system.

708.12.2 Traps. Traps serving fixtures and devices discharging wastewater to *graywater* reuse systems shall have a liquid seal of not less than 2 inches (51 mm) and not more than 4 inches (102 mm). Where a trap seal is subject to loss by evaporation, a trap seal primer valve shall be installed in accordance with the *International Plumbing Code*.

708.12.3 Collection pipe. *Graywater* reuse systems shall utilize drainage piping *approved* for use within plumbing drainage systems to collect and convey untreated *graywater*. Vent piping *approved* for use within plumbing venting systems shall be utilized for vents within the *graywater* system. Drains to the sanitary sewer shall use *approved* waste piping.

708.12.3.1 Joints. Collection piping conveying untreated *graywater* shall utilize joints *approved* for use with the *distribution piping* and appropriate for the intended applications as specified in the *International Plumbing Code*.

708.12.3.2 Size. Collection piping conveying *rainwater* from collection surfaces shall be sized in accordance with storm drainage sizing requirements specified in the *International Plumbing Code*.

708.12.3.3 Labeling and marking. Additional marking of untreated *graywater* collection piping shall not be required beyond that required for sanitary drainage, waste, and vent piping by the *International Plumbing Code*.

708.12.4 Filtration. Collected *graywater* shall be filtered as required for the intended end use. Filters shall be accessible for inspection and maintenance. Filters shall utilize a pressure gage or other *approved* method to provide indication when a filter requires servicing or replacement. Filters shall be installed with shutoff valves installed immediately upstream and downstream to allow for isolation during maintenance.

708.12.5 Disinfection. Where the intended application for collected *graywater* requires disinfection or other treatment or both, collected *graywater* shall be disinfected as needed to ensure that the required water quality is delivered at the point of use. Untreated *graywater* shall be retained in collection reservoirs for a maximum of 24 hours in accordance with Section 708.12.6.1.

708.12.6 Storage tank. The design of the *storage tank* shall be in accordance with Sections 708.12.6.1 through 708.12.6.12.

708.12.6.1 Sizing. The holding capacity of the *storage tank* shall be sized in accordance with the anticipated demand. Where *graywater* is to be used in untreated form for groundwater recharge or subsurface irrigation, the *storage tank* shall be sized to limit the retention time of *graywater* to a maximum of 24 hours.

708.12.6.2 Location. *Storage tanks* shall be installed above or below grade. Above grade *storage tanks* shall be protected from direct sunlight and shall be constructed using opaque, UV resistant, materials such as, but not limited to, heavily tinted plastic, lined metal, concrete, wood, or painted to prevent algae growth, or shall have specially constructed sun barriers including but not limited to installation in garages, crawlspaces, or sheds. *Storage tanks* and their manholes shall not be located directly under any soil or waste piping or any source of contamination. *Graywater storage tanks* shall be located with a minimum horizontal distance between various elements as indicated in Table 708.12.6.2. *Storage tanks* containing untreated *graywater* shall be located a minimum horizontal distance of 5 feet from *buildings*, in addition to the requirements in Table 708.12.6.2.

**TABLE 708.12.6.2
LOCATION OF GRAYWATER STORAGE TANKS**

Element	Minimum Horizontal Distance from Storage Tank (feet)
Critical root zone (CRZ) of protected trees	2
Lot line adjoining private lots	5

Element	Minimum Horizontal Distance from Storage Tank (feet)
Seepage pits	5
Septic tanks	5
Water wells	50
Streams and lakes	50
Water service	5
Public water main	10

708.12.6.3 Materials. Where collected onsite, water shall be collected in an *approved* tank constructed of durable, nonabsorbent and corrosion-resistant materials. The *storage tank* shall be constructed of materials compatible with any disinfection systems used to treat water upstream of the tank and with any systems used to maintain water quality within the tank.

708.12.6.3.1 Wood tanks. Wooden *storage tanks* that are not equipped with a makeup water source shall be provided with a flexible liner.

708.12.6.4 Foundation and supports. *Storage tanks* shall be supported on a firm base capable of withstanding the *storage tank's* weight when filled to capacity. Where earthquake loads are applicable in accordance with the *International Building Code*, above-ground collection reservoir supports shall be designed and installed for the seismic forces in accordance with the *International Building Code*.

708.12.6.4.1 Ballast. Where the soil can become saturated, an underground *storage tank* shall be ballasted, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined weight of the tank and hold down ballast shall meet or exceed the buoyancy force of the tank. Where the installation requires a foundation, the foundation shall be flat and shall be designed to support the *storage tank* weight when full, consistent with the bearing capability of adjacent soil.

708.12.6.4.2 Structural support. Where installed below grade, *storage tank* installations shall be designed to withstand earth and surface structural loads without damage and with minimal deformation when filled with water or empty.

708.12.6.5 Makeup water. Where an uninterrupted supply is required for the intended application, *potable* or municipally supplied reclaimed/recycled water shall be provided as a source of makeup water for the *storage tank*. The *potable* or reclaimed/recycled water supply shall be protected against backflow by means of an air gap not less than 4 inches (102 mm) above the overflow or an *approved* backflow device in accordance with the *International Plumbing Code*. There shall be a full-open valve located on the makeup water supply line to the *storage tank*. Inlets to *storage tank* shall be controlled by fill valves or other automatic supply valves installed so as to prevent the tank from overflowing and to prevent the water level from dropping below a predetermined point. Where makeup water is provided, the water level shall not be permitted to drop below the *graywater* inlet or the intake of any attached pump.

708.12.6.6 Overflow. The *storage tank* shall be equipped with an overflow pipe having the same or larger area as the sum of the areas of all reservoir inlet pipes. The overflow pipe shall be trapped and shall be indirectly connected to the sanitary drainage system. The overflow drain shall not be equipped with a shutoff valve. A minimum of one cleanout shall be provided on each overflow pipe in accordance with Section 708 of the *International Plumbing Code*.

708.12.6.7 Access. A minimum of one access opening shall be provided to allow inspection and cleaning of the tank interior. Access openings shall have an *approved* locking device or other *approved* method of securing access. Below grade *storage tanks*, located outside of the *building*, shall be provided with either a manhole not less than 24 inches (610 mm) square or a manhole with an inside diameter not less than 24 inches (610 mm) and extending not less than 4 inches above ground. Finished grade shall be sloped away from the manhole to divert surface water from the manhole. Each manhole cover shall have an effective

locking device. Service ports in manhole covers shall be not less than 8 inches (203 mm) in diameter and shall be a minimum of 4 inches (102 mm) above the finished grade level. The service port shall have an effective locking cover or a brass cleanout plug.

Exception: *Storage tanks* under 800 gallons in volume installed below grade shall not be required to be equipped with a manhole, but shall have a service port not less than 8 inches (203 mm) in diameter.

708.12.6.8 Venting. The tank shall be provided with a vent sized in accordance with the *International Plumbing Code* and based on the diameter of the tank influent pipe. The reservoir vent shall not be connected to sanitary drainage system vents.

708.12.6.9 Inlets. *Storage tank* inlets shall be designed to introduce water into the tank with minimum turbulence, and shall be located and designed to avoid agitating the contents of the *storage tank*.

708.12.6.10 Outlets. Outlets shall be located at least 4 inches (102 mm) above the bottom of the *storage tank*, and shall not skim water from the surface.

708.12.6.11 Drain. A drain shall be located at the lowest point of the *storage tank* and shall be indirectly connected to the sanitary drainage system. The total area of all drains shall not be smaller than the total area of all overflow pipes. A minimum of one cleanout shall be provided on each drain pipe in accordance with Section 708 of the *International Plumbing Code*.

708.12.6.12 Labeling and signage. Each *storage tank* shall be *labeled* with its rated capacity and the location of the upstream bypass valve. The contents of *storage tanks* shall be identified with the words "CAUTION: NON-POTABLE WATER – DO NOT DRINK" Where an opening is provided that could allow the entry of personnel, the opening shall be marked with the words, "DANGER – CONFINED SPACE." Markings shall be indelibly printed on a tag or sign constructed of corrosion-resistant waterproof material mounted on the tank or shall be indelibly printed on the tank. The letters of the words shall be not less than 0.5 inches in height and shall be of a color in contrast with the background on which they are applied.

708.12.7 Valves. Valves shall be supplied in accordance with Sections 708.12.7.1 and 708.12.7.2.

708.12.7.1 Bypass valve. One three-way diverter valve certified to NSF 50 or other *approved* device shall be installed on *graywater* collection piping upstream of each *storage tank*, or drainfield, as applicable, to divert untreated *graywater* sources to the sanitary sewer to allow servicing and inspection of the system. Bypass valves shall be installed downstream of fixture traps and vent connections. Bypass valves shall be *labeled* to indicate the direction of flow, connection and *storage tank* or drainfield connection. Bypass valves shall be installed in accessible locations. Two shutoff valves shall not be installed to serve as a bypass valve.

708.12.7.2 Backwater valve. *Backwater valves* shall be installed on each overflow and tank drain pipe. *Backwater valves* shall be installed so that access is provided to the working parts for service and *repair*.

708.12.8 Vent piping. *Storage tanks* shall be provided with a vent in accordance with the requirements of Section 708.12.6.8. Vents shall be sized in accordance with the *International Plumbing Code*, based on the aggregate diameter of *storage tank* influent pipes. Open vents shall be protected from contamination by means of a U-bend installed with the opening directed downward or an *approved* cap. Vent outlets shall extend a minimum of 4 inches above grade, or as necessary to prevent surface water from entering the *storage tank*. Vent openings shall be protected against the entrance of vermin and insects in accordance with the requirements of Section 708.8.

708.12.9 Pumping and control system. *Mechanical equipment* including pumps, valves and filters shall be accessible and removable in order to perform *repair*, maintenance and cleaning. Pressurized water shall be supplied at a pressure appropriate for the application and within the range specified by the *International*

Plumbing Code. Where water could be supplied at an excessive pressure, a pressure-reducing valve shall be installed in accordance with the requirements of the *International Plumbing Code*.

708.12.9.1 Standby power. Where required for the intended application, automatically activated standby power, capable of powering all essential treatment and pumping systems under design conditions shall be provided.

708.12.9.2 Inlet control valve alarm. Make-up water systems shall be provided with a warning mechanism that alerts the user to a failure of the inlet control valve to close correctly. The alarm shall activate before the water within the collection reservoir *storage tank* begins to discharge into the overflow system.

708.12.9.3 Water-pressure reducing valve or regulator. Where the *graywater* pressure supplied by the pumping system exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the *graywater* distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section 604.8 of the *International Plumbing Code*.

708.12.10 Distribution pipe. *Distribution piping* shall comply with Sections 708.12.10.1 through 708.12.10.4.

708.12.10.1 Materials. *Distribution piping* conveying *graywater* shall conform to standards and requirements specified by the *International Plumbing Code* for *non-potable* water.

708.12.10.2 Joints. *Distribution piping* conveying *graywater* shall utilize joints *approved* for use with the *distribution piping* and appropriate for the intended applications as specified in the *International Plumbing Code*.

708.12.10.3 Size. *Distribution piping* conveying *graywater* water shall be sized in accordance with the *International Plumbing Code* for the intended application or applications.

708.12.10.4 Labeling and marking. All *graywater distribution piping* shall be either the color purple and embossed or integrally stamped or marked “CAUTION: NONPOTABLE WATER – DO NOT DRINK” or shall be installed with a purple identification tape or wrap. Identification tape shall be at least 3 inches wide and have white or black lettering on purple field stating “CAUTION: NON-POTABLE WATER – DO NOT DRINK”. Identification tape shall be installed on top of *graywater distribution pipes*, fastened at least every 10 feet to each pipe length and run continuously the entire length of the pipe. Lettering shall be readily observable within the room or space where the piping is located.

Exception: Outside of the *building*, purple piping is not required downstream of the backflow preventer where *graywater* is used for outdoor applications.

708.13 Tests and inspections. Tests and inspections shall be performed in accordance with Sections 708.13.1 through 708.13.9.

708.13.1 Drainage and vent test. A pressure test shall be applied to the *graywater* collection piping, overflow piping, *storage tank*, *storage tank* drainage piping and tank vent piping in accordance with Section 312 of the *International Plumbing Code*.

708.13.2 Drainage and vent final test. A final test shall be applied to the *graywater* collection piping, overflow piping, *storage tank*, and tank vent piping in accordance with Section 312.4 of the *International Plumbing Code*.

708.13.3 Water supply system test. The testing of makeup water supply piping and *rainwater distribution piping* shall be conducted in accordance with Section 312.5 of the *International Plumbing Code*.

708.13.4 Inspection and testing of backflow prevention assemblies. The testing of backflow preventers and *backwater valves* shall be conducted in accordance with Section 312.10 of the *International Plumbing Code*.

708.13.5 Inspection vermin and insect protection. Inlets and vents to the system shall be inspected to verify that each is protected to prevent the entrance of insects and vermin into the *storage tank* and piping systems in accordance with Section 708.8.

708.13.6 Storage tank tests. *Storage tanks* shall be tested in accordance with all of the following:

1. *Storage tanks* shall be filled with water to the overflow line prior to and during inspection. All seams and joints shall be left exposed and the tank shall remain water tight without leakage for a period of 24 hours.
2. After 24 hours, supplemental water shall be introduced for a period of 15 minutes to verify proper drainage of the overflow system and verify that there are no leaks.
3. Following the successful test of the overflow, the water level in the tank shall be reduced to a point 2 inches below the makeup water trigger point using the tank drain. The tank drain shall be observed for proper operation. The makeup water system shall be observed to verify proper operation, and successful automatic shutoff of the system at the refill threshold. Water shall not be drained from the overflow at any time during the refill test.

708.13.7 Supply pressure test. The static water pressure at the point of use furthest from the supply shall be verified to be within the range required for the application, in accordance with Section 707.12.11.

708.13.8 Water quality test. The quality of the water for the intended application shall be verified at the point of use in accordance with the requirements of the *jurisdiction*.

708.14 Operation and maintenance manuals. Operations and maintenance materials shall be supplied with *graywater* systems in accordance with Sections 708.14.1 through 708.14.4.

708.14.1 Manual. A detailed operations and maintenance manual shall be supplied in hardcopy form with all *graywater* systems.

708.14.2 Schematics. The manual shall include a detailed system schematic, locations of all system components, and a list of all system components including manufacturer and model number.

708.14.3 Maintenance procedures. The manual shall provide a maintenance schedule and procedures for all system components requiring periodic maintenance. Consumable parts including filters shall be noted along with part numbers.

708.14.4 Operations procedures. The manual shall include system startup and shutdown procedures. The manual shall include detailed operating procedures for the system.

SECTION 709 RECLAIMED WATER SYSTEMS

709.1 Scope. The provisions of this section shall govern the construction, installation, *alteration*, and *repair* of systems supplying *non-potable reclaimed water*.

709.2 Permits. *Permits* shall be required for the construction, installation, *alteration*, and *repair* of *reclaimed water* systems. *Construction documents*, engineering calculations, diagrams, and other such data pertaining to the reclaimed system shall be submitted with each application for *permit*.

709.3 Potable water connections. Connections between a *reclaimed water* system and a *potable* water system shall be protected against backflow in accordance with Section 608 of the *International Plumbing Code*.

709.4 Installation. Except as provided for in this section, systems shall be installed in compliance with the provisions of the *International Plumbing Code* and manufacturer's instructions, as applicable.

709.5 Applications. *Reclaimed water* shall be utilized in accordance with Section 706 and local codes.

709.6 Approved components and materials. Piping, plumbing components, and material used in the *reclaimed water* systems shall be manufactured of material *approved* for the intended application.

709.7 Water-pressure reducing valve or regulator. Where the *reclaimed water* pressure supplied to the *building* exceeds 80 psi (552 kPa) static, a pressure-reducing valve shall be installed to reduce the pressure in the *reclaimed water* distribution system piping to 80 psi (552 kPa) static or less. Pressure-reducing valves shall be specified and installed in accordance with Section 604.8 of the *International Plumbing Code*.

709.8 Trenching requirements. Water service piping, including piping containing *reclaimed water*, shall be separated from the *building sewer* by 5 feet (1524 mm) of undisturbed or compacted earth. *Reclaimed water* piping shall be separated from *potable* water piping underground by 5 feet (1524 mm) of undisturbed or compacted earth. *Reclaimed water* service pipes shall not be located in, under or above cesspools, septic tanks, septic tank drainage fields or seepage pits. Buried *reclaimed water* piping shall comply with the requirements of Section 306 of the *International Plumbing Code* for support, trenching, bedding, backfilling, and tunneling.

Exceptions:

1. The required separation distance shall not apply where the bottom of the *reclaimed water* service pipe within 5 feet (1524 mm) of the sewer is a minimum of 12 inches (305 mm) above the top of the highest point of the sewer and the pipe materials comply with the requirements of the *International Plumbing Code* for the application.
2. The required separation distance shall not apply where the bottom of the *potable* water service pipe within 5 feet (1524 mm) of the *reclaimed water* pipe is a minimum of 12 inches (305 mm) above the top of the highest point of the *reclaimed water* pipe and the pipe materials comply with the requirements of the *International Plumbing Code* for the application.
3. Water service pipe is permitted to be located in the same trench with a *building sewer*, provided such sewer is constructed of materials that comply with the requirements of the *International Plumbing Code* for the application.
4. The required separation distance shall not apply where a *potable* or *non-potable* water service pipe crosses a sewer pipe provided the water service pipe is sleeved to at least 5 feet (1524 mm) horizontally from the sewer pipe centerline on both sides of such crossing with pipe materials that comply with the requirements of the *International Plumbing Code* for the application.
5. The required separation distance shall not apply where a *potable* water service pipe crosses a *reclaimed water* pipe provided the *potable* water service pipe is sleeved to at least 5 feet (1524 mm) horizontally from the *reclaimed water* pipe centerline on both sides of such crossing with pipe materials that comply with the requirements of the *International Plumbing Code* for the application.

709.9 Reclaimed water systems. The design of the *reclaimed water* systems shall conform to *accepted engineering practice*.

709.9.1 Distribution pipe. *Distribution piping* shall comply with Sections 709.9.1.1 through 709.9.1.4.

709.9.1.1 Materials. *Distribution piping conveying reclaimed water* shall conform to standards and requirements specified by the *International Plumbing Code*.

709.9.1.2 Joints. *Distribution piping conveying reclaimed water shall utilize joints approved for use with the distribution piping and appropriate for the intended applications as specified in the International Plumbing Code.*

709.9.1.3 Size. *Distribution piping conveying reclaimed water shall be sized in accordance with the International Plumbing Code for the intended application.*

709.9.1.4 Labeling and marking. *Reclaimed water distribution piping shall be either the color purple and embossed or integrally stamped or marked “CAUTION: NONPOTABLE WATER – DO NOT DRINK” or be installed with a purple identification tape or wrap. Identification tape shall be at least 3 inches wide and have white or black lettering on purple field stating “CAUTION: NONPOTABLE WATER – DO NOT DRINK”. Identification tape shall be installed on top of reclaimed water distribution pipes, fastened at least every 10 feet to each pipe length and run continuously the entire length of the pipe. Lettering shall be readily observable within the room or space where the piping is located.*

Exception: Outside of the *building*, purple piping is not required downstream of the backflow preventer where *reclaimed water* is used for outdoor applications.

709.10 Tests and inspections. Tests and inspections shall be performed in accordance with Sections 709.10.1 and 709.10.2.

709.10.1 Water supply system test. The testing of makeup water supply piping and *reclaimed water distribution piping* shall be conducted in accordance with Section 312.5 of the *International Plumbing Code*.

709.10.2 Inspection and testing of backflow prevention assemblies. The testing of backflow preventers shall be conducted in accordance with Section 312.10 of the *International Plumbing Code*.

SECTION 710 PROJECT ELECTIVES

710.1 General. Section 710 contains *project electives* related to water conservation and efficiency. *Project electives* shall not be mandatory unless selected by the owner or *registered design professional* and indicated in the Project Elective Checklist required by Section 303.1.

710.2 Indoor water use. This section contains *project electives* related to indoor water use.

710.2.1 Water conservation tier project electives. Each water conservation tier above that mandated in Table 302.1 shall be recognized as an individual *project elective*.

710.3 On-site wastewater treatment project elective. Where projects are intended to qualify for an on-site wastewater treatment *project elective* in accordance with Section 303.4, all wastewater from the *building* shall be treated on-site to *tertiary standards* and reused on site.

710. 4 Non-potable outdoor water supply project elective. Where projects are intended to qualify for a *non-potable* outdoor water supply *project elective* in accordance with Section 303.4, sillcocks, hose bibs, wall hydrants, yard hydrants, and other outdoor outlets shall be supplied by *non-potable* water. Such outlets shall be located in a locked vault or shall be operable only by means of a removable key.

710.4.1 Labeling and signage. Each outlet shall be provided with signage in accordance with Section 706.2.

710.5 Non-potable water for plumbing fixture flushing water project elective. Where projects are intended to qualify for a *non-potable* water for plumbing fixture flushing *project elective* in accordance with Section 303.4, *non-potable* water shall be used for flushing water closets and urinals.

710.5.1 Water quality. *Non-potable* water for water closet and urinal flushing shall meet minimum water quality requirements as established for indoor flushing applications by local codes and regulations. Where chlorine is used for disinfection, the *non-potable* water shall contain not more than 4 mg/L of chloramines or free chlorine. Where ozone is used for disinfection, the *non-potable* water shall not contain gas bubbles having elevated levels of ozone at the point of use.

710.5.2 Filtration required. *Non-potable* water utilized for water closet and urinal flushing applications shall be filtered by a 100 micron or finer filter.

710.5.3 Labeling and signage. The entries to rooms having water closets or urinals that are supplied with *non-potable* water shall be provided with signage in accordance with Section 706.2.

710.6 Automatic fire sprinkler system project elective. Where projects are intended to qualify for an automatic fire sprinklers system *project elective* in accordance with Section 303.4, automatic fire sprinkler systems shall be supplied with *non-potable* water from an on-site *rainwater* collection system. Such *rainwater* collection system shall comply with Section 707. The requirements of Sections 710.6.1 and 710.6.2 shall apply to the fire sprinkler system and the on-site *rainwater* collection system.

710.6.1 Emergency power. An emergency power system complying with Chapter 27 of the *International Building Code* shall be provided for powering the pump and controls for the on-site *rainwater* collection system.

710.6.2 Source volume indication. The fire command center for the *building* shall be equipped with a device that indicates the volume of *non-potable* water contained in the collection reservoir. The indicator shall be *approved* and shall be in compliance with NFPA 72.

710.7 Non-potable water supply to fire pumps project elective. Where projects are intended to qualify for a *non-potable* water supply to fire pumps *project elective* in accordance with Section 303.4, one or more fire pumps shall be located within 200 feet of a source of reclaimed or recycled water of sufficient quality, pressure, and capacity for fire pump applications and the fire pumps shall be connected to such source of reclaimed or recycled water. The connections shall be in accordance with Section 403.3.2 of the *International Building Code*.

710.7.1 Labeling and signage. Fire pumps connected to a *non-potable* water supply shall have signage in accordance with Section 706.2 provided at the *building's* fire command center and at each fire pump.

710.8 Non-potable water for industrial process makeup water project elective. Where projects are intended to qualify for a *non-potable* water for industrial process makeup water *project elective* in accordance with Section 303.4, industrial processes requiring makeup water shall utilize *non-potable* water except where the process requires *potable* water for proper functioning.

710.8.1 Labeling and signage. All rooms containing process equipment supplied with *non-potable* water shall be provided with signage in accordance with Section 706.2.

710.9 Efficient hot water distribution system project elective. Where projects are intended to qualify for an efficient hot water distribution *project elective* in accordance with Section 303.4, the volume of water in the piping between the source of hot water and the hot water outlets of shower, sink and lavatory fixture fittings shall not exceed 64 ounces (1.89 L). The volume of water contained in fixture branch piping that connects to a hot water circulation loop or electrically heat-traced pipe shall not exceed 24 ounces (0.47 L). The volume shall be calculated in accordance with Section 710.9.1.

710.9.1 Volume calculation. The volume of water between the source of hot water and a given outlet shall be calculated by adding the internal volume of all piping, fittings, valves, *meters*, and manifolds between the source and the outlet. Piping volumes shall be calculated using Table 702.8.2. Where water is supplied by a circulating hot water system or an electrically heat-traced pipe, the hot water source shall be considered to be the loop or the heat -traced pipe, and the volume shall include the fitting on the loop that supplies the fixture branch.

710.10 Non-potable water for cooling tower makeup water project elective. Where projects are intended to qualify for a *non-potable* water for cooling tower makeup water *project elective* in accordance with Section 303.4, *non-potable* water shall be utilized for cooling tower makeup water in accordance with the requirements of Section 706.3.

710.11 Graywater collection project elective. Where projects are intended to qualify for a *graywater* collection *project elective* in accordance with Section 303.4, wastewater from lavatories, showers, bathtubs, clotheswashers, and laundry trays shall be collected for reuse onsite in accordance with Section 708.

CHAPTER 8

INDOOR ENVIRONMENTAL QUALITY AND COMFORT

SECTION 801 GENERAL

801.1 Scope and intent. The provisions of this chapter are intended to provide an interior environment that is conducive to the health and well-being of, *building* occupants, neighbors and construction personnel.

801.2 Indoor air quality management plan required. An indoor air quality management plan shall be developed. Such plan shall address the methods and procedures to be used during design and construction to obtain compliance with Sections 802 through 805.

SECTION 802 BUILDING CONSTRUCTION FEATURES, OPERATIONS AND MAINTENANCE FACILITATION

802.1 Scope. To facilitate the operation and maintenance of the completed *building*, the *building* and its systems shall comply with the requirements of Sections 802.2 through 802.5.

802.2 Air handling system access. The arrangement and location of air handling system components including, but not limited to, ducts, air handler units, fans, coils and condensate pans shall allow access for cleaning and *repair* of the air handling surfaces of such components. Access ports shall be installed in the air handling system to permit such cleaning and repairs. Piping, conduits, and other *building* components shall not be located so as to obstruct the required access ports.

802.3 Durability of air handling surfaces. Surfaces exposed to airflow within air handling systems shall be constructed of materials that are resistant to deterioration and will not break away, crack, peel, flake off, or show evidence of delamination or continued erosion when tested in accordance with the erosion test in UL 181.

802.4 Air handling system filters. Filter racks shall be designed to prevent airflow from bypassing filters. Access doors and panels provided for filter replacement shall be fitted with flexible seals to provide an effective seal between the doors and panels and the mating filter rack surfaces. Special tools shall not be required for opening access doors and panels. Filter access panels and doors shall not be obstructed.

802.5 Airstream surfaces. Materials exposed to airflow within ducts, within air plenums, or on top of suspended ceilings, shall not break away, crack, peel, flake off, or show evidence of delamination or continued erosion when tested in accordance with the erosion test in UL 181.

SECTION 803 HVAC SYSTEMS

803.1 Construction phase requirements. The *ventilation of buildings* during the construction phase shall be in accordance with sections 803.1.1 through 803.1.3.

803.1.1 Duct openings. Duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal or shall be closed by an *approved* method to reduce the amount of dust and debris that collects in the system from the time of rough-in installation and until startup of the heating and cooling equipment. Dust and debris shall be cleaned from duct openings prior to system flush out and *building* occupancy.

803.1.2 Indoor air quality during construction. Temporary *ventilation* during construction shall be provided in accordance with Sections 803.1.2.1 through 803.1.2.3.

803.1.2.1 Ventilation. *Ventilation* during construction shall be achieved through openings in the *building* envelope using natural *ventilation* in accordance with the provisions of the *International Building Code* or the *International Mechanical Code*, or fans that produce a minimum of three air changes per hour.

803.1.2.2 Protection of HVAC system openings. HVAC supply and return duct and equipment openings shall be protected during dust-producing operations.

803.1.2.3 Return air filters. Where a forced air HVAC system is used during construction, new return air filters shall be installed prior to system flush out and *building* occupancy.

803.1.3 Construction phase ductless system or filter. Where spaces are conditioned during the construction phase, space conditioning systems shall be of the ductless variety, or filters for ducted systems shall be rated at MERV 8 or higher and system equipment shall be designed to be compatible. Duct system design shall account for pressure drop across the filter.

803.2 Thermal environmental conditions for human occupancy. Buildings shall be designed in compliance with ASHRAE 55 –04, Sections 6.1, “Design,” and 6.2, “Documentation.”

Exception: Spaces with special requirements for processes, activities, or contents that require a thermal environment outside of that which humans find thermally acceptable, such as food storage, natatoriums, shower rooms, saunas, and drying rooms.

803.3 Environmental tobacco smoke control. Smoking shall not be allowed inside of buildings. Signage stating such shall be posted within 10 ft (3 m) of each building entrance. Any exterior designated smoking areas shall be located not less than 25 ft (7.5 m) away from building entrances, outdoor air intakes, and operable windows.

803.4 Isolation of pollutant sources. The isolation of pollutant sources related to print, copy and janitorial rooms, garages and hangars shall be in accordance with Section 803.4.1.

803.4.1 Print, copy and janitorial rooms and garages. Enclosed rooms or spaces that are greater than 200 square feet in area and that are used as a print or copy facility, janitorial room, repair garage or aircraft hangar where the use of chemicals occurs shall comply with all of the following:

1. The enclosing walls shall extend from the floor surface to the underside of the floor, roof deck or solid ceiling above and shall be constructed to resist the passage of airborne chemical pollutants.
2. Doors in the enclosing walls shall be automatic or self-closing.
3. An HVAC system shall be provided that: provides separate exhaust airflow to the outdoors at a rate of not less than 0.50 cfm per square foot; that maintains a negative pressure of not less than 7pa within the room; and that prohibits the recirculation of air from the room to other portions of the *building*.

803.5 Filters. Filters for air conditioning systems shall be rated at MERV 11 or higher and system equipment shall be designed to be compatible. The air handling system design shall account for pressure drop across the filter.

SECTION 804

SPECIFIC INDOOR AIR QUALITY & POLLUTANT CONTROL MEASURES

804.1 Fireplaces and appliances. Where located within *buildings, fireplaces*, solid fuel-burning appliances, vented decorative gas appliances, vented gas *fireplace* heaters and decorative gas appliances for installation in *fireplaces* shall comply with Sections 804.1.1 through 804.1.7. Unvented room heaters and unvented decorative appliances, including alcohol burning, shall be prohibited.

804.1.1 Installation. *Fireplaces* and appliances shall be installed in accordance with the manufacturer's instructions.

804.1.2 Venting. *Fireplaces* and fuel-burning appliances shall be vented to the outdoors and shall be provided with combustion air in accordance with the *International Mechanical Code and the International Fuel Gas Code*.

804.1.3 Gas fireplaces. Vented decorative gas appliances and vented gas fireplace heaters shall be direct-vented and listed in accordance with ANSI Z21.50/CSA 2.22 and ANSI Z21.88/CSA 2.33, respectively.

804.1.4 Fireplaces. Wood-burning *fireplaces* shall be provided with combustion air directly from the outdoors and shall be provided with a means to tightly close off the chimney flue and combustion air outlets when the *fireplace* is not in use.

804.1.5 Wood-fired appliances. Wood stoves and wood *fireplace* inserts shall be *listed* in accordance with UL 1482 and shall be certified in accordance with the requirements of the EPA Standards of Performance for New Residential Wood Heaters, 40 CFR Part 60 subpart AAA.

804.1.6 Biomass appliances. Biomass fireplaces, stoves and inserts shall be *listed* in accordance with ASTM E1509. Biomass boilers and furnaces shall be *listed* in accordance with CSA B366.1-2009 or UL391.

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804.2 Radon mitigation. *Buildings* in High and Moderate Radon Potential (Zone 1 and 2) locations, as determined by Figure 804.2(1) and Table 804.2 shall comply with Sections 804.2.1 through 804.2.10.

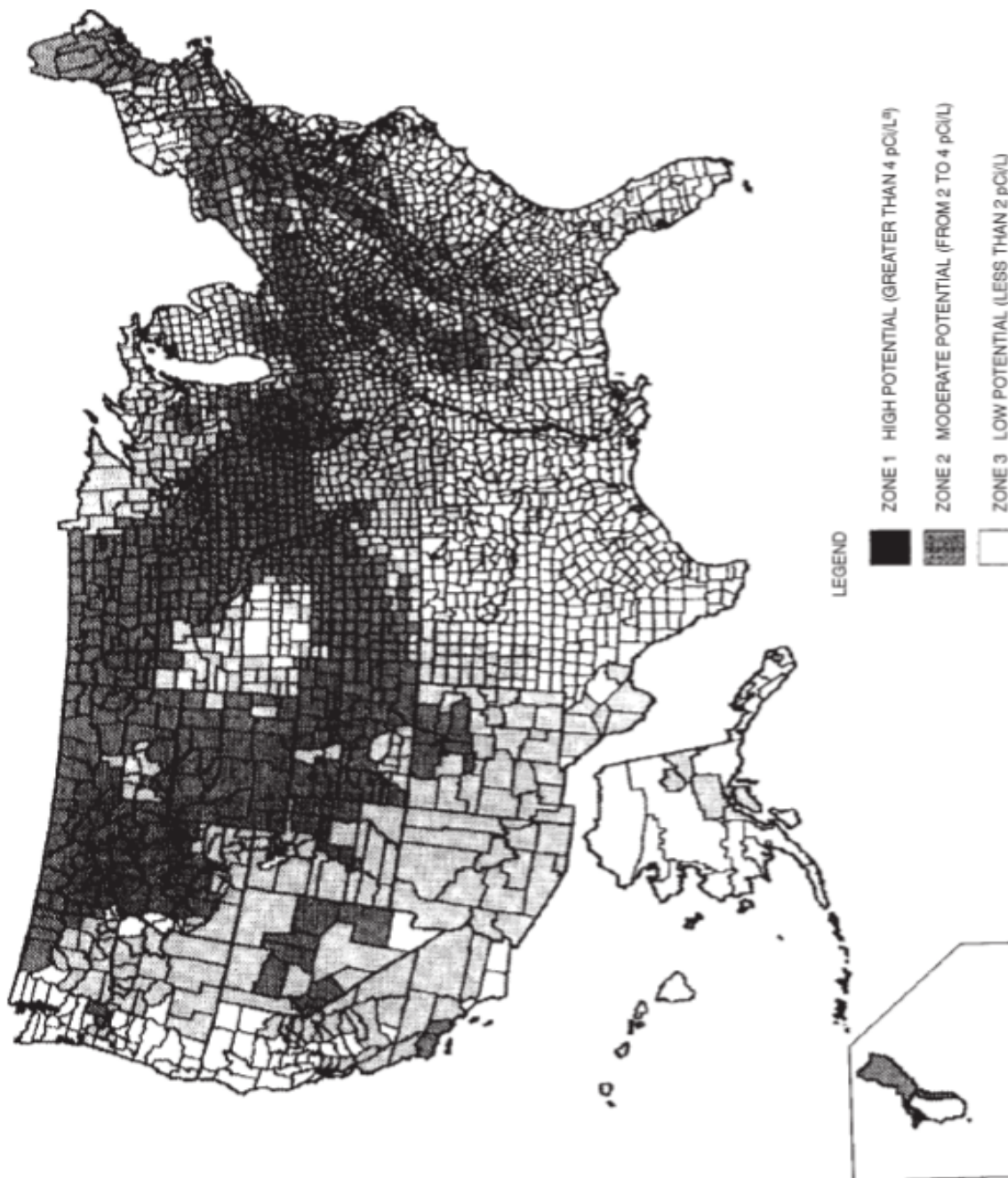


FIGURE 804.2
EPA MAP OF RADON ZONES

a. pCi/L standard for picocuries per liter of radon gas. EPA recommends that all homes that measure 4 pCi/L and greater be mitigated

The United States Environmental Protection Agency and the United States Geological Survey have evaluated the radon potential in the United States and have developed a map of radon zones designed to assist code officials in deciding whether radon-resistant features are applicable in new construction.

The map assigns each of the 3,141 counties in the United States to one of three zones based on radon potential. Each zone designation reflects the average short-term radon measurement that can be expected to be measured in a building without the implementation of radon control methods. The radon zone designation of highest priority is Zone 1. Table 804.2 lists the Zone 1 counties illustrated on the map. More detailed information can be obtained from state-specific booklets (EPA-402-R-93-021 through 070) available through State Radon Offices or from U.S. EPA Regional Offices.

**TABLE 804.2
HIGH RADON POTENTIAL (ZONE 1) COUNTIES^a**

(continued)

ALABAMA	CONNECTICUT	Morgan	Wabash	Thomas	Cass	Washington
Calhoun	Fairfield	Moultrie	Warren	Trego	Hillsdale	Watsonwan
Clay	Middlesex	Ogle	Washington	Wallace	Jackson	Wilkin
Cleburne	New Haven	Peoria	Wayne	Washington	Kalamazoo	Winona
Colbert	New London	Piatt	Wells	Wichita	Lenawee	Wright
Coosa		Pike	White	Wyandotte	St. Joseph	Yellow Medicine
Franklin	GEORGIA	Putnam	Whitley		Washtenaw	
Jackson	Cobb	Rock Island		KENTUCKY		MISSOURI
Lauderdale	De Kalb	Sangamon	IOWA	Adair	MINNESOTA	Andrew
Lawrence	Fulton	Schuyler	All Counties	Allen	Becker	Atchison
Limestone	Gwinnett	Scott		Barren	Big Stone	Buchanan
Madison		Stark	KANSAS	Bourbon	Blue Earth	Cass
Morgan	IDAHO	Stephenson	Atchison	Boyle	Brown	Clay
Talladega	Benewah	Tazewell	Barton	Bullitt	Carver	Clinton
	Blaine	Vermilion	Brown	Casey	Chippewa	Holt
CALIFORNIA	Boise	Warren	Cheyenne	Clark	Clay	Iron
Santa Barbara	Bonner	Whiteside	Clay	Cumberland	Cottonwood	Jackson
Ventura	Boundary	Winnebago	Cloud	Fayette	Dakota	Nodaway
	Butte	Woodford	Decatur	Franklin	Dodge	Platte
COLORADO	Camas		Dickinson	Green	Douglas	
Adams	Clark	INDIANA	Douglas	Harrison	Faribault	MONTANA
Arapahoe	Clearwater	Adams	Ellis	Hart	Fillmore	Beaverhead
Baca	Custer	Allen	Ellsworth	Jefferson	Freeborn	Big Horn
Bent	Elmore	Bartholomew	Finney	Jessamine	Goodhue	Blaine
Boulder	Fremont	Benton	Ford	Lincoln	Grant	Broadwater
Chaffee	Gooding	Blackford	Geary	Marion	Hennepin	Carbon
Cheyenne	Idaho	Boone	Gove	Mercer	Houston	Carter
Clear Creek	Kootenai	Carroll	Graham	Metcalfe	Hubbard	Cascade
Crowley	Latah	Cass	Grant	Monroe	Jackson	Chouteau
Custer	Lemhi	Clark	Gray	Nelson	Kanabec	Custer
Delta	Shoshone	Clinton	Greeley	Pendleton	Kandiyohi	Daniels
Denver	Valley	De Kalb	Hamilton	Pulaski	Kittson	Dawson
Dolores		Decatur	Haskell	Robertson	Lac Qui Parle	Deer Lodge
Douglas	ILLINOIS	Delaware	Hodgeman	Russell	Le Sueur	Fallon
El Paso	Adams	Elkhart	Jackson	Scott	Lincoln	Fergus
Elbert	Boone	Fayette	Jewell	Taylor	Lyon	Flathead
Fremont	Brown	Fountain	Johnson	Warren	Mahnomen	Gallatin
Garfield	Bureau	Fulton	Keary	Woodford	Marshall	Garfield
Gilpin	Calhoun	Grant	Kingman		Martin	Glacier
Grand	Carroll	Hamilton	Kiowa	MAINE	McLeod	Granite
Gunnison	Cass	Hancock	Lane	Androscoggin	Meeker	Hill
Huerfano	Champaign	Harrison	Leavenworth	Aroostook	Mower	Jefferson
Jackson	Coles	Hendricks	Lincoln	Cumberland	Murray	Judith Basin
Jefferson	De Kalb	Henry	Logan	Franklin	Nicollet	Lake
Kiowa	De Witt	Howard	Marion	Hancock	Nobles	Lewis and Clark
Kit Carson	Douglas	Huntington	Marshall	Kennebec	Norman	Liberty
Lake	Edgar	Jay	McPherson	Lincoln	Olmsted	Lincoln
Larimer	Ford	Jennings	Nemaha	Oxford	Penobscot	Madison
Las Animas	Fulton	Johnson	Kosciusko	Piscataquis	Pennington	McCone
Lincoln	Greene	Johnson	Lagrange	Somerset	Pipestone	Meagher
Logan	Grundy	Kosciusko	Lawrence	York	Polk	Mineral
Mesa	Hancock	Lawrence	Madison		Pope	Missoula
Moffat	Henderson	Madison	Marion	MARYLAND	Ramsey	Park
Montezuma	Henry	Marion	Marshall	Baltimore	Red Lake	Phillips
Montrose	Iroquois	Marshall	Miami	Calvert	Redwood	Pondera
Morgan	Jersey	Miami	Monroe	Carroll	Renville	Powder River
Otero	Jo Daviess	Monroe	Montgomery	Frederick	Rice	Powell
Ouray	Kane	Montgomery	Pratt	Harford	Rock	Prairie
Park	Kendall	Noble	Rawlins	Howard	Roseau	Ravalli
Phillips	Knox	Orange	Republic	Montgomery	Scott	Richland
Pitkin	La Salle	Putnam	Rice	Washington	Sherburne	Roosevelt
Prowers	Lee	Randolph	Riley		Sibley	Rosebud
Pueblo	Livingston	Rush	Rooks	MASS.	Stearns	Sanders
Rio Blanco	Logan	Scott	Rush	Essex	Steele	Sheridan
San Miguel	Macon	Shelby	Russell	Middlesex	Stevens	Silver Bow
Summit	Marshall	Steuben	Saline	Worcester	Swift	Stillwater
Teller	Mason	St. Joseph	Scott		Todd	Teton
Washington	McDonough	Tippecanoe	Sheridan	MICHIGAN	Traverse	Toole
Weld	McLean	Tipton	Sherman	Branch	Wabasha	Valley
Yuma	Menard	Union	Smith	Calhoun	Wadena	Wibaux
	Mercer	Vermillion	Stanton		Waseca	

TABLE 804.2 – continued
HIGH RADON POTENTIAL (ZONE 1) COUNTIES^a

Yellowstone	NEW JERSEY	Auglaize	Delaware	Miner	Bristol	Marshall
National Park	Hunterdon	Belmont	Franklin	Minnehaha	Brunswick	Mercer
	Mercer	Butler	Fulton	Moody	Buckingham	Mineral
NEBRASKA	Monmouth	Carroll	Huntingdon	Perkins	Buena Vista	Monongalia
Adams	Morris	Champaign	Indiana	Potter	Campbell	Monroe
Boone	Somerset	Clark	Juniata	Roberts	Chesterfield	Morgan
Boyd	Sussex	Clinton	Lackawanna	Sanborn	Clarke	Ohio
Burt	Warren	Columbiana	Lancaster	Spink	Clifton Forge	Pendleton
Butler		Coshocton	Lebanon	Stanley	Covington	Pocahontas
Cass	NEW MEXICO	Crawford	Lehigh	Sully	Craig	Preston
Cedar	Bernalillo	Darke	Luzerne	Turner	Cumberland	Summers
Clay	Colfax	Delaware	Lycoming	Union	Danville	Wetzel
Colfax	Mora	Fairfield	Mifflin	Walworth	Dinwiddie	
Cuming	Rio Arriba	Fayette	Monroe	Yankton	Fairfax	WISCONSIN
Dakota	San Miguel	Franklin	Montgomery		Falls Church	Buffalo
Dixon	Santa Fe	Greene	Montour	TENNESSEE	Fluvanna	Crawford
Dodge	Taos	Guernsey	Northampton	Anderson	Frederick	Dane
Douglas		Hamilton	Northumberland	Bedford	Fredericksburg	Dodge
Fillmore	NEW YORK	Hancock	Perry	Blount	Giles	Door
Franklin	Albany	Hardin	Schuylkill	Bradley	Goochland	Fond du Lac
Frontier	Allegany	Harrison	Snyder	Claiborne	Harrisonburg	Grant
Furnas	Broome	Holmes	Sullivan	Davidson	Henry	Green
Gage	Cattaraugus	Huron	Susquehanna	Giles	Highland	Green Lake
Gosper	Cayuga	Jefferson	Tioga	Grainger	Lee	Iowa
Greeley	Chautauqua	Knox	Union	Greene	Lexington	Jefferson
Hamilton	Chemung	Licking	Venango	Hamblen	Louisa	Lafayette
Harlan	Chenango	Logan	Westmoreland	Hancock	Martinsville	Langlade
Hayes	Columbia	Madison	Wyoming	Hawkins	Montgomery	Marathon
Hitchcock	Cortland	Marion	York	Hickman	Nottoway	Menominee
Hurston	Delaware	Mercer		Humphreys	Orange	Pepin
Jefferson	Dutchess	Miami	RHODE ISLAND	Jackson	Page	Pierce
Johnson	Erie	Montgomery	Kent	Jefferson	Patrick	Portage
Kearney	Genesee	Morrow	Washington	Knox	Pittsylvania	Richland
Knox	Greene	Muskingum		Lawrence	Powhatan	Rock
Lancaster	Livingston	Perry	S. CAROLINA	Lewis	Pulaski	Shawano
Madison	Madison	Pickaway	Greenville	Lincoln	Radford	St. Croix
Nance	Onondaga	Pike		Loudon	Roanoke	Vernon
Nemaha	Ontario	Preble	S. DAKOTA	Marshall	Rockbridge	Walworth
Nuckolls	Orange	Richland	Aurora	Maury	Rockingham	Washington
Otoe	Otsego	Ross	Beadle	McMinn	Russell	Waukesha
Pawnee	Putnam	Seneca	Bon Homme	Meigs	Salem	Waupaca
Phelps	Rensselaer	Shelby	Brookings	Monroe	Scott	Wood
Pierce	Schoharie	Stark	Brown	Moore	Shenandoah	
Platte	Schuyler	Summit	Brule	Perry	Smyth	WYOMING
Polk	Seneca	Tuscarawas	Buffalo	Roane	Spotsylvania	Albany
Red Willow	Steuben	Union	Campbell	Rutherford	Stafford	Big Horn
Richardson	Sullivan	Van Wert	Charles Mix	Smith	Staunton	Campbell
Saline	Tioga	Warren	Clark	Sullivan	Tazewell	Carbon
Sarpy	Tompkins	Wayne	Clay	Trousdale	Warren	Converse
Saunders	Ulster	Wyandot	Codrington	Union	Washington	Crook
Seward	Washington		Corson	Washington	Waynesboro	Fremont
Stanton	Wyoming	PENNSYLVANIA	Davison	Wayne	Winchester	Goshen
Thayer	Yates	Adams	Day	Williamson	Wythe	Hot Springs
Washington		Allegheny	Deuel	Wilson		Johnson
Wayne	N. CAROLINA	Armstrong	Douglas		WASHINGTON	Laramie
Webster	Alleghany	Beaver	Edmunds	UTAH	Clark	Lincoln
York	Buncombe	Bedford	Faulk	Carbon	Ferry	Natrona
	Cherokee	Berks	Grant	Duchesne	Okanogan	Niobrara
NEVADA	Henderson	Blair	Hamlin	Grand	Pend Oreille	Park
Carson City	Mitchell	Bradford	Hand	Piute	Skamania	Sheridan
Douglas	Rockingham	Bucks	Hanson	Sanpete	Spokane	Sublette
Eureka	Transylvania	Butler	Hughes	Sevier	Stevens	Sweetwater
Lander	Watauga	Cameron	Hutchinson	Uintah		Teton
Lincoln		Carbon	Hyde		W. VIRGINIA	Uinta
Lyon	N. DAKOTA	Centre	Jerauld	VIRGINIA	Berkeley	Washakie
Mineral	All Counties	Chester	Kingsbury	Alleghany	Brooke	
Pershing		Clarion	Lake	Amelia	Grant	
White Pine	OHIO	Clearfield	Lincoln	Appomattox	Greenbrier	
	Adams	Clinton	Lyman	Augusta	Hampshire	
NEW HAMPSHIRE	Allen	Columbia	Marshall	Bath	Hancock	
Carroll	Ashland	Cumberland	McCook	Bland	Hardy	
		Dauphin	McPherson	Botetourt	Jefferson	

a. EPA recommends that the county testing be supplemented with other available State and local data to further understand the radon potential of Zone 1 areas.

804.2.1 Subfloor preparation. A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the occupied spaces of the building, to facilitate future installation of a sub-slab depressurization system, if needed. The gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate, a minimum of 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a $\frac{1}{4}$ -inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill), a minimum of 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.
3. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire sub-floor area.

804.2.2 Soil-gas-retarder. A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material that conforms to ASTM E1643 shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly to serve as a soil-gas-retarder by bridging any cracks that develop in the slab or floor assembly and to prevent concrete from entering the void spaces in the aggregate base material. The sheeting shall cover the entire floor area with separate sections of sheeting lapped at least 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. All punctures or tears in the material shall be sealed or covered with additional sheeting.

804.2.3 Entry routes. Potential radon entry routes shall be closed in accordance with Sections 804.2.3.1 through 804.2.3.10.

804.2.3.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs or other floor assemblies shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.

804.2.3.2 Concrete joints. All control joints, isolation joints, construction joints and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk or other elastomeric sealant applied in accordance with the manufacturer's recommendations.

804.2.3.3 Condensate drains. Condensate drains shall be trapped or routed through nonperforated pipe to daylight.

804.2.3.4 Sumps. Sump pits open to soil or serving as the termination point for sub-slab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as the suction point in a sub-slab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

804.2.3.5 Foundation walls. Hollow block masonry foundation walls shall be constructed with either a continuous course of *solid masonry*, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course

immediately below that ledge shall be sealed. Joints, cracks or other openings around all penetrations of both exterior and interior surfaces of masonry block or wood foundation walls below the ground surface shall be filled with polyurethane caulk or equivalent sealant. Penetrations of concrete walls shall be filled.

804.2.3.6 Dampproofing. The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed.

804.2.3.7 Air-handling units. Air-handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit.

Exception: Units with gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage.

804.2.3.8 Ducts. Ductwork passing through or beneath a slab shall be of seamless material or sealed water-tight. Joints in such ductwork shall be sealed water-tight.

804.2.3.9 Crawl space floors. Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.

804.2.3.10 Crawl space access. Access doors and other openings or penetrations between *basements* and adjoining crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.

804.2.4 Passive submembrane depressurization system. In buildings with crawl space foundations, the following components of a passive sub-membrane depressurization system shall be installed during construction.

Exception: Buildings in which an *approved* mechanical crawl space ventilation system or other equivalent system is installed.

804.2.4.1 Ventilation. Crawl spaces shall be provided with vents to the exterior of the building.

804.2.4.2 Soil-gas-retarder. The soil in crawl spaces shall be covered with a continuous layer of minimum 6-mil (0.15 mm) polyethylene soil-gas-retarder that conforms to ASTM E1643. The ground cover shall be lapped a minimum of 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the crawl space area.

804.2.4.3 Vent pipe. A plumbing tee or other *approved* connection shall be inserted horizontally beneath the sheeting and connected to a 3- or 4-inch-diameter (76 mm or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

804.2.5 Passive subslab depressurization system. In *basement* or slab-on-grade buildings, the following components of a passive sub-slab depressurization system shall be installed during construction.

804.2.5.1 Vent pipe. A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent gas-tight pipe shall be embedded vertically into the sub-slab aggregate or other permeable material before the slab is cast. A "T" fitting or equivalent method shall be used to ensure that the pipe opening remains within the sub-slab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the sub-slab aggregate or connected to it through a drainage system.

The pipe shall be extended up through the building floors, terminate at least 12 inches (305 mm) above the surface of the roof in a location at least 10 feet (3048 mm) away from any window or other opening into the *conditioned spaces* of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

804.2.5.2 Multiple vent pipes. In buildings where interior footings or other barriers separate the sub-slab aggregate or other gas-permeable material, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

804.2.6 Vent pipe drainage. All components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil-gas-retarder.

804.2.7 Vent pipe accessibility. Radon vent pipes shall be accessible for future fan installation through an *attic* or other area outside the *habitable space*.

Exception: The radon vent pipe need not be accessible in an *attic* space where an *approved* rooftop electrical supply is provided for future use.

804.2.8 Vent pipe identification. All exposed and visible interior radon vent pipes shall be identified with at least one *label* on each floor and in accessible *attics*. The *label* shall read: "Radon Reduction System."

804.2.9 Combination foundations. Combination *basement/crawl* space or *slab-on-grade/crawl* space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.

804.2.10 Power source. To provide for future installation of an active sub-membrane or sub-slab depressurization system, an electrical circuit terminated in an *approved* box shall be installed during construction in the *attic* or other anticipated location of vent pipe fans. An electrical supply shall also be accessible in anticipated locations of system failure alarms.

804.3 Building flush out. After all interior finishes are installed, the *building* shall be flushed-out by supplying continuous *ventilation* with all air handling units at their maximum outdoor air rate for at least 14 days while maintaining an internal temperature of at least 60°F, and relative humidity not higher than 60 percent. Occupancy shall be permitted to start 7 days after start of the flush-out, provided that flush-out continues for the full 14 days. The *building* shall not be "baked out" by increasing the temperature of the space. Where continuous *ventilation* is not possible, the aggregate of flush-out periods shall be equivalent to 14 days of continuous *ventilation*.

Exceptions:

1. Group S, F, H and U occupancies shall not be required to comply with this section.
2. A building shall not be required to be flushed-out where it is tested for indoor air quality and the testing results indicate that the levels of VOC's are acceptable.

804.4 Building Entrances. All building entrances shall employ an entry mat system that shall have a scraper surface, an absorption surface, and a finishing surface in accordance with Sections 804.4.1 through 804.4.3. Each surface shall be not less than the width of the entry opening, and the minimum length is measured in the primary direction of travel.

Exceptions:

1. Entrances to individual dwelling units.
2. The length of entry mat surfaces is allowed to be reduced because of a barrier, such as a counter, partition or wall, or where local regulations prohibit the use of scraper surfaces outside of the entry. In such cases, the entry mat surfaces shall have a minimum length of 3 ft (914mm) of indoor surface, with a minimum combined length of 6 ft (1829 mm).

804.4.1 Scraper Surface. The scraper surface shall comply with all of the following:

1. It shall be the first surface stepped on when entering the building.
2. It shall be either immediately outside of or inside of the entry.
3. It shall be not less than 3 feet (914mm) in length.
4. It shall consist of permanently mounted grates or removable mats with knobby or squeegee like projections.

804.4.2 Absorption Surface. The absorption surface shall comply with all of the following:

1. It shall be the second surface stepped on when entering the building.
2. It shall be not less than 3 feet (914mm) in length and made from materials that can perform both a scraping action and a moisture wicking action.

804.4.3 Finishing Surface. The finishing surface shall comply with all of the following:

1. It shall be the third surface stepped on when entering the building.
2. It shall be not less than 4 feet (1219mm) in length and made from materials that will both capture and hold any remaining particles or moisture.

SECTION 805 ASBESTOS USE PREVENTION

805.1 Scope. The use of materials containing asbestos in *building* construction shall be prohibited.



SECTION 806 MATERIAL EMISSIONS & POLLUTANT CONTROL

806.1 Emissions from glued wood products. Glued wood products used interior to the approved *weather covering* of the building shall comply with the emission limits or be manufactured in accordance with the standards cited in Table 806.1. Compliance with emission limits shall be demonstrated following the requirements of Section 93120 of title 17, California Code of Regulations, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products.

Exceptions:

1. Glued wood products that are made using adhesives that do not contain urea-formaldehyde (UF) resins.
2. Glued wood products that are sealed on all sides and edges.
3. Glued wood products that are used to make elements considered to be furniture, fixtures and equipment (FF&E) that are not permanently installed.

**TABLE 806.1
GLUED PRODUCTS EMISSIONS**

PRODUCT	FORMALDEHYDE LIMIT (ppm)	STANDARD
Hardwood plywood	0.05	-
Particle board	0.09	-
Medium density fiberboard	0.11	-
Thin medium density fiberboard ^a	0.13	-
Wood Structural Panels (plywood and OSB) manufactured with moisture resistant adhesives rated with the EXTERIOR or EXPOSURE 1 Bond Classification	-	DOC PS1 or DOC PS2
Prefabricated I-joist	-	ASTM D5055
Structural Composite Lumber	-	ASTM D5456

a. Maximum thickness of 5/16 inch (8mm).

806.2 Adhesives and sealants. A minimum of 85 percent by weight or volume, of site applied adhesives and sealants shall comply with the VOC content limits in Table 806.2(1) or alternative VOC emissions limits in Table 806.2(2). The VOC content shall be determined in accordance with the appropriate standard being either U.S. EPA Method 24, SCAQMD Method 304, 316A or 316B. The exempt compound content shall be determined by either SCAQMD Methods 302 and 303 or ASTM D 3960. Table 806.2(1) adhesives and sealants regulatory category and VOC content compliance determination shall conform to the SCQMD Rule 1168 Adhesive and sealant Applications as amended on 1/7/05. The provisions of this section shall not apply to adhesives and sealants subject to state or federal consumer product VOC regulations. HVAC duct sealants shall be classified as “Other” category within the SCAQMD Rule 1168 sealants table.

Exception: HVAC air duct sealants are not required to meet the emissions or the VOC content requirements when the air temperature in which they are applied is less than 40°F (4.5°C).

Table 806.2(2) adhesive alternative emissions standards compliance shall be determined utilizing test methodology incorporated by reference in the CDPH/EHLB/Standard Method V1.1 “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.1” dated February 2010. The alternative emissions testing shall be performed by a laboratory that has the CDPH/EHLB/Standard Method V1.1 test methodology in the scope of its ISO 17025 Accreditation.

**TABLE 806.2(1)
SITE APPLIED ADHESIVE AND SEALANTS VOC LIMITS**

ADHESIVE	VOC LIMIT
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesive	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Dry wall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single ply roof membrane adhesives	250
Architectural Sealants	250
Architectural Sealant Primer	
Non Porous	250
Porous	775
Modified Bituminous Sealant Primer	500
Other Sealant Primers	750
CPVC solvent cement	490
PVC solvent cement	510
ABS solvent cement	325
Plastic Cement Welding	250
Adhesive Primer for Plastic	550
Contact Adhesive	80
Special Purpose Contact Adhesive	250
Structural Wood Member Adhesive	140

- a. VOC limit less water and less exempt compounds in grams/liter
b. For low-solid adhesives and sealants, the VOC limit is expressed in grams/liter of material as specified in Rule 1168. For all other adhesives and sealants, the VOC limits are expressed as grams of VOC per liter of adhesive or sealant less water and less exempt compounds as specified in Rule 1168.

**TABLE 806.2(2)
VOC EMISSION LIMITS**

VOC	LIMIT
Individual VOCs	$\leq \frac{1}{2}$ CA chronic REL ^a
Formaldehyde	$\leq 16.5 \mu\text{g}/\text{m}^3$ or $\leq 13.5 \text{ ppb}^b$

- a. CDPH/EHLB/Standard Method V1.1 Chronic Reference Exposure Level (CREL)
b. Effective January 1, 2012 limit becomes less than or equal to the CDPH/EHLB/Standard Method V1.1 CREL ($\leq 9 \mu\text{g}/\text{m}^3$ or $\leq 7 \text{ ppb}$)

806.2.1 Single-ply roof membrane adhesives. Single-ply roof membrane adhesives shall be exempt from the requirements of Table 806.2(1) in climate zones 6, 7 and 8 as identified in the 2009 IECC.

806.3 Architectural paints and coatings. A minimum of 85 percent by weight or volume, of site-applied interior architectural coatings shall comply with VOC content limits in Table 806.3(1) or the alternate emissions limits in Table 806.3(2). The exempt compound content shall be determined by ASTM D3960.

Table 806.3(2) architectural coating alternate emissions standards compliance shall be determined utilizing test methodology incorporated by reference in the CDPH/EHLB/STANDARD METHOD V.1.1 "Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From

Indoor Sources Using Environmental Chambers Version 1.1” dated February 2010. The alternative emissions testing shall be performed by a laboratory that has the CDPH/EHLB/STANDARD METHOD V 1.1 test methodology in the scope of its ISO 17025 Accreditation.

806.4 Flooring A minimum of 85 percent of the total area of flooring installed within the interior of the *building* shall comply with the requirements of Table 806.4 (2). Where flooring with more than one distinct product layer is installed, the emissions from each layer shall comply with these requirements. The test methodology used to determine compliance shall be from CDPH/EHLB/STANDARD METHOD V.1.1 “*Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers Version 1.1*” dated February 2010. The emissions testing shall be performed by a laboratory that has the CDPH/EHLB/STANDARD METHOD V 1.1 test methodology in the scope of its ISO 17025 Accreditation.

Where post manufacture coatings or surface applications have not been applied, the flooring listed in Table 806.4(1) shall be deemed to comply with the requirements of Table 806.4(2).

806.5 Acoustical ceiling tiles and wall systems. A minimum of 85 percent of acoustical ceiling tiles and wall systems, by square feet, shall comply with the requirements of Table 806.5(2). Where ceiling and wall systems with more than one distinct product layer are installed, the emissions from each layer shall comply with these requirements. The test methodology used to determine compliance shall be from CDPH/EHLB/STANDARD METHOD V.1.1 “*Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers Version 1.1*” dated February 2010. The emissions testing shall be performed by a laboratory that has the CDPH/EHLB/STANDARD METHOD V 1.1 test methodology in the scope of its ISO 17025 Accreditation.

Where post manufacture coatings or surface applications have not been applied, the ceiling or wall systems listed in Table 806.5(1) shall be deemed to comply with the requirements of Table 806.5(2).

806.6 Insulation. A minimum of 85 percent of insulation shall comply with the requirements of Table 806.6. The test methodology used to determine compliance shall be from CDPH/EHLB/STANDARD METHOD V.1.1 “*Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers Version 1.1*” dated February 2010. The emissions testing shall be performed by a laboratory that has the CDPH/EHLB/STANDARD METHOD V 1.1 test methodology in the scope of its ISO 17025 Accreditation.

**TABLE 806.3(1)
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS^{c,d,e}**

	Effective: JANUARY 1, 2010	Effective: JANUARY 1, 2012
Coating Category	LIMIT^a g/l	LIMIT^a g/l
Flat Coatings	50	
Non-flat Coatings	100	
Non-flat - High Gloss Coatings	150	
Specialty Coatings:		
Aluminum Roof Coatings	400	
Basement Specialty Coatings	400	
Bituminous Roof Coatings	50	
Bituminous Roof Primers	350	

	Effective: JANUARY 1, 2010	Effective: JANUARY 1, 2012
Bond Breakers	350	
Concrete Curing Compounds	350	
Concrete/Masonry Sealers	100	
Driveway Sealers	50	
Dry Fog Coatings	150	
Faux Finishing Coatings	350	
Fire Resistive Coatings	350	
Floor Coatings	100	
Form-Release Compounds	250	
Graphic Arts Coatings (Sign	500	
High Temperature Coatings	420	
Industrial Maintenance Coatings	250	
Low Solids Coatings	120 ^b	
Magnesite Cement Coatings	450	
Mastic Texture Coatings	100	
Metallic Pigmented Coatings	500	
Multi-Color Coatings	250	
Pre-Treatment Wash Primers	420	
Primers, Sealers, and	100	
Reactive Penetrating Sealers	350	
Recycled Coatings	250	
Roof Coatings	50	
Rust Preventative Coatings	400	250
Shellacs, Clear	730	
Shellacs, Opaque	550	
Specialty Primers, Sealers, and Undercoaters	350	100
Stains	250	
Stone Consolidants	450	
Swimming Pool Coatings	340	
Traffic Marking Coatings	100	
Tub and Tile Refinish Coatings	420	
Waterproofing Membranes	250	
Wood Coatings	275	
Wood Preservatives	350	
Zinc-Rich Primers	340	

a. Limits are expressed as VOC Regulatory (except as noted), thinned to the manufacturer's maximum thinning recommendation, excluding any colorant added to tint bases.

b. Limit is expressed as VOC actual.

c. The specified limits remain in effect unless revised limits are listed in subsequent columns in the table.

d. Values in this table are derived from those specified by the California Air Resources Board, Architectural Coatings Suggested Control Measure, February 1, 2008.

e. Table 806.3(1) architectural coating regulatory category and VOC content compliance determination shall conform to the California Air Resources Board *Suggested Control Measure for Architectural Coatings* dated February 1, 2008.

**Table 806.3(2)
ARCHITECTURAL COATINGS VOC EMISSION LIMITS**

VOC	LIMIT
Individual	≤½ CA chronic REL ^a
Formaldehyde	≤ 16.5 ug/m ³ or ≤ 13.5 ppb

a. CA Chronic Reference Exposure Level (CREL)

**TABLE 806.4 (1)
FLOORING DEEMED TO COMPLY WITH VOC EMISSION LIMITS**

Ceramic and concrete tile
Organic-free, mineral-based
Clay pavers
Concrete pavers
Concrete
Metal

**TABLE 806.4(2)
FLOORING VOC EMISSION LIMITS**

VOC	LIMIT
Individual VOCs	≤½ CA chronic REL ^a
Formaldehyde	≤ 16.5 ug/m ³ or ≤ 13.5 ppb

a. CA Chronic Reference Exposure Level (CREL)

**TABLE 806.5 (1)
CEILING AND WALL SYSTEMS DEEMED TO COMPLY
WITH VOC EMISSION LIMITS**

Ceramic tile
Organic-free, mineral-based
Clay masonry
Concrete masonry
Concrete
Metal

**TABLE 806.5(2)
ACOUSTICAL CEILING TILES AND WALL SYSTEMS
VOC EMISSION LIMITS**

VOC	LIMIT
Individual	≤½ CA chronic REL ^a
Formaldehyde	≤ 16.5 ug/m ³ or ≤ 13.5 ppb

a. CA Chronic Reference Exposure Level (CREL)

b. Defined to be the total response of measured VOCs falling within the C6-C16 range, with responses calibrated to a toluene surrogate.

**TABLE 806.6
INSULATION
VOC EMISSION LIMITS**

VOC	LIMIT
Individual VOCs	$\leq \frac{1}{2}$ CA chronic REL ^a
Formaldehyde	$\leq 16.5 \text{ ug/m}^3$ or $\leq 13.5 \text{ ppb}$

a. CA Chronic Reference Exposure Level (CREL)

**SECTION 807
ACOUSTICS**

807.1 Sound transmission. *Buildings* and tenant spaces shall comply with the sound transmission requirements of Sections 807.2 through 807.5.2.

Exception: The following buildings and spaces need not comply with this section:

1. *Building* or *structures* that have the interior environment open to the exterior environment.
2. Parking *structures*.
3. Concession stands and toilet facilities in Group A-4 and A-5 occupancies.

807.2 Exterior sound transmission. Where Group A1, A3, E and I occupancy *buildings*, Group B occupancy *buildings* used for educational purposes, or Group R are constructed at the locations listed in Items 1 through 4, the wall and roof-ceiling assemblies making up the *building* envelope shall have a sound transmission class (STC) or outdoor-indoor transmission class (OITC) of not less than 50, the windows and doors in the *building* envelope walls shall have a sound transmission class (STC) or outdoor-indoor transmission class (OITC) of not less than 30, the sliding doors in the building envelope walls shall have a sound transmission class (STC) or outdoor-indoor transmission class (OITC) of not less than 28 and the hinged doors in the building envelope walls shall have a sound transmission class (STC) or outdoor-indoor transmission class (OITC) of not less than 30. Where the sound transmission is field tested, the sound transmission shall be not less than 45 STC or OITC for wall and roof-ceiling assemblies and not less than 25 STC or OITC for windows and doors. Transmission classes shall be determined in accordance with ASTM E90 for sound transmission class (STC) values or ASTM E1332 for outdoor-indoor transmission class (OITC) values.

1. Within 1000 feet (300 m) of a freeway, fire station, fuel dispensing facility, factory, industrial or manufacturing zone or facilities, commercial storage facility, or sports arena or stadium.
2. Within 500 feet (150 m) of a roadway containing 4 or more traffic lanes.
3. Within the published DNL 65 dBA noise contour associated with a commercial airport, or where such information is lacking, within 5 miles (8 km) of a commercial airport.
4. Within 3,000 feet (900 m) of an active railway.

807.3 Interior sound transmission. Wall and floor-ceiling assemblies that separate Group A, F and M occupancies from Group B, I or R occupancies shall have a sound transmission class (STC) of not less

than 50. Sound transmission classes shall be determined in accordance with ASTM E90, or for concrete masonry and clay masonry assemblies shall be calculated in accordance with TMS 0302 or determined in accordance with ASTM E90.

Exception: This section shall not apply to wall and floor-ceiling assemblies enclosing:

1. Public entrances to tenants of covered and open mall *buildings*.
2. Concession stands and lavatories in Group A-4 and A-5 occupancies.

807.4 Mechanical and emergency generator equipment and systems. *Building* mechanical and emergency generator systems shall be designed to control airborne *noise* in accordance with Sections 807.4.1 through 807.4.3.

807.4.1 Separating assemblies. Wall and floor-ceiling assemblies that separate a mechanical or emergency generator equipment room or space from the remainder of the *building* shall have a sound transmission class (STC) of not less than 60 determined in accordance with ASTM E90 and ASTM E413, or for concrete masonry and clay masonry assemblies as calculated in accordance with TMS 0302 or as determined in accordance with ASTM E90 and ASTM E413.

807.4.2 Mechanical and emergency generator equipment outside of buildings. Where *mechanical equipment* and emergency generators are located outside of the *building* envelope or are exposed to the exterior environment, an adjacent property shall not be subjected to a sound level greater than indicated in Table 807.4.2. Special inspections shall be required and conducted in accordance with Section 903.1 in order to demonstrate compliance.

807.4.3 HVAC background sound. HVAC system caused background sound levels for all modes of operation within rooms shall be in accordance with the lower and upper noise criteria (NC) limits as shown in Table 807.4.3. Special inspections shall be required and conducted in accordance with Section 903.1 in order to demonstrate compliance.

**TABLE 807.4.2
MAXIMUM PERMISSIBLE A-WEIGHTED SOUND LEVELS**

Initiating Property	Adjacent Property	Maximum A-Weighted Sound Level (dB)	
		Day Time	Night Time
		7:00 AM to 10:00 PM	10:00 PM to 7:00 AM
All, except factory, industrial, or storage	All, except factory, industrial, or storage	65	50
Factory, industrial, or storage	All other, except factory, industrial, or storage	65	50
Factory, industrial, or storage	Factory, industrial, or storage	75	75

**TABLE 807.4.3
BACKGROUND SOUND IN ROOMS**

Occupancy Type	Room	Noise Criteria (NC) Limits
Assembly-A-1	Symphony, concert, recital halls	25 to 30
	Music teaching studios	25 to 30
	Music practice rooms	30 to 35
	Motion picture theaters	30 to 40
Assembly-A-3	Places of religious worship	25 to 35
	Art gallery, exhibit hall, funeral parlor, lecture_halls,_libraries, and museums.	30 to 40
	Courtroom	25 to 35
Assembly-A-4	Gymnasiums, natatoriums and seating areas	35 to 45
Business-B	Office-enclosed	25 to 35
	Office-open plan	35 to 45
	Corridors and lobbies	40 to 45
	Conference rooms	25 to 35
	Educational occupancies above 12 th grade	(See Education)
Education - E		ANSI/ASA S12.60-2010/Part 1 or ANSI/ASA S12.60-2009/Part 2
	Core learning lecture and class rooms that are less than or equal to 20,000 cu. ft. (566 m ³) in volume	
	Core learning lecture and class rooms that are greater than 20,000 cu. ft. (566 m ³) in volume	
	Open plan class rooms	
	Administrative offices and rooms	
Institutional-I-2	Private rooms	25 to 35
	Wards	30 to 40
	Operating rooms	25 to 35
	Corridors and public areas	30 to 40
Residential-R-1 & R-2	Rooms or suites	25 to 35
R-2	Meeting rooms	25 to 35
	Corridors and lobbies	35 to 45
	Service areas	35 to 45

807.5 Special inspections for sound transmission. An *approved agency*, funded by the *building owner*, shall furnish report(s) of test findings indicating that the results are in compliance with this section and the *construction documents*. Discrepancies shall be brought to the attention of the design professional and *code official* prior to the completion of that work. A final testing report documenting required testing and corrections of any discrepancies noted in prior tests shall be submitted at a point in time agreed upon by the *building owner*, or *building owner's agent*, design professional, and the *code official* for purposes of demonstrating compliance.

807.5.1 Testing for mechanical and emergency generator equipment outside of buildings. In accordance with Section 807.4.2, all mechanical and emergency generator equipment shall be

field tested in accordance with Table 903.1. Testing shall be conducted following the complete installation of the equipment or generators, the installation of sound reduction barriers, and balancing and operation of the equipment or generators. Testing shall be at locations representing the four cardinal directions from the face of the project *building*. Such testing shall occur on a Tuesday, Wednesday or Thursday at both the day and night times within the periods shown in Table 807.4.2.

807.5.2 Testing for building system background noise. Testing shall be executed in accordance with Section 807.4.3 within not less than 50 percent of the total number of rooms contained in a *building* or *structure*, exclusive of closets and storage rooms less than 50 square feet in area, and exclusive of toilet facilities in accordance with Table 903.1. Testing shall occur following the complete installation of the equipment and systems, the installation of any sound reduction barriers, and balancing and operation of the equipment and systems.

SECTION 808 DAYLIGHTING

808.1 General. The fenestration in building roofs and walls shall be placed in accordance with Sections 808.1 through 808.3. Interior spaces shall be planned to benefit from the exposure to natural light offered by the fenestration in accordance with this section.

808.2 Applicability. Daylighting of *building* spaces in accordance with Section 808.3 shall be required for buildings containing Group A-3, B, E, F, M or S occupancies.

Exception: Daylighting is not required in the following rooms and spaces:

1. A Group A3 occupancy where the specific use of the room or space is for other than reading areas in libraries, waiting areas in transportation terminals, exhibition halls, gymnasiums and indoor athletic areas.
2. A Group B occupancy where the specific use of the room or space is for other than educational facilities for students above the 12th grade, laboratories for testing and research, post offices, print shops, offices and training and skill development not within a school or academic program.
3. Those portions of Group M or S occupancies located directly underneath a higher floor.
4. *Building* spaces where darkness is required for the primary use of the space, including, but not limited to, light sensitive material handling and darkrooms.
5. *Building* spaces that are required to be cooled below 50 degrees F.
6. Unconditioned *buildings* that are equipped with exterior doors that when opened, provides equivalent daylighting.
7. *Alteration, repair, movement, or change of occupancy of existing buildings.*

808.3 Daylighting of building spaces. Not less than 50 percent of the total floor area in *regularly occupied spaces* shall be located within a *daylit area* that complies with either Section 808.3.1 or Section 808.3.2. *Buildings* required to have more than 25,000 square feet of *daylit area* shall comply with Section 808.3.2.

Exception:

Where *exterior walls* or *roofs* are *obstructed*, the required *daylit area* shall be modified in accordance with Equation 8-1.

required *daylit area* $\geq 50\% \times \text{TDP}$

(Equation 8-1)

The total daylight potential (TDP) is a weighted average of the individual daylight potentials for each floor:

$$\text{TDP} = \sum(\text{DP}_1 \div \text{FA}_1/\text{TF}) + (\text{DP}_2 \div \text{FA}_2/\text{TF}) + \dots$$

$$\text{DP}_1 = 1 - [(\text{OW}_1 / \text{TW}_1) \div (\text{OR}_1 / \text{TR}_1)]$$

$\text{OW}_{1,2,\dots}$ = The length of *obstructed exterior wall* for each floor.

$\text{TW}_{1,2,\dots}$ = The total length of exterior wall for each floor.

$\text{OR}_{1,2,\dots}$ = The *obstructed roof area* immediately above each floor.

$\text{TR}_{1,2,\dots}$ = The total roof area immediately above each floor.

$\text{FA}_{1,2,\dots}$ = The floor area of each floor.

TF = The total floor area of all floors.

808.3.1 Daylight prescriptive requirements. Each *sidelighting daylight zone* that complies with Section 808.3.1.1 shall be considered to be a *daylit area*. Each *toplighting daylight zone* that complies with Section 808.3.1.2 shall be considered to be a *daylit area*.

808.3.1.1 Sidelighting. The *sidelighting daylight zone* shall include *fenestration* that complies with Table 609.5 and Figure 609.5. *Fenestration* shall not be located in an *obstructed wall*.

808.3.1.2 Toplighting. The *toplighting daylight zone* shall include *fenestration* that complies with Table 609.5 and Figure 609.5. *Fenestration* shall not be located in an *obstructed roof*.

808.3.2 Daylight performance requirements. All areas having a daylight saturation of not less than 60 percent shall be considered to be *daylit areas*. Daylight analysis shall be conducted in accordance with Section 808.3.2.1.

808.3.2.1 Daylight simulation. A climate based analysis shall comply with the following:

1. Provide data on an hourly basis for a typical meteorological year, excluding hours between and including the last hour before sunset and the first hour after sunrise every day.

2. Address the effects of exterior shading devices, shade trees complying with all of the requirements of Section 404.2.3, *buildings, structures*, and geological formations. Include the effects of movable exterior fenestration shading devices. The configuration of manually controlled exterior fenestration shading devices shall be adjusted on the spring and fall equinoxes only. The configuration of automatically controlled exterior fenestration shading devices and fenestration with automatically controlled variable transmittance shall be adjusted to accurately represent the control system operation.
3. Exclude the effects of interior furniture systems, shelving, and stacks
4. Use the actual reflectance characteristics of all materials.
5. Include the effects of blinds, shades and other movable interior fenestration shading devices. The configuration of *manually* controlled fenestration shading devices shall be adjusted on the spring and fall equinoxes only. The configuration of automatically controlled fenestration shading devices and fenestration with automatically controlled variable transmittance shall be adjusted to accurately represent the control system operation.
6. Calculation points shall be spaced not more than 39 inches (991 mm) by 39 inches (991 mm) and 30 inches (762 mm) above the floor. The calculation grid shall start within 39 inches (991mm) of each wall or partition.
7. Where details about the window framing, mullions, wall thickness and well depth cannot be included in the model, the visible transmittance of all fenestration shall be reduced by 20 percent.

SECTION 809 PROJECT ELECTIVES

809.1 General. Section 809 contains *project electives* related to indoor air quality and environmental comfort. *Project electives* shall not be mandatory unless selected by the owner or *registered design professional* and indicated in the Project Elective Checklist required by Section 303.1.

809.2 VOC emissions project electives. Sections 809.2.1 through 809.2.4 shall be considered to be separate *project electives*. The electives shall be cumulative and compliance with each *project elective* shall be recognized individually.

809.2.1. Flooring material project elective. Where projects are intended to qualify for a “flooring material” *project elective* in accordance with Table 303.1 and Section 303.4, a minimum of 50 percent of the total area of flooring installed within the interior of the *building* shall be one or more of the flooring materials listed in Table 806.4(1).

809.2.2. Ceiling materials project elective. Where projects are intended to qualify for a “ceiling materials” *project elective* in accordance with Table 303.1 and Section 303.4, a minimum of 50 percent of ceiling systems, by square feet, shall be one or more of the ceiling systems listed in Table 806.5(1).

809.2.3. Wall materials project elective. Where projects are intended to qualify for a “wall materials” *project elective* in accordance with Table 303.1 and Section 303.4, a minimum of 50

percent of wall systems, by square feet, shall be one or more of the wall systems listed in Table 806.5(1).

809.2.4. Total VOC limit project elective. Where projects are intended to qualify for a “total VOC limit” project elective in accordance with Table 303.1 and Section 303.4, a minimum of 50 percent of all products addressed in Sections 806.2, 806.3, 806.4, 806.5 and 806.6 shall have a *Total Volatile Organic Compounds (TVOCs)* emission limit of $\leq 500 \text{ ug/m}^3$. The test methodology used to determine compliance shall be from CDPH/EHLB/STANDARD METHOD V.1.1 “*Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers Version 1.1*” dated February 2010. The emissions testing shall be performed by a laboratory that has the CDPH/EHLB/STANDARD METHOD V 1.1 test methodology in the scope of its ISO 17025 Accreditation.

809.3 Views to building exterior project elective. Where projects are intended to qualify for a “views to building exterior” project elective in accordance with Table 303.1 and Section 303.4, not less than 75 percent of the floor area in regularly occupied spaces shall have a direct line of sight to the exterior through clear vision glazing. A total of not less than 45 square feet of clear vision glazing in the exterior wall or roof shall be visible. The direct line of sight shall originate at a height of 42 inches above the finished floor of the space, shall terminate at the clear vision glazing in the exterior wall or roof, and shall be less than 40 feet in length.

Exception: Where the direct line of sight is less than 25 feet in length, a total of not less than 18 square feet of clear vision glazing in the exterior wall or roof shall be visible.

809.4 Interior plants density project elective. Where the intent is to qualify for this project elective, interior living plants shall be incorporated into regularly occupied spaces at a rate as indicated in Table 809.4 but not less than one unit of planting per 100 square feet of occupied space per *building*.

809.4.1 Size of interior plants. Interior living plants shall be sized based upon their exposed soil surface. An 8” grow pot (gp) plant would have a plant value of .5 units; a 10” gp would have a plant value of .78 units and a 14” g.p. plant would have a plant value of 1.53 units. Bed plantings and vertical plantings would have a plant value of 1.44.

809.4.2 Distribution of interior plants. Interior living plants shall be distributed throughout the building such that all regularly occupied spaces contain one unit of planting per 100 square feet or more of plantings.

Exceptions:

1. Industrial facilities and similar locations where interior plants might present hazards to operation of process equipment.
2. Healthcare facilities, laboratories, clean rooms and similar locations where interior plants might present a unique challenge for indoor air management.
3. Other locations in which interior plants might present unique hazards to building processes or occupants as determined by the *code official*.

**TABLE 809.4
INTERIOR PLANT DENSITY ^a**

Occupancy	Specific Use	Plant Density
Assembly: Groups		
A-1	Movie theaters	3 units per 100 seats
	Concert hall, Theaters other than for movies	6 units per 100 seats
A-2	Restaurants	1 unit per 16 seats
A-3	Places of worship	6 units per 100 seats
	Assembly spaces other than places of worship	3 units per 100 seats
A-4 – A-5	All	6 units per 100 seats
Business: Group B	All	1 unit per 100 square feet
Educational: Group E		
E, I-4	Day Care	1 unit per 3 occupants
E	Schools	1 unit per 5 students
Factory and Industrial: Groups F-1, F-2		None.
High Hazard: Groups H-1, H-2, H-3, H-4, H-5		None
Institutional: Groups I-1, I-2, I-3, I-4	All	1.25 units per occupant
Mercantile: Group M	All	1 units per 100 square feet
Groups R-1, R-2, R-3, R-4 (see note b)		1 unit per occupant
Storage: Groups S-1, S-2		None.
Utility and Miscellaneous: Group U		None.

a. Requirements based on square feet shall be the *occupied floor area* of the occupancy or use.

b. Residential occupancy as regulated by this code in accordance with Section 101.2.

809.4.3 Interior plant species. Not less than 70% of the plant species provided in each building shall be of the following species. Additional species shall be permitted as *approved* by the *code official*.

1. Aglaonema sp.
2. Anthurium sp.
3. Diffenbachia sp.
4. Draceana sp.

5. Epipremnum sp.
6. Ferns
7. Ficus sp.
8. Howea fosteriana
9. Orchids
10. Palms (various)
11. Philodendron sp.
12. Spathiphyllum sp.
13. Schefflera sp.
14. Zamiodulcas sp.

809.4.4 Interior plant maintenance. An interior plant maintenance plan shall be submitted by the *registered design professional* and *approved* prior to construction. The maintenance plan shall address the following:

1. The total number and sizes of plants installed.
2. The location and density of plants.
3. The plant service for each species: The best management practices (BMPs) to be employed shall be described, including:
 - 3.1 soil moisture, pH and nutrient monitoring.
 - 3.2 watering and cleaning requirements.
4. The plant health for each species including:
 - 4.1 Identification of plant disease or ill health.
 - 4.2 Plant replacement regime.
 - 4.3 Replacement of plants of ill health so that the density of plants is maintained.

CHAPTER 9

COMMISSIONING, OPERATION AND MAINTENANCE

SECTION 901 GENERAL

901.1 Scope. The provisions of this chapter are intended to facilitate the pre- and post- occupancy *commissioning*, operation and maintenance of *buildings* constructed in accordance with this code in a manner that is consistent with the intent of other provisions of this code, and to further that goal through the education of *building* owners and maintenance personnel with regard to related best operating and management practices.

SECTION 902 APPROVED AGENCY

902.1 Approved agency. An *approved agency* shall provide all of the information necessary for the *code official* to determine that the agency meets the applicable requirements. The *code official* shall be permitted to be the *approved agency*.

902.1.1 Independence. An *approved agency* shall be objective, competent and independent from the contractor responsible for the work being inspected. The agency shall also disclose possible conflicts of interest so that objectivity can be confirmed.

902.1.2 Equipment. An *approved agency* shall have adequate equipment to perform the required *commissioning*. The equipment shall be periodically calibrated.

902.1.3 Personnel. An *approved agency* shall employ experienced personnel educated in conducting, supervising and evaluating tests and *commissioning*.

SECTION 903 COMMISSIONING

903.1 General. Where application is made for construction as described in this section, the *registered design professional in responsible charge* or *approved agency* shall perform *commissioning* during construction and after occupancy as required by Table 903.1. Where Table 903.1 specifies that *commissioning* is to be done on a periodic basis, the *registered design professional in responsible charge* shall provide a schedule of periodic *commissioning* with the submittal documents that shall be reviewed and *approved* by the *code official*.

The *approved agency* shall be qualified and shall demonstrate competence, to the satisfaction of the *code official*, for the *commissioning* of the particular type of construction or operation. The *registered design professional in responsible charge* and engineers of record involved in the design of the project are permitted to act as the *approved agency* provided those personnel meet the qualification requirements of this section to the satisfaction of the *code official*. The *approved agency* shall provide written documentation to the *code official* demonstrating competence and relevant experience or training. Experience or training shall be considered relevant where the documented experience or training is related in complexity to the same type of *commissioning* activities for projects of similar complexity and material qualities.

903.1.1 Pre occupancy report requirement. The *approved agency* shall keep records of the *commissioning* required by Table 903.1. The *approved agency* shall furnish *commissioning* reports to the owner and the *registered design professional in responsible charge* and, upon request, to the *code official*. Reports shall indicate that work was or was not completed in conformance to *approved construction documents*. Discrepancies shall be brought to the immediate attention of the contractor for correction. where discrepancies are not corrected, they shall be brought to the attention of the owner, *code official* and to the *registered design professional in responsible charge* prior to the completion of that phase of the work. Prior to the issuance of a Certificate of Occupancy, a final *commissioning* report shall be submitted to and accepted by the *code official*.

903.1.2 Post occupancy report requirement. Post occupancy *commissioning* shall occur as specified in the applicable sections of this code. A post occupancy *commissioning* report shall be provided to the owner within 30 months after the Certificate of Occupancy is issued for the project and shall be made available to the *code official* upon request.

**TABLE 903.1
COMMISSIONING PLAN**

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
Chapter 4: Site development and land use						
Natural resources and base line conditions of <i>building site</i>	X	None	Report	With <i>Permit</i> Submittal	None	402.3.1
Landscape irrigation systems	X	None	Field inspection	Installation	None	402.3.3 406.6
<i>Topsoil</i> and Vegetation Protection Measures; Setbacks from protected areas	X	None	Field inspection and report	Installation of measures, prior to other site disturbance	None	402.3
Imported Soils	X	None	Field inspection and report	With <i>Permit</i> Submittal; After all fill operations complete.	None	402.3.5. 5
Soil Restoration and Reuse	X	None	Field inspection and report	Preparation and replacement of soils	None	402.3.5. 4
Soil Percolation Test	X	None	Field Inspection and report	Prior to installation of <i>graywater</i> irrigation system	None	406.2.2
Stormwater management system operation	None	X	Field Inspection		24 months	402.3.2
Erosion and sediment control	X	X	Field inspection	During construction	Periodic for 24 months	402.3.6

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
				activities		
Hardscape and shading provided by structures and vegetation	X	X	Field inspection and report	During construction and installation	24 months	404.2
Vegetative Roofs and Terraces	X	X	Field inspection and report	Installation of protective membranes, base materials, soils and vegetation	24 months	404.3.2
Site Lighting	X	None	Testing and report	Installation	None	405
Chapter 5: Materials						
Moisture Control (Section 506.3)						
1. Foundation sub-soil drainage system.	X	None	Field inspection and verification	Periodic inspection for entire sub-soil drainage system.	None	506.3 and IBC Ch 18
2. Foundation damp-proofing and water-proofing.	X	None	Field inspection and verification	Periodic inspection for the entire foundation.	None	506.3 and IBC Ch 18
3. Flashing at: Windows, exterior doors, skylights, wall flashing and drainage systems.	X	None	Field inspection and verification	Periodic inspection for not less than XX% of all flashing locations.	None	506.3 and IBC Ch 14
4. Exterior wall coverings.	X	None	Field inspection and verification	Periodic inspection for not less than 25% of exterior wall cladding systems.	None	506.3 and IBC Ch 14
Chapter 6 - Energy						
Energy consumption, monitoring, targeting and reporting						
a. Monitoring system	X	None	Inspection and verification	During construction and prior to occupancy	None	604
b. Calibration	X	X	Testing and review and evaluation or	During commissioning	Annually	604, 611

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
			test reports			
Mechanical systems completion – all buildings						
a. Air system balancing – provide the means for system balancing	X	None	Inspection and verification	During construction and prior to occupancy	None	612.1.2.1 and through reference to IECC
b. Hydronic system balancing – provide means for system balancing	X	None	Inspection and verification	During construction and prior to occupancy	None	612.1.2.2 and through reference to IECC
c. Duct system testing	X	None	Testing, testing report and verification of results	During construction and/or at final inspection.	None	613.5.3 and through reference to the IECC
d. Mechanical system manuals – construction documents to require O&M manual	X	None	Verification of construction documents	Plan review	None	612.1.5.2
Mechanical systems – buildings over 5,000 square feet total building floor area						
a. Commissioning required and noted in plans and specifications	X	None	Verification of construction documents	Plan review	None	612.1
b. Documentation of required commissioning outcomes	X	None	Verification with the building owner	Subsequent to completion of all commissioning activities	None	612.1
c. Preparation and availability of a commissioning plan	X	None	Verification with the RDP or commissioning agent	Between plan review and commissioning initiation	None	612.1.1
d. Balance HVAC systems (both air and hydronic)	X	X	HVAC system installer/contractor or commissioning	After installation of HVAC systems and	TBD	612.1.2

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
			agent	prior to occupancy		
e. Functional performance testing of HVAC equipment	X	X	HVAC system installer/contractor or commissioning agent	After installation of HVAC systems and prior to occupancy	TBD	612.1.3
f. Functional performance testing of HVAC controls and control systems	X	X	HVAC system installer/contractor or commissioning agent	After installation of HVAC systems and prior to occupancy	TBD	612.1.3.2
g. Preparation of preliminary commissioning report	None	X	HVAC system installer/contractor or commissioning agent	None	Subsequent to commissioning	612.1.4
h. Acceptance of HVAC systems and equipment/system verification report	None	X	Building owner	None	Letter verifying receipt of the commissioning report	612.1.4.1
i. Preparation and distribution of final HVAC system completion - Documentation that construction documents require drawings, manuals, balancing reports and commissioning report be provided to the owner and that they have been provided	None	X	RDP, contractor or commissioning authority	None	90 days after final certificate of occupancy	612.1.5
Ch 6 - Lighting						
Auto demand reduction control system functionality	X	X	Functional Testing	Final Inspection	18-24 months	605.4
Plug load controls	X	None	Functional Testing	Final Inspection	None	609.6
Connection of		X	Field Inspection	None	18-24 months	609.6

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
appliances to switched receptacles						
Specified transformer nameplate efficiency rating	X	None	Field Inspection	Final Inspection	None	609.8.1.1
Verification of lamp	X	X	Field Inspection	Final Inspection	18-24 months	609.10
Verification of ballast	X	None	Field Inspection	Final Inspection	None	609.10
→						
Lighting controls						
a. Installation	X	None	Field Inspection	Post Installation	None	609.11
b. Calibration	X	X	System Installer/Contractor or Commissioning Agent	Post Installation	18-24 months	612.2
Chapter 7: Water						
Water Quality Tests						
Rainwater System		X	Field testing and verification	None	707.16.1	707.16.1
Graywater System		X	Field testing and verification	None	708.13.8	708.13.8
Chapter 8: IEQ						
Building construction, features, operations and maintenance facilitation						
Air handling system access	X	X	Field inspection and verification	During construction and prior to occupancy	18 - 24 months	802.2
Air handling system filters	X	X	Field inspection and verification	During construction and prior to occupancy	18 - 24 months	802.4
HVAC Systems						
Temperature and humidity in occupied spaces		X	Field inspection and verification		18 - 24 months	803.2
Specific indoor air quality & pollutant control measures						
Listing, installation and venting of fireplaces and combustion appliances	X		Field inspection and verification	During construction and prior to occupancy		804.1
Radon mitigation	X		Field inspection and verification	During construction and prior to occupancy		804.2

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
Sound Transmission						
Mechanical and emergency generator equipment located outside buildings or located where exposed to exterior environment.	X	None	Field testing and verification	See Section 807.5.1	None	807.5.1
HVAC Background Sound	X	None	Field testing and verification	See Section 807.5.2	None	807.5.2

SECTION 904 BUILDING OPERATIONS, MAINTENANCE AND OWNER EDUCATION

904.1 General. The operations and maintenance and *building* owner education documents shall be in accordance with Sections 904.3 and 904.4 and submitted to the owner prior to the issuance of the Certificate of Occupancy. Record documents shall be in accordance with Section 904.2. The *building* owner shall file a letter with the *code official* certifying the receipt of record documents and *building* owner education, operations and maintenance documents. At least one copy of these materials shall be in the possession of the owner and at least one additional copy shall remain with the *building* throughout the life of the *structure*.

904.1.1 Owner responsibility. *Buildings* built under this code shall be maintained and operated at the level of performance required by the *approved* documents.

904.1.1.1 Periodic reporting. Where required by Table 302.1, a report confirming that the *building* is maintained and operated at the level of performance required by the *approved* documents shall be submitted to the *code official* at approved intervals.

904.2 Record documents. The cover sheet of the record documents for the project shall clearly indicate that at least one copy of the materials shall be in the possession of the owner and at least one additional copy shall remain with the *building* throughout the life of the *structure*. Record documents shall include all of the following:

1. Copies of the *approved construction documents*, including plans and specifications.
2. As-built plans and specifications indicating the actual locations of piping, ductwork, valves, controls, equipment, access panels, lighting and other similar components where they are concealed or are installed in locations other than those indicated on the *approved construction documents*.
3. A copy of the Certificate of Occupancy.

904.3 Building operations and maintenance documents. The *building* operations and maintenance documents shall consist of manufacturer's specifications and recommendations, programming procedures and data points, narratives, and other means of illustrating to the owner how the *building*, site and systems

are intended to be maintained and operated. The following information shall be included in the materials, as applicable to the specific project:

1. Directions to the owner or occupant on the manual cover sheet indicating that at least one copy of the materials shall be in the possession of the owner or occupant and at least one additional copy shall remain with the *building*.
2. Operations and maintenance manuals for equipment, products and systems installed under or related to the provisions of Chapter 4 including, but not limited to, the following, as applicable:
 - 2.1 Vegetative shading, vegetative roofs and natural resource protections and setbacks.
 - 2.2 Water conserving landscape and irrigation systems.
 - 2.3 Stormwater management systems
 - 2.4 Permanent erosion control measures.
 - 2.5 Landscape or tree management plans.
3. Operations and maintenance documents for materials, products, assemblies and systems installed under or related to the provisions of this code for material resource conservation in accordance with Chapter 5 including, but not limited to, the following, as applicable:
 - 3.1 Care and maintenance and instructions and recommended replacement schedule for flooring, including, but not limited to, carpeting, walk-off mats and tile.
 - 3.2 Care and maintenance instructions for natural materials including, but not limited to, wood, *bio-based materials* and stone.
 - 3.3 Available manufacturer's instructions on maintenance for:
 - 3.3.1. Exterior wall finishes
 - 3.3.2. *Roof coverings*
 - 3.3.3. Exterior doors, windows and *skylights*
 - 3.4 Information and recommended schedule for required routine maintenance measures, including but not limited to, painting and refinishing.
 - 3.5 A copy of the service life plan required by Chapter 5.
4. Operations and maintenance documents for equipment, products and systems installed under or related to the provisions of this code for energy conservation in accordance with Chapter 6 including, but not limited to, the following:
 - 4.1 Heating, Ventilating and Air Conditioning systems including:
 - 4.1.1. Recommended equipment maintenance schedule.

- 4.1.2. Air filters and fluid filters, including recommended replacement schedule and materials.
 - 4.1.3. Time clocks, including settings determined during *commissioning*.
 - 4.1.4. Programmable controls and thermostats, including settings determined during *commissioning*.
- 4.2 Domestic hot water systems including performance criteria and controls.
- 4.3 *Building thermal envelope* systems including:
- 4.3.1. Glazing systems inspection schedule.
 - 4.3.2. Performance criteria for replacements and *repairs*.
 - 4.3.3. Information and recommended schedule on required routine maintenance measures, including but not limited to, sealants, mortar joints and screens.
- 4.4 Electrical and lighting systems including:
- 4.4.1. Technical specifications and operating instructions for installed lighting equipment
 - 4.4.2. Luminaire maintenance and cleaning plan
 - 4.4.3. Lamp schedule, recommended relamping plan, and lamp disposal information.
 - 4.4.4. Programmable and automatic controls documentation, including settings determined during *commissioning*.
 - 4.4.5. Occupant sensor and daylight sensors documentation, including settings determined during *commissioning*.
- 4.5 Automatic demand reduction systems
5. Operations and maintenance documents for equipment, products and systems installed under or related to the provisions of this code for water conservation in accordance *with* Chapter 7, including, but not limited to the following:
- 5.1 Domestic fixtures.
 - 5.2 Water regulating devices including faucets and valves.
 - 5.3 Irrigation and *rainwater* and *graywater* catchment.
6. Operations *and* maintenance *documents* for equipment products and systems under or related to the provisions of this code for indoor environmental quality in accordance *with* Chapter 8, including, but not limited to the following:
- 6.1 Humidification/dehumidification.

6.2 Green cleaning products, procedures and techniques.

6.3 Recommended window cleaning schedule.

6.4 *Ventilation* controls.

6.5 Floor finishes.

6.6 Fireplaces and combustion appliances.

6.7 Radon mitigation system.

6.8 Indoor plants.

904.4 Building owner education manual. The owner shall cause to be assembled an informational document on the *building*, site or *structure* and systems and sustainable features that are covered by this code and included in the *building*. Such information shall be educational in nature and sufficient for future tenants, owners and operators of the *building*, *building site*, *structure* and systems to understand the basic purpose and basis for these systems and features and how they are to be maintained for continued performance. The education documents shall consist of a statement of performance goals or requirements and a narrative illustrating the reasoning behind the *building's* site, features, and systems design. One copy of the owner education manual shall be in the possession of the owner and one additional copy shall remain with the *building* throughout the life of the *structure*. Where a whole *building life cycle assessment* is performed in accordance with Section 304, the data and final report shall be included in the owner education manual.

CHAPTER 10

EXISTING BUILDINGS

SECTION 1001 GENERAL

1001.1 Scope. The provisions of this chapter shall control the *alteration, repair, addition, maintenance and operation and change of occupancy* of existing *buildings and structures*. Existing *building sites* shall comply with Chapter 11.

1001.2 Building operation and maintenance. Existing *buildings* and parts thereof, shall be operated and maintained in conformance with the code edition and zoning or other adopted site development regulations applicable at the time of construction, and as required by Section 102.6. The owner or the owner's designated agent shall be responsible for the operation and maintenance of existing *buildings*. The requirements of this chapter shall not provide the basis for removal or abrogation of fire protection and safety systems and devices in *existing structures*.

1001.3 Compliance. *Alterations, repairs, additions* and changes of occupancy to *existing structures* shall comply with the provisions of this chapter.

1001.4 Building materials, assemblies and systems. *Building* materials shall comply with the requirements of this section.

1001.4.1 Existing materials, assemblies, configurations and systems. Materials, assemblies, configurations and systems already in use in a *building* in conformance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the *code official* to be dangerous to life, health or safety. Where such conditions are determined to be dangerous to the environment, life, health or safety, they shall be mitigated or made safe.

1001.4.2 New and replacement materials, assemblies, configurations and systems. Except as otherwise required or permitted by this code, materials, assemblies, configurations and systems permitted by the applicable code for new construction shall be used. Like materials shall be permitted for *repairs* and *alterations* provided that a hazard to life, health or property is not created. Hazardous materials shall not be used where the code for new construction would not *permit* their use in *buildings* of similar occupancy, purpose and location.

SECTION 1002 ADDITIONS

1002.1 General. *Additions* to any *building* or *structure* shall comply with the requirements of this code for new construction. Unaltered portions of the *building* or *structure* shall be in accordance with the provisions of the code in force at the time of their construction and shall comply with Section 1003.2.

Additions to existing portions or components of the *building structure* shall be in accordance with the provisions of this code for those portions or components being altered.

1. *Additions* to an existing *building* or *structure* shall be made such that the existing *building* or *structure* together with the *addition* are not less conforming with the provisions of this code than the existing *building* and or *structure* was prior to the *addition*.
2. *Additions* shall not be permitted to *buildings* and *structures* that are located in *flood hazard areas*.

Exception: Where an existing *building* or *structure* is located such that all habitable space is located not less than 1 foot above the flood elevation, *additions* complying with Section 402.2.1(1) shall be permitted.

SECTION 1003 ALTERATIONS TO EXISTING BUILDINGS

1003.1 General. *Alterations* to existing *buildings* and *building* systems shall be in accordance with the provisions of this code for those areas, assemblies, systems and components being altered. Unaltered portions and components, areas and systems of the *building* or *structure* shall be in accordance with the provisions of the code in force at the time of their construction and shall comply with Section 1003.2. *Alterations* shall be such that the existing *building* or *structure* is not less conforming to the provisions of this code upon the completion of work than the existing *building* or *structure* was prior to the *alteration*. Energy compliance for this purpose shall be evaluated in accordance with Section 602.4. Areas, assemblies, systems and components that are altered shall be in accordance with this section and Sections 1003.2 and 1003.3.

Exception: Where, in the opinion of the *code official*, there is no significant compromise of the intent of this code, the *code official* shall have the authority to approve materials and assemblies that perform in a manner that is at least the equivalent of those being replaced.

1003.2 Minimum energy, HVAC and water requirements. Compliance with Sections 1003.2.1 through 1003.2.3 shall be required.

Exceptions:

1. Materials, assemblies and components regulated by Sections 1003.2.1, 1003.2.2 or 1003.2.3 that are dependent upon properties of other concealed materials, assemblies or system components to function properly and where the properties of the concealed materials, assemblies or components are unknown or insufficient and will not be revealed during construction.
2. Where the application of the requirements of Sections 1003.2.1, 1003.2.2 or 1003.2.3 are determined by the *code official* to be technically infeasible based upon the existing configuration of spaces, unless the intent of the *permit* applicant is to reconfigure those spaces or portions thereof.
3. Where a tenant in a multi-tenant *building* does not have control within that tenant space of a complete system or item, compliance for that complete system or item shall not be required.

1003.2.1 Heating, ventilation and air conditioning. Heating, *ventilation* and air conditioning systems and equipment shall be in accordance with the following:

1. Non-functioning thermostats shall be repaired or replaced.

2. Leaking accessible supply air and return ducts shall be sealed with *approved* sealants. Although the presence of existing duct tape shall not be deemed to indicate noncompliance where a duct is not leaking, duct tape shall not be acceptable for repair of such a leak.
3. Outside air dampers, damper controls and linkages controlled by HVAC units shall be in good repair and adjustment.
4. Hot water and steam leaks, defective steam traps and radiator control, relief, and vent valves shall not be permitted in any accessible piping.
5. Leaking accessible chilled water lines and equipment shall be repaired or replaced.

1003.2.2 Service water systems. Defective hot and cold water piping and equipment within service water systems shall be repaired or replaced.

1003.2.3 Motor-driven equipment. There shall not be leaks in compressed air or pumped water systems.

1003.3 Additional requirements. *Alterations* of portions and components of *buildings* shall comply with Sections 1003.3.1 through 1003.3.9.

Exceptions:

1. The total cost of improvements required by Sections 1003.3.1 through 1003.3.9 shall not be required to exceed 10 percent of the costs of the *alterations* exclusive of land and *building site* improvements. The costs of *alterations* shall include costs related to Section 1003.2, but shall not limit its application.
2. This section shall not require compliance that exceeds that required for systems regulated by Chapters 6 through 8 of this code.
3. Materials, assemblies and components regulated by Sections 1003.3.1 through 1003.3.9 that are dependent upon properties of other concealed materials, assemblies or system components to function properly and where the properties of the concealed materials, assemblies or components are unknown or insufficient and will not be revealed during construction.
4. Where the application of the requirements of Sections 1003.3.1 through 1003.3.9 are determined by the *code official* to be technically infeasible based upon the existing configuration of spaces, unless the intent of the *permit* applicant is to reconfigure those spaces or portions thereof.
5. Where a tenant in a multi-tenant *building* does not have control within that tenant space of a complete system or item, compliance for that complete system or item shall not be required.

1003.3.1 Energy audit and report. The *building* owner shall commission a *building* energy audit and provide copies of the audit report to the local *jurisdiction*. The audit shall be conducted by persons qualified to perform such audits, as determined by the *code official*. The energy audit report shall indicate the improvements listed in Sections 1003.3.2 through 1003.3.9 that the

auditor recommends for scoping and prioritizing the modification, replacement or the addition of equipment or systems to improve the energy performance of the *building*.

Exception: An energy audit and report shall not be required where a *building* is vacant and has been vacant for a minimum of six months prior to the sale date of the property.

1003.3.2 Metering devices. Dedicated individual utility or private *metering* devices to facilitate the measurement and verification of energy and water use within the *building* or space shall be provided for at least one of the following:

1. Electrical energy consumption for individual tenant spaces
2. Water consumption for individual tenant spaces
3. Natural gas or fuel oil consumption for individual tenant spaces
4. Lighting loads
5. Motor and drive loads
6. Chiller part-load efficiency
7. Cooling loads
8. Economizer and heat recovery loads
9. Boiler efficiencies
10. *Building* process systems and equipment loads
11. Water consumption for landscape irrigation

1003.3.3 Heating, ventilation and air conditioning. Heating, *ventilation* and air conditioning systems and equipment shall be in accordance with the following:

1. Time clock and *time switch controls* that can turn systems off and on according to *building* occupancy requirements shall be provided and connected to the following HVAC equipment: chillers and other space cooling equipment, chilled water pumps, boilers and other space heating devices, hot water pumps, heat exchanger circulation pumps, supply fans, return fans, and exhaust fans. Where occupant override is provided, it shall be designed with a timer to automatically revert to time clock and *time switch controls* in not longer than twelve hours.

Exception: A time clock and *time switch controls* shall not be required for spaces with twenty-four-hour occupancy or containing materials with special atmospheric requirements dependent on twenty-four-hour space conditioning, or where a majority of areas of the *building* served by the system are under set-back thermostat control, or where manufacturer's specifications stipulate that the system must not be shut off.

2. Functional outside air economizers shall be provided on all cooling systems of more than 6 1/4 tons total cooling capability, 75K *Btu/hr.*, or more than two thousand five hundred

cubic feet per minute air flow, provided manufacturer's guidelines are available for adding the economizer to the existing system.

Exceptions: An outside air economizer shall not be required for *buildings* or special uses requiring one hundred percent outside air for *ventilation*, where the existing system has a water based economizer, where the existing system does not have an outside air intake, where special economizer operations such as, but not limited to, carefully controlled humidity would require more energy use than is conserved, where there is insufficient space to install necessary equipment, where installation of an economizer would require major modifications to the *building's* life-safety system, or where the existing system is a multi-zone system where the same intake air may be used at the same time for either heating or cooling in different parts of the *building*.

3. HVAC piping and ducts, including those located above suspended ceilings, shall be insulated to *R-values* in accordance with this code.

Exception: Additional insulation shall not be required for piping within HVAC equipment, within conditioned space that conveys fluids between sixty degrees Fahrenheit and one hundred five degrees Fahrenheit, piping that is already insulated and the insulation is in good condition, or where the insulation cannot be installed without structural *alteration*.

4. Furnace combustion units shall have been cleaned and tuned within one year prior to the alteration. Filters shall be replaced in accordance with the furnace manufacturer's recommendations. Where central heat is intended to be replaced with individual electric space heaters, the application for the electrical *permit* shall include documentation demonstrating that the new electric heaters will not consume more energy than the existing nonelectric heater(s).
5. Boiler systems shall have been cleaned and tuned within one year prior to the alteration.
6. Boilers shall be equipped with an outdoor air lock-out thermostat or a temperature reset control.
7. Chiller systems shall have been cleaned and tuned within one year prior to the *alteration*.
8. Chillers shall be equipped with an outdoor air lockout thermostat and chilled water reset control.
9. A maximum 5 year phase out plan shall be provided for *buildings* with existing systems that use CFC-based refrigerants.
10. Where mechanical and electrical systems and equipment are joined with microprocessors that communicate with each other or to a computer, a properly integrated *building* automation system shall be installed to optimize energy, operations, and indoor comfort. The *building* automation system shall allow the owner to set up schedules of operation for the equipment and provide equipment optimal start with adaptive learning; provide trim and respond capabilities based on zone demand; ability to monitor energy usage, including the ability to *meter* electric, gas, water, steam, hot water, chilled water, and fuel oil services; offer economizing based on enthalpy calculation and/or CO2 set point control; offer load shedding when power companies are at peak demand and need; and

offer the ability to send alarms to alert *building* owner, manager, or operator when problems occur due to system failures.

1003.3.4 Service water systems. Service water systems and equipment shall be in accordance with the following:

1. Water heater and hot water *storage tanks* shall have a combined minimum total of external and internal insulation value of R-16.
2. Accessible hot and cold water supply and *distribution pipes* shall be insulated to *R-values* as specified in this code.
3. In Seismic Design Categories D, E and F, as established in accordance with the *International Building Code*, water heater and water *storage tanks* with a tank capacity of thirty gallons or greater shall be strapped or otherwise secured to a wall, floor, ceiling, or other object that itself is adequately secured to a wall, floor, or ceiling. Water, gas and overflow pipes connected to water tanks shall be similarly secured. Gas water heaters shall have a flexible gas line entering the appliance.
4. Circulating pump systems for hot water supply purposes other than comfort heating shall be controlled as specified in Section 608.8.
5. Showerhead, toilet, urinal and faucet flow rates shall be in accordance with this code.

1003.3.5 Lighting. Lighting systems and equipment shall be in accordance with sections 505.2.2.3 and 505.2.4 of the *International Energy Conservation Code*.

1003.3.6 Commercial refrigeration equipment. Commercial refrigeration equipment shall be cleaned and tuned for efficiency, including, but not limited to, cleaning of condenser coils and evaporators, and replacement of defective or worn door gaskets and seals.

1003.3.7 Motor-driven equipment. Motor-driven systems and equipment shall be in accordance with the following:

1. Filters shall be cleaned or replaced.
2. Belts and other coupling systems shall be in good repair.

1003.3.8 Swimming pools and spas. Swimming pools and spas and their equipment shall be in accordance with the following:

1. Heated swimming pools and spas shall be equipped with a cover for unoccupied hours.

Exception: A cover shall not be required for indoor pools or spas in which water temperature is less than eighty degrees Fahrenheit during time of non-use.

2. Pool and spa recirculation pumps shall be under timeclock control.
3. Heaters shall be cleaned and tuned for efficiency within one year prior to the *change of occupancy*.

1003.3.9 Unconditioned attic insulation. In *buildings* with three or fewer stories above grade plane, ceiling insulation with a minimum *R-value* as required by this code shall be installed in accessible attic spaces that are directly above conditioned spaces. For the purposes of this section, accessible attic space shall be the space between a ceiling joists and roof rafters where the vertical clear height from the top of a ceiling joist or the bottom chord of a truss, to the underside of the roof sheathing at the roof ridge, is greater than twenty-four inches. Where the required *R-value* insulation cannot fit in the attic space, the maximum amount of insulation compatible with available space and existing uses shall be installed.

1003.3.10 Asbestos-containing products. Identification and removal of *asbestos-containing products* shall be in accordance with ASTM E2356 and ASTM E1368.

SECTION 1004 CHANGE OF OCCUPANCY

1004.1 Change of occupancy. Where a change in occupancy of a *building* or tenant space places it in a different division of the same group of occupancy or in a different group of occupancies, as determined in accordance with the provisions of the *International Building Code*, compliance with Section 1003.2 shall be required. Altered portions of, and *additions* to, existing *buildings* that are not a result of *change of occupancy* requirements, shall comply with other sections of this chapter, as applicable.

Exception: *Historic buildings* in accordance with Section 1005 shall not be required to comply with Section 1004.

SECTION 1005 HISTORIC BUILDINGS

1005.1 Historic buildings. The provisions of this code relating to the construction, *repair*, *alteration*, *addition*, restoration and movement of *structures*, and *change of occupancy*, where each individual provision is evaluated separately on its own merit, shall not be mandatory for *historic buildings* for any of the following conditions:

1. Where implementation of that provision would change the visible configuration of *building* components in a manner that is not in keeping with the *buildings* historic nature, as determined by the *code official*, or
2. Where compliance with that provision would produce a conflict with a *building* function that is fundamental to the historic nature of the *building*.



SECTION 1006 JURISDICTIONAL REQUIREMENTS

1006.1 General. Sections 1006.2 and 1006.3 shall be mandatory and Section 1006.4 shall be enforced only where specifically indicated by the *jurisdiction* in Table 302.1.

1006.2 Demolition. Where *buildings*, *structures* or portions thereof are *deconstructed* or demolished, a minimum of 50 percent of materials shall be diverted from landfills and incineration. Documentation of the total materials in *buildings*, *structures* and portions thereof to be *deconstructed* or demolished and

materials to be diverted, and evidence of diversion, shall be provided. Material quantities shall be indicated and calculated by weight or volume, but not by both.

1006.3 Sale of existing buildings and portions of buildings. *Buildings* and portions of buildings that are sold shall comply with Sections 1003.2 and 1003.3 within 1 year of sale.

1006.4 Evaluation and certification of existing buildings and building sites. Where a *permit* application is accepted by a *jurisdiction* for the evaluation of an existing *building* and *building site* in accordance with the requirements of this code as applicable to a new project, and this code does not otherwise require conformance, evaluation shall be in accordance with the requirements of this section. *Project electives* in accordance with Table 303.1 shall be included in the evaluation of the existing *building*.

1006.4.1 Certificate of conformance. Where conformance with the requirements of this code as applicable to a new *building* is verified by the *code official* for an existing *building* and *building site*, a certificate shall be issued indicating conformance with this code, as modified by the limitations contained in Sections 1006.4.2 through 1006.4.3.2.

1006.4.2 Specific exclusions. Where evidence of compliance is not available, *existing buildings* evaluated under Section 1006.4 shall not be subject to the requirements of Section 806. Provisions of this code related to the projects construction phase, including Sections 402.3.1, 402.3.5, 402.3.6, 502.1, 506 and 803.1, and other sections as approved by the *code official*, shall not be required for *buildings* evaluated under Section 1006.4. Where buildings do not comply with the aforementioned sections, the certification shall specifically list the sections for which compliance has not been required or verified.

1006.4.3 Existing concealed construction. Existing concealed construction in *buildings* regulated by Section 1006.4 shall be in accordance with Sections 1006.4.3.1 and 1006.4.3.2.

1006.4.3.1 Previously approved documents. Previously *approved construction documents* for the initial construction of an existing *building* and, where possible, description of changing uses and major upgrades over the *building's* lifetime for which a certificate of occupancy was previously issued shall be deemed an acceptable indication of materials, assemblies and equipment in concealed spaces, except where field inspection reveals sufficient evidence suggesting noncompliance, subject to the evaluation of the *code official*.

1006.4.3.2 Previously approved documents not available. Where previously *approved construction documents* for the initial construction of an existing project are not available, materials, assemblies and equipment in spaces in existing *buildings* and existing portions thereof that are concealed, including, but not limited to, materials in spaces within walls and floor/ceiling assemblies, shall be exposed and spot checked in limited areas as determined by the *code official*.

CHAPTER 11

EXISTING BUILDING SITE DEVELOPMENT

SECTION 1101 GENERAL

1101.1 Scope. The provisions of this chapter shall control the *alteration, repair, maintenance* and operation of existing *building sites* and the *alteration to building site improvements* where *additions* are made to, or changes of occupancy occur within, the existing *buildings* on the site.

1101.2 Operation and maintenance. *Building sites* shall be operated and maintained in conformance with the code edition under which the site improvements were installed. The owner or the owner's designated agent shall be responsible for the operation and maintenance of *building sites*. To determine compliance with this section, the *code official* shall have the authority to require a *building site* to be reinspected. The requirements of this chapter shall not provide the basis for removal or abrogation of protections or systems from existing *building sites*.

1101.3 Compliance. *Alterations and repairs to building sites* shall comply with the provisions of this code. Where differences occur between the provisions of this code and the provisions of other locally adopted land use, zoning or site development regulations, the provisions of the most restrictive code or regulation shall apply.

Exception: The following need not comply with Chapter 4, provided that the area of *impervious surfaces* on the *building site* is not increased:

1. Restriping of parking lots provided there is not a change in the number of parking spaces;
2. Replacement of *hardscape, structures* and vegetation with materials that duplicate the materials in the permitted plans and specifications

1101.4 Building site materials, systems and landscaping. *Building materials* used for *building site* development shall comply with the requirements of this section.

1104.4.1 Existing materials, assemblies, configurations and systems. Materials and systems already in use on a *building site* in conformance with the requirements or approvals in effect at the time of their installation shall be permitted to remain in use unless determined by the *code official* to be dangerous to the environment, life, health or safety. Where such conditions are determined to be dangerous to the environment, life, health or safety, they shall be mitigated or made safe.

Existing *buildings* and site improvements located within or located closer to protected areas than permitted by Section 402.2 but that are in conformance with the requirements or approvals in effect at the time of their installation shall be permitted to remain in use unless determined by the *code official* to be dangerous to the environment, life, health and safety of the community and the occupants of the *building site*. Where such conditions are determined to be dangerous to the environment, life, health or safety, they shall be mitigated or made safe.

1101.4.2 New and replacement materials, assemblies, configurations and systems. Except as otherwise required or permitted by this code, materials, assemblies, configurations and systems permitted by the applicable code for new construction shall be used. Like materials shall be permitted for *repairs* and *alterations* provided no hazard to the environment, life, health or property is created. Hazardous materials shall not be used where the code for new construction would not *permit* their use at *building sites* of similar occupancy, purpose and location.

SECTION 1102 ADDITIONS

1102.1 General. *Additions* to any *building site* improvements shall comply with the requirements of this code for new construction. Unaltered portions of a *building site* shall be in accordance with the provisions of the code in force at the time of their construction.

Where *additions* to a *building*, or *additions* to *building site* improvements result in the *alteration* of existing portions or improvements of the *building site*, those *alterations* shall comply with this section and Section 1103.

Additions to an existing *building site* shall be made to ensure the following:

1. Existing *building site* improvements together with the additional or expanded improvements are not less conforming with the provisions of this code than the existing *building site* was prior to the *addition*, and;
2. Where *additions* to any *building* reduces, or requires *alteration* to, *building site* improvements, the *alterations* to the *building site* together with unaltered site improvements shall not be less conforming to the provisions of this code prior to the *addition* to the *building* or *structure*.

SECTION 1103 ALTERATIONS TO EXISTING BUILDING SITES

1103.1 General. *Alterations* to existing portions or *site* improvements on *building sites* shall be in accordance with the provisions of this code for those portions or *building site* improvements being altered. Unaltered portions and site improvements of the *building site* shall be in accordance with the provisions of the code in force at the time of their construction. *Alterations* shall be such that the existing *building site* is no less conforming with the provisions of this code than the existing *building site* was prior to the *alteration*.

Unaltered portions and site improvements of a *building site* shall be in accordance with the provisions of the code in force at the time of their construction or preservation.

Exception: Where, in the opinion of the *code official*, there is no significant compromise of the intent of this code, the *code official* shall have the authority to approve materials and assemblies that perform in a manner that is at least the equivalent of those being replaced.

1103.2 Changes to hardscapes and surface vehicle parking. Where existing *hardscapes* that do not conform to the requirements of 404.2 are altered, the *alterations* shall comply with the provisions of this code.

Where existing vehicle surface parking lots that do not comply with Section 403.4 are altered to rearrange parking space configuration or to increase the number of parking spaces, the altered parking lot shall comply with Section 403.4. In addition, if the existing *building site* does not have the number of *short term bicycle parking* spaces required by Section 403.3, additional *short term bicycle parking* complying with Section 403.3 shall be provided in order that the *building site* subsequent to the alternation complies with Section 403.3 for *short term bicycle parking*.

SECTION 1104 CHANGE OF OCCUPANCY

1104.1 Conformance. Where a change in the use or occupancy of a *building* or tenant space places it in a different division of the same group of occupancy or in a different group of occupancies, as determined in accordance with the provisions of the *International Building Code*, compliance with Sections 1104.2 shall be required. Altered portions of, and *additions* to, existing *buildings* and existing *building sites* that are not a result of *change of occupancy* requirements, shall comply with other sections of Chapter 10 and this chapter.

1104.2 Building site improvements. Where a change in occupancy results in an increase in the *occupant load* of the *building*, bicycle parking shall comply with the following:

1. *Short term bicycle parking* spaces shall be provided in accordance with Section 403.3 equivalent to a new *building* of the new occupancy.
2. Where the existing *building* and *building site* have parking for motorized vehicles, *long term bicycle parking* shall be provided in accordance with Section 403.3 equivalent to a new *building* of the new occupancy. Where the existing *building* does not contain covered parking spaces for vehicles, only 25 percent of the *long term bicycle parking* needs to be covered.

SECTION 1105 HISTORIC BUILDING SITES

1105.1 Historic building sites. The provisions of this code relating to the construction, *repair*, *alteration*, *addition*, and restoration of *building sites* and site improvements, where each individual provision is evaluated separately on its own merit, shall not be mandatory for *historic building sites* for any of the following conditions:

1. Where implementation of that provision would change the visible configuration of *building site* improvements in a manner that is not in keeping with the *building site's* historic nature, as determined by the *code official*,
2. Where compliance with that provision would produce a conflict with a *building site* function that is fundamental to the historic nature of the *building site*, or
3. Where such *building sites* are judged by the *code official* to not constitute a distinct environmental hazard.

CHAPTER 12

REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.4.

AHRI

Air Conditioning, Heating and Refrigeration Institute
2111 Wilson Boulevard, Suite 500
Arlington, VA 22201

Standard reference number	Title	Referenced in code section number
870—2009	Direct Geexchange Heat Pumps.	Table 607.2.2.1, .Table 613.4.2.3

ANSI

American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

Standard reference number	Title	Referenced in code section number
Z21.50/CSA 2.22.2003	Vented Gas Fireplaces	804.1.3
Z21.88a/CSA 2.33a	ANSI/CSA Standard for Vented Gas Fireplace Heaters.	804.1.3

APHA

American Public Health Association
800 I Street NW
Washington, DC 20001

Standard reference number	Title	Referenced in code section number
2005	Standard Methods for Examination of Water and Waste Water-21 st Edition	707.16.1.1

ARB

California Air Resource Board
1001 "I" Street, P. O. Box 2815
Sacramento, CA 9512

Standard reference number	Title	Referenced in code section number
February 1, 2008	California Air Resources Board, Architectural Coatings Suggested Control Measures February 1, 2008.	Table 806.3(1)

ASA

Acoustical Society of America
Suite 1N01
2 Huntington Quadrangle
Melville, NY 11747-4502

Standard reference number	Title	Referenced in code section number
ANSI/ASA S12.2-2008	Criteria for Evaluating Room Noise.	Table 903.1
ANSI /ASA S12.60-2010/Pt.1	Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 1: Permanent Schools.	Table 807.4.3
ANSI/ASA S12.60-2009/Pt.2	Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 2; Relocatable Classroom Factors.	Table 807.4.3

ASME

American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
A112.18.1/ CSA B125.1—2010	Plumbing Supply Fittings	Table 702.1, Table 702.1.1(2), 702.2

ASHRAE

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
1791 Tullie Circle
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
55-2004	Thermal Environmental Conditions on Human Occupancy.....	607.6.1, 803.2, C102.6.1
62.1-2010	Ventilation for Acceptable Indoor Air Quality.....	605.3, 607.3, C102.6.1
90.1-2010	Energy Standard for Buildings Except Low-rise Residential Buildings (ANSI/ASHRAE/IESNA 90.1-2007).....	613.4.2.1, 613.4.2.2, 613.4.5, 613.5.3
140-2010	Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs.....	602.3.2
189.1—2009	Standard for the Design of High Performance Green Buildings, Except Low Rise Residential Buildings.....	302.1, Table 302.1

ASSE

American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
1016—2010	Performance Requirements for Automatic Compensating, Valves for Individual Showers and Tub/Shower Combinations.....	Table 702.1, Table 702.1.1(2)

ASTM

ASTM International
100 Barr Harbor
West Conshohocken, PA 19428-2959

Standard reference number	Title	Referenced in code section number
C5-10	Standard Specification for Quicklime for Structural Purpose.....	507.5.10
C206-03(2009)	Standard Specification for Finishing Hydrated Lime.....	507.5.10
C1371-04a	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emmissometers.....	404.3.1.1
C1549-09	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.....	404.3.1.1
D2974—07a	Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and other Organic Soils.....	406.5.2.1
D3385—09	Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer... ..	406.5.2.2
D3960—05	Standard Practice of Determining Volatile Organic Compound (VOC) Content of Paints & Related Coatings.....	806.2, 806.3
D5093-02(2008)	Standard Test Method for Field Measurement of Infiltration Rate Using Double-Ring Infiltrometer With Sealed-Inner Ring.....	406.5.2.2
D5055-10	Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists	Table 806.1
D5456-10	Standard Specification for Evaluation of Structural Composite Lumber Products	Table 806.1
D6886—03	Standard Test Method for Specification of the Volatile Organic Compounds (VOCs) in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography	503.2.4
D7612-10	Standard Practice in Categorizing Wood and Wood-Based Products according to their Fiber	Sources 202
E90-04	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.....	807.2; 807.3 807.4.1, 809.2, 809.3
E96/E96M-05	Standard Test Method for Water Vapor Transmission of Materials.....	507.6

E408-71(2008)	Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.....	404.3.1.1
E413-10	Classification for Rating Sound Insulation.....	807.4.1
E779-10	Standard Test Method for Determining Air Leakage Rate by Ton Pressurization.....	606.1.4.2
E1332-90 (2003)	Standard Classification for the Determination of Outdoor-Indoor Transmission Class.....	807.2
E1368-05e1	Standard Practice for Visual Inspection of Asbestos Abatement Projects.....	1003.3.10
E1509—04	Standard Specification for Room Heaters, Pellet Fuel-Burning Type.....	804.1.6
E1643-10	Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granules Fill Under Concrete Slabs.....	804.2.2
E1918-06	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.....	404.3.1.1
E1980—01	Standard Practice for Calculating Solar Reflectance Index of Horizontal And Low-Sloped Opaque Surfaces.....	202, 404.1.1, 404.2.1, 404.3.1.2
E2112—07	Standard Practice for Installation of Exterior Windows, Doors and Skylights.....	504.3.3
E2356-09	Standard Practice for Comprehensive Building Asbestos Surveys.....	1003.3.10
E2398—05	Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers For Green Roof Systems.....	406.6
F1639-05	Standard Test Method for Performance of Combination Ovens.....	702.21

CCR

California Code of Regulations
 Department of Industrial Relations
 Office of the Director
 455 Golden Gate Avenue
 San Francisco, CA 94102

Standard reference number	Title	Referenced in code section number
Section 93120-Title 17	California Code Regulations, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions.....	806.1

CDPH

California Department of Public Health
 1615 Capitol Avenue
 Sacramento, CA 95814

Standard reference number	Title	Referenced in code section number
CDPH Section 01350	EHLB Standard Method for Testing VOC emissions from indoor sources.....	806.1

CRRC

Cool Roof Rating Council
 1610 Harrison Street
 Oakland, CA 94612

Standard reference number	Title	Referenced in code section number
CRRC-1	Cool Roof Rating Council Standard.....	404.3.1.1, 404.3.1.2

CSA

Canadian Standards Association
 5060 Spectrum Way
 Mississauga, Ontario, Canada L4N 5N6

Standard reference number	Title	Referenced in code section number
CAN/CSA B366.1-2009	Solid-Fuel-Fired Central Heating Appliances.....	804.1.6
CSA Z21.50/CSA 2.22-2003	Vented Gas Fireplaces.....	804.1.3
CSA Z21.88a/CSA 2.33a	ANSI/CSA Standard for Vented Gas Fireplace Heaters.....	804.1.3

DCHS

California Department of Health Services
Office of Regulations
P.O. Box 997413, MS 0015
Sacramento, CA 95899-7413

Standard reference number	Title	Referenced in code section number
CA/DHS/EHLB/R-174-2010	Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers Version 1.1 February 2010.....	2004-1, 806.2, Table 806.2(2), 806.3, Table 806.2(2), 806.5, 806.6, 809.2.4

DOC

U.S. Department of Commerce
National Institute of Standards and Technology
1401 Constitution Avenue NW
Washington, DC 20230

Standard reference number	Title	Referenced in code section number
NOAA	National Oceanic and Atmospheric Administration Annual Mean Sunshine Percentage Table.....	Table 609.5
PS1—09	Structural Plywood.....	Table 806.1
PS2—10	Performance Standard for Wood-Based Structural-Use Panels.	Table 806.1

DOE

U.S. Department of Energy
C/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
10 CFR Part 431	Sub-Part K, Appendix A.....	Table 609.8.1.1(1), Table 609.8.1.1(2), Table 609.8.1.1(3)
DOE/CH/10093-4-10/86	Appendix C of NREL "Wind Energy Resource Atlas of United States".....	611.3
NREL, 2003	Photovoltaic Resource Map.....	Figure 611.4

EPA

Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Standard reference number	Title	Referenced in code section number
40 CFR, Part 60 Subpart AAA	EPA Standards of Performance for New Residential Wood Heaters.....	804.1.5
40 CFR 300	Small Business Liability Relief and Brownfield Revitalization Act-Public Law 107-118.....	202
EPA Act 2005	Energy Act 2005.....	609.8.1.1
EPA eGRID 2007	Version 1.1; 2005 data; EPA eGrid Data.....	Table 603.1.1(1); Table 603.1.1(2), Table 603.1.3
ENERGY STAR	Energy Star.....	404.3.1, 607.2.2.3, 607.2.3.1, 610.2.3, 610.3.1, 610.3.2, 613.4.2.1, 613.4.2.2, 613.4.5, 613.5.3, 613.5.1.1, 613.5.1.2, 609.2, Table 702.1, Table 702.1.1(2), 702.6.1, 702.6.2, 702.6.4, C102.2
Montreal Protocol-1992	The Montreal Protocol on Substances that Deplete the Ozone Layer- http://www.epa.gov/Ozone/title6/phaseout/22phaseout.html	C103
US EPA Method 24	Radon Manual for Large Bldgs; Radon Manual for Large Bldgs; Radon Manual schools & large buildings 40 CFR part 61 subpart 61.145, 61.150, 61.154 , Chapter 2 & EPA 625-R-016. Determination of Volatile Matter Content, Water Content, Density, Volume Solids And Weight Solids of Surface Coatings	806.2
Water Sense Feb-2007	High Efficiency Toilet Specification.....	Table 702.1, Table 702.1.1(3)
Water Sense October-2007	Lavatory Faucet Specification.....	Table 702.1
Water Sense October-2009	Flushing Urinal Specification.....	Table 702.1
Water Sense March 2010	Showerhead Specification.....	Table 702.1

FSC

Forest Stewardship Council
212 Third Avenue, North, Suite 504
Minneapolis, MN 55401

Standard reference number	Title	Referenced in code section number
V.1-7/2010	Forest Management Initiative Version 1.0 – 7/2010	503.2.4

ICC

International Code Council, Inc.
500 New Jersey Avenue, NW
6th Floor
Washington, DC 20001

Standard reference number	Title	Referenced in code section number
IBC-12	International Building Code®	101.2., 102.4.1; 102.4.12.1, 102.6, 109.2 201.3, 202, 304.1, 403.3.2, 403.4 406.3.1, 606.1.1.1; 609.3, 610.2, 703.7.1, 707.12.7.3, 708.12.6.4, 710.6.1; 710.7, 803.1.2.1; 804.1.7, 1002.1, 1003.3.4, 1004.1, 1104.1
IFGC-12	International Fuel Gas Code®	102.4.2, 201.3, 604.4.1, 610.2, 804.1.2
IMC-12	International Mechanical Code®	102.4.3, 201.3, 202, 604.4.2, 605.3, 607.3, 607.9.1, 610.2, 612.1.2.1, 703.7, 803.1.2.1, 803.3, 804.1.2
IPC-12	International Plumbing Code®	102.3.4, 201.3, 608, 610.2; Table 702.2.2(1), Table 702.1.1(2), 704.1.3, 704.2, 707.5, 707.6, 707.11 705.2, 707.3, 707.12.3.2, 707.12.4.1, 707.12.4.2, 707.12.4.3, 707.12.7.2, 707.12.7.4, 707.12.7.5, 707.12.7.6 707.12.10, 707.12.7.11, 707.12.11; 707.12.11.3; 707.12.12.1; 707.12.12.2, 707.12.12.3; 707.13.1; 707.13.2, 707.13.3, 707.13.4, 708.3, 708.5; 708.10, 708.12.1.1, 708.12.2, 708.12.3.1, 708.12.3.2, 708.12.3.3, 708.12.6.5, 708.12.6.6, 708.12.6.8, 708.12.6.11, 708.12.8, 708.12.9, 708.12.9.3, 708.12.10.1, 708.12.10.2, 708.12.10.3, 708.13.1, 708.13.2, 708.13.3, 708.13.4, 709.3, 709.4, 709.7, 709.8, 707.9.1.1; 709.9.1.2, 709.9.1.3, 709.10.1, 709.10.2, C102.5.1
IPMC-12	International Property Maintenance Code®	102.4.6, 102.6
IFC-12	International Fire Code®	102.4.6, 102.6, 201.3
IECC-12	International Energy Conservation Code®	102.4.8, 201.3, 202, 404.2, 404.3 407.4.1, 407.4.2, 407.4.3, 407.4.4, 601.3 602.2.2.1, 602.3.2.2, 603.1.2, 603.2, 603.2.1, 603.3, Table 603.3(1), Table 603.3(2), 603.4, 606.1, 606.1.1, 606.1.4.3, 607.1, 607.2.1, 607.2.3, 607.4, 607.6, 607.8, 607.9, 607.9.1, 608.1, 608.2.1, 608.3, 608.4, 609.1, 609.7, 609.9, 609.11, 610.2, 612.1, 612.3, 612.3.2, 612.3.3.1 612.3.3.3, 612.4, 612.4.2, 613.4.2.1, 613.4.2.2, 613.4.4, 613.4.5, 613.5.3, 613.6.2, 613.6.3, Table 903.1, 1003.3.5, 1104.1
IWUIC-12	International Wildland-Urban Interface®	102.4.9
ICC-PC-12	International Performance Code®	102.4.10
IEBC-12	International Existing Building Code®	102.4.11, 102.6
IRC-12	International Residential Code®	202; 804.2
IZC-12	International Zoning Code®	102.4.12

IEC

The International Electrotechnical Commission
Central Office
3, rue de Varembe'
P. O. Box 131
Ch-1211 Geneva 20
Switzerland

Standard reference number	Title	Referenced in code section number
IEC, 60034-30-2009	Standard on Efficiency classes for low voltage AC motors	610.2.1.1, 610.2.2.2

IESNA

Illuminating Engineering Society of North America
120 Wall Street, 17th Floor
New York, NY 10005-4001

Standard reference number	Title	Referenced in code section number
TM-15-07	Luminaire Classification System for Outdoor Luminaires.....	Table 405.2, Table 405.3(1), Table 405.3(2)

ISEA

International Safety Equipment Association
1901 N. Moore Street, Suite 808
Arlington, VA 22209

Standard reference number	Title	Referenced in code section number
Z358.1	Emergency Eyewash and Shower Equipment.....	702.1.3

ISO

International Organization for Standardization
ISO Central Secretariat
1 ch, de la Voie-Creuse, Case Postale 56
CH-1211 Geneva 20, Switzerland

Standard reference number	Title	Referenced in code section number
13256-1-1998	Water to Air Closed Loop.....	Table 607.2.2.1, Table 613.5.1.3
13256-1-1998	Water to Air Open Loop.....	Table 607.2.2.1, Table 613.5.1.3
13256-2-1998	Water to Water Closed Loop.....	Table 607.2.2.1, Table 613.5.1.3
13256-2-1998	Water to Water Open Loop.....	Table 607.2.2.1, Table 613.5.1.3
14044-2006	Environmental management – Lifecycle assessment-requirements and guidelines.....	304
ISO/IEC 17025-2005	General Requirements for the Competence of Testing and Calibration Laboratories.....	806.2, Table 806.2(2), 806.3, 806.4, 806.5, 806.6, 809.2.4, 2004-11

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269

Standard reference number	Title	Referenced in code section number
NFPA 70-2011	National Electrical Code.....	507.1, 507.10, 507.12, 604.4.4, 611.2.3.2, 611.3.3.1
NFPA 72-2010	National Alarm and Signaling Code.....	710.6.2

NREL

National Renewable Energy Laboratory
1617 Cole Boulevard
Golden, CO 80401-3305

Standard reference number	Title	Referenced in code section number
SERI TR-642-761	Simplified Clear Sky Model for Direct and Diffuse Insolation on Horizontal Surfaces.....	611.2

NSF

NSF International
789 Dixboro Road
Ann Arbor, MI 48105

Standard reference number	Title	Referenced in code section number
NSF/ANSI 44-09	Residential Cation Exchange Water.....	704.1.2, 704.1.4
NSF/ANSI 50-09	Equipment for Swimming Pools, Spas, Hot Tubs, and other Recreational Water Facilities.....	708.12.7.1
NSF/ANSI 58-09	Reverse Osmosis Drinking Water Treatment Systems.....	704.2
NSF/ANSI 61-09	Drinking Water Systems Components – Health Effects.....	707.16
NSF/P151-95	Health Effects from Rain Water Catchment Systems Components.....	707.12.1.1

SCAQMD

South Coast Air Quality Management District
21865 Capley Drive
Diamond Bar, CA 91765

Standard reference number	Title	Referenced in code section number
SCAQMD Method 302-91 (Revised 1993)	Distillation of Solvents from Paints, Coatings and Inks, South Coast Air Quality Management District	803.2
SCAQMD Method 303-91 (Revised 1993)	Determination of Exempt Compounds, South Coast Air Quality Management District.....	803.2
SCAQMD Method 304-91 (Revised February 1996)	Determination of Volatile Organic Compounds (VOC) in Various Materials, South Coast Air Quality Management District	803.2
SCAQMD Method 316A-92	Determination of Volatile Organic Compounds (VOC) in Materials Used for Pipes and Fittings.....	803.2
SCAQMD Method 316B-92	Determination of Volatile Organic Compounds (VOC) In Adhesives containing Cyanoacrylates.....	803.2
SCAQMD Rule 1168	Adhesives and Sealant Applications.....	806.2

SFI

Sustainable Forest Initiative, Inc.
900 17th Street, NW, Suite 700
Washington, DC 20006

Standard reference number	Title	Referenced in code section number
SFI-2010-2014	Sustainable Forest Initiative 2010-2014.....	503.2.4

SMACNA

Sheet Metal & Air Conditioning Contractors National Assoc. Inc.
4021 Lafayette Center Road
Chantilly, VA 22021

Standard reference number	Title	Referenced in code section number
2010	SMACNA HVAC Air Duct Leakage Test Manual (1 st Edition).....	607.4.1, 613.4.4

TCIA

Tree Care Industry Association
136 Harvey Road, Suite 101
Londonderry, NH 03053

Standard reference number	Title	Referenced in code section number
ANSI A300 Part 5 2005	Tree Shrub and Other Woody Plt Mgmt-Management of Trees and Shrubs during Site Planning, Site Development, and Construction.....	406.4.1

TMS

The Masonry Society
3970 Broadway, Unit 201-D
Boulder, CO 80304-1135

Standard reference number	Title	Referenced in code section number
0302-2011	Standard Method for Determining the Sound Transmission Class Rating for Masonry Walls	809.3, 809.5.1

UL

Underwriters Laboratories Inc.
333 Pfingsten Road
Northbrook, IL 60062

Standard reference number	Title	Referenced in code section number
UL 181-2005	Factory-Made Air Ducts & Air Connectors.....	802.5
UL 1703-2002	Standard for Flat-Plate Photovoltaic Modules & Panels.....	611.3.1.3
UL 1741-2010	Standard for Invertors, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources.....	611.3.1.4
UL 1482-2011	Room Heaters, Solid Fuel Type.....	804.1.5

USCC

US Composting Council
1 Comac Loop 14 B1
Rokonkoma, NY 11779

Standard reference number	Title	Referenced in code section number
TMECC 05.7a	Test Method for the Examination of Composting and Compost.....	406.4.2.1

USDA

United States Department of Agriculture
Office of Energy Policy and New Uses
Room 361, Reporters Bldg.
300 Seventh Street, SW
Washington, DC 20024

Standard reference number	Title	Referenced in code section number
7 CFR Part 2902-Rev. 1/1/06	Guidelines for designating Bio-based products for Federal Procurement.....	503.2.4

APPENDIX A

OPTIONAL ORDINANCE

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

The *International Codes* are designed and promulgated to be adopted by reference by ordinance. *Jurisdictions* wishing to adopt the *International Green Construction Code*[®] (*IgCC*[®]) as enforceable regulations of sustainable construction practice governing structures and premises should ensure that certain factual and fiscal information is included in the adopting ordinance at the time adoption is being considered by the appropriate governmental body.

The following sample adoption ordinance addresses several key elements of a code adoption ordinance, including the information required for insertion into the code text and an evidentiary-based adoption structure contain bonding requirements tied to the issuance of building permits, certificates of occupancy and the compliance verification process, a concept already familiar to *jurisdictions*' master development plans for larger-scale, Planned-Unit Developments (PUD's).

Most importantly, this Optional Ordinance 'B' intends to open the dialogue among stakeholders, and give *jurisdictions* a place to start an fiscal and evidentiary-based adoption structure utilizing performance bonding requirements tied to the compliance verification process. The bonding requirement is designed to ensure that the project complies with the *IgCC*. The bond is held by the *jurisdiction*. Bond amounts are set at a percentage of total cost of the building, based on local economic and geo-centric requirements overseen by *jurisdictional* authorities, and tied to square footage.

SAMPLE ORDINANCE FOR ADOPTION OF THE INTERNATIONAL GREEN CONSTRUCTION CODE ORDINANCE NO. _____

An ordinance of the [JURISDICTION] adopting the *International Green Construction Code*[®], regulating and governing the impact of buildings and structures on the environment in the [JURISDICTION]; providing for the issuance of permits and collection of fees therefore; repealing Ordinance No. _____ of the [JURISDICTION] and all other ordinances and parts of the ordinances in conflict therewith.

The [GOVERNING BODY] of the [JURISDICTION] does ordain as follows:

Section 1. That a certain document, three (3) copies of which are on file in the office of the [TITLE OF JURISDICTION'S KEEPER OF RECORDS] of [NAME OF JURISDICTION], being marked and designated as the *International Green Construction Code*, including Appendix Chapters [FILL IN THE APPENDIX CHAPTERS BEING ADOPTED] (see *International Green Construction Code* Section 101.2.1), as published by the International Code Council, be and is hereby adopted as the *Green Construction Code* of the [JURISDICTION], in the State of [STATE NAME] for regulating and governing the impact of buildings and structures on the environment as herein provided; providing for the issuance of permits and collection of fees thereof; and each and all of the regulations, provisions, penalties, conditions and terms of said *Green Construction Code* on file in the office of the [JURISDICTION] are hereby referred to, adopted, and made a part hereof, as if fully set out in this

ordinance, with the additions, insertions, deletions and changes, if any, prescribed in Section 2 of this ordinance.

Section 2. The following sections are hereby revised:

Section 101.1. Insert: [NAME OF JURISDICTION]

Table 302.1. Insert: [JURISDICTIONAL REQUIREMENTS].

Section 3. That Ordinance No. _____ of [JURISDICTION] entitled [FILL IN HERE THE COMPLETE TITLE OF THE ORDINANCE OR ORDINANCES IN EFFECT AT THE PRESENT TIME SO THAT THEY WILL BE REPEALED BY DEFINITE MENTION] and all other ordinances or parts of ordinances in conflict herewith are hereby repealed.

Section 4. That if any section, subsection, sentence, clause or phrase of this ordinance is, for any reason, held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this ordinance. The [GOVERNING BODY] hereby declares that it would have passed this ordinance, and each section, subsection, clause or phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses and phrases be declared unconstitutional.

Section 5. That nothing in this ordinance or in the Green Construction Code hereby adopted shall be construed to affect any suit or proceeding impending in any court, or any rights acquired, or liability incurred, or any cause or causes of action acquired or existing, under any act or ordinance hereby repealed as cited in Section 3 of this ordinance; nor shall any just or legal right or remedy of any character be lost, impaired or affected by this ordinance.

Section 6. That the [GOVERNING BODY] hereby directs and causes for all privately owned nonresidential projects of at least [insert] square feet, a performance bond, irrevocable letter of credit from a financial institution authorized to do business in the *jurisdiction*, or evidence of cash deposited in an escrow account in a financial institution in the *jurisdiction*, to be provided to the *jurisdiction*, with the bond, LOC or escrow, “due and payable prior to receipt of certificate of occupancy.”

- (a) A commercial applicant who applies for an incentive described in Section 7 shall provide a performance bond which shall be due and payable upon approval of the first building construction permit application.
- (b) On or before [EFFECTIVE DATE], all applicants for construction governed by Section 1 shall provide a performance bond, which shall be due and payable prior to issuance of a certificate of occupancy.
- (c) For the purpose of compliance with subsections (a) and (b) of this section, in lieu of the bond required by this section, the [GOVERNING BODY] may accept an irrevocable letter of credit from a financial institution authorized to do business in the [JURISDICTION] or evidence of cash deposited in an escrow account in a financial institution in the [JURISDICTION] in the name of the licensee and the [JURISDICTION]. The letter of credit or escrow account shall be in the amounts required by subsection (d) of this section.
- (d) The amount of the required performance bond under subsection (a) of this section shall be 1 percent of the incentive provided.
- (e) The amount of the required performance bond under subsection (b) of this section shall be:

- (1) For a project not exceeding 150,000 square feet of gross floor area, 2 percent of the total cost of the building;
 - (2) For a project from 150,001 to 250,000 square feet of gross floor area, 3 percent of the total cost of the building; and.
 - (3) For a project exceeding 250,000 square feet building of gross floor area, 4 percent of the total cost of the building.
- (f) The maximum amount of a performance bond shall be \$3 million.
- (g) All or part of the performance bond shall be forfeited to the [JURISDICTION] and deposited in a Green Building Fund if the building fails to meet the verification requirements described in sub-parts (1) and (2) below.
- (1) Publicly-owned, private leasing of public property, publicly financed buildings, and tenant improvements.
 - (2) Privately-owned buildings. Any new construction or substantial improvement of a nonresidential privately-owned project with [insert] square feet of gross floor area or more shall:
 - a. On or before [EFFECTIVE DATE], submit to the Department of Buildings, as part of any building construction permit application, a green building checklist documenting the green building elements to be pursued in the building construction permit.
 - b. Within 365 days (1 year) of the receipt of a certificate of occupancy, be verified “in compliance” with the requirements of this ordinance through:
 - i. An agency of the [JURISDICTION] government; or
 - ii. Third-party entities which meet criteria to be established by the [GOVERNING BODY] by rulemaking within 180 days of the effective date of this ordinance;

as having fulfilled or exceeded the requirements of the *International green Construction Code*.
- (h) The [JURISDICTION] shall draw down on the bond funds if the required green building verification is not provided within 730 days (2 years) after issuing the first certificate of occupancy.
- (i) The [GOVERNING BODY] shall promulgate rules to establish additional requirements for the drawing down or return of performance bonds.

Section 7. Incentives.

- (a) Within 180 days of the effective date of this ordinance, the [GOVERNING BODY] shall establish an incentive program to promote early adoption of green building practices by applicants for building construction permits for *buildings regulated by this code*. The incentive program shall be funded by funds deposited in the Green Building Fund, subject to the availability of funds. As part of the incentive program, the [GOVERNING BODY] shall establish a [[PROPERTY TAX INCENTIVE or INCENTIVES PROGRAM]] for Qualifying Green Building Properties, and

[[MAY PROVIDE GRANTS]] to help defray costs associated with the early adoption of the green building practices of the *International green Construction Code*.

Section. 8. Green Building Fund.

- (a) There is established a fund designated as the Green Building Fund, which shall be ENROLLED ORIGINAL Codification [JURISDICTION] of Columbia Official Code, 2001 Edition 8 West Group Publisher, 1-800-328-9378, separate from the General Fund of the [JURISDICTION] of Columbia. All additional monies obtained pursuant to sections 6 and 9, and all interest earned on those funds, shall be deposited into the Fund without regard to fiscal year limitation pursuant to an act of Congress, and used solely to pay the costs of operating and maintaining the Fund and for the purposes stated in subsection (c) of this section. All funds, interest, and other amounts deposited into the Fund shall not be transferred or revert to the General Fund of the [JURISDICTION] of Columbia at the end of any fiscal year or at any other time, but shall continually be available for the uses and purposes set forth in this section, subject to authorization by Congress in an appropriations act.
- (b) The [GOVERNING BODY] shall administer the monies deposited in the Fund.
- (c) The Fund shall be used as follows:
 - (1) Staffing and operating costs to provide technical assistance, plan review, and inspections and monitoring of green buildings;
 - (2) Education, training and outreach to the public and private sectors on green building practices; and
 - (3) Incentive funding for private buildings as provided for in Section 7.

Section. 9. Green building fee.

- (a) A green building fee is established to fund the implementation this ordinance and the Green Building Fund.
- (b) Upon the effective date of this ordinance, the green building fee shall be established by increasing the building construction permit fees in effect at the time in accordance with the following schedule of additional fees:
 - (1) New construction – an additional \$0.0020 per square foot.
 - (2) Alterations and repairs exceeding \$1,000 but not exceeding \$1 million – an additional 0.13 percent of construction value; and
 - (3) Alterations and repairs exceeding \$1 million - an additional 0.065 percent of construction value.

Section. 10. Establishment of a [JURISDICTION] Green Building Advisory Council.

- (a) The Department of the Environment shall provide the central coordination and technical assistance to [JURISDICTION] agencies and instrumentalities in the implementation of the provisions of this ordinance.

- (b) Within 90 days after the effective date of this ordinance, the **[GOVERNING BODY]** shall establish a Green Building Advisory Council to monitor the **[JURISDICTION]**'s compliance with the requirements of this ordinance and to make policy recommendations designed to continually improve and update the ordinance.
- (c) The **[JURISDICTION]** GBAC shall consist of the following nine (9) members: (1), (2), (3), (4), (5), (6), (7), (8), and (9).
- 1) Members of the GBAC who are not ex officio members shall have expertise in building construction, development, engineering, natural resources conservation, energy conservation, green building practices, environmental protection, environmental law, or other similar green building expertise.
 - 2) The Chairperson of the GBAC shall be the Director of the Department of the Environment.
 - 3) All members of the GBAC shall either work in, or be residents of the **[JURISDICTION]**, and shall serve without compensation.
 - 4) The members shall serve a 2-year term.
 - 5) A member appointed to fill a vacancy or after a term has begun, shall serve only for the remainder of the term or until a successor is appointed.
 - 6) The GBAC shall advise the **[GOVERNING BODY]** on:
 - i. The development, adoption, and revisions of this ordinance, including suggestions for additional incentives to promote green building practices;
 - ii. The evaluation of the effectiveness of the **[JURISDICTION]**'s green building policies and their impact on the **[JURISDICTION]**'s environmental health, including the relation of the development of the **[JURISDICTION]**'s green building policies to the specific environmental challenges facing the **[JURISDICTION]**;
 - iii. The green building practices to be included in the triennial revisions of the Construction Codes; and
 - iv. The promotion of green building education, including educating relevant **[JURISDICTION]** employees, the building community, and the public regarding the benefits and techniques of high-performance building standards.
 - v. The GBAC shall meet at least six (6) times each year.
 - 7) The GBAC shall issue an annual report of its recommendations to the **[GOVERNING BODY]**. The report shall include recommended updates of green building standards, building systems monitoring and data compiled from **[JURISDICTION]**-owned or **[JURISDICTION]** instrumentality-owned and operated buildings, and an analysis of the building projects exempted by the **[GOVERNING BODY]** under section 11. The report shall be distributed to all members of the Council and the **[GOVERNING BODY]** and made available to the general public within 30 days after its issuance.

Section 11. Exemptions and extensions. The [GOVERNING BODY] may, in unusual circumstances and only upon a showing of good cause, grant an exemption from any of the requirements of this ordinance based on:

- (a) Substantial evidence of a practical infeasibility or hardship of meeting a required green building standard;
- (b) A determination that the public interest would not be served by complying with such requirements; or
- (c) Other compelling circumstances as determined by the [GOVERNING BODY] by rulemaking.
 - 1) The burden shall be on the applicant to show circumstances to establish hardship or infeasibility under this section.
 - 2) If the [GOVERNING BODY] determines that the required verification requirement is not practicable for a project, the [GOVERNING BODY] shall determine if another green building standard is practicable before exempting the project from all green building requirements.
 - 3) The [GOVERNING BODY] shall promulgate rules to establish requirements for the exemption process within 180 days of the effective date of this ordinance.
- (d) Notwithstanding any other provision of this ordinance, construction encompassed by building construction permits applied for within 180 days (6 months) of the effective date of this ordinance shall be exempt from the verification requirements of this ordinance.
- (e) Notwithstanding any other provision of this ordinance, the [GOVERNING BODY], upon a finding of reasonable grounds, may extend the period for green building verifications required in Section 6(g) sub-parts (1) and (2), for up to three (3) successive 120-day (4-month) periods.

Section 12. Rulemaking. Within 180 days of the effective date of this ordinance, the [GOVERNING BODY] shall promulgate rules to implement this ordinance. The proposed rules shall be submitted to the [GOVERNING BODY] for a 45-day period of review, excluding Saturdays, Sundays, legal holidays, and days of [GOVERNING BODY] recess. If the [GOVERNING BODY] does not approve or disapprove the proposed rules, in whole or in part, by resolution within this 45-day review period, the proposed rules shall be deemed *approved*.

Section 13. That the [JURISDICTION'S KEEPER OF RECORDS] is hereby ordered and directed to cause this ordinance to be published. (An additional provision may be required to direct the number of times the ordinance is to be published and to specify that it is to be in a newspaper in general circulation. Posting may also be required.)

Section 14. That this ordinance and the rules, regulations, provisions, requirements, orders and matters established and adopted hereby shall take effect and be in full force and effect [TIME PERIOD] from and after the date of its final passage and adoption.

APPENDIX B

GREENHOUSE GAS REDUCTION IN EXISTING BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101 GENERAL

B101.1 Scope. The provisions of this chapter are designed to reduce *greenhouse gas* emissions in existing *buildings*.

Exception:

1. Phases 2 – 4 in Section B103 shall not be required for *buildings* with an initial certificate of occupancy less than 5 years old.
2. *Buildings* that generate less than [jurisdiction to insert] pounds of CO₂ per square foot., per year.
3. *Building* owners that demonstrate to the *code official* that GHG emission reductions meeting the intent of this code have been accomplished prior to adoption of this appendix.

B101.2 Intent. This chapter shall provide the basis and establish targets by which a jurisdiction can implement measures to reduce the emission of *greenhouse gases* in existing *buildings*. This chapter further intends to provide a structure by which other features can be introduced into existing *buildings* for the purpose of making them more sustainable.

SECTION B102 DEFINITIONS

CARBON FOOTPRINT, BUILDING. The total amount of *carbon dioxide equivalent* emissions associated with a *building's* energy use. A *building's* carbon footprint is the sum of direct *greenhouse gas* emissions, indirect *greenhouse gas* emissions (for district energy), and indirect *greenhouse gas* emissions (for purchased electricity). A *building's* carbon footprint does not include energy use associated with vehicle travel unless accounted for in the *building's* utility billing.

GHG REDUCTION PLAN. A plan that identifies quantifiable measures for reducing *greenhouse gas* (GHG) emissions. The plan shall include timelines for implementation, estimates of *greenhouse gas* reductions, and provisions for verifying actual *greenhouse gas* reductions – compared to original estimated reductions.

GREENHOUSE GAS INVENTORY. A comprehensive quantification of *greenhouse gas* emissions associated with a *building's* energy use limited to Scope 1 and Scope 2 *greenhouse gases* emitted from the use of primary and secondary energy.

SCOPE 1 GREENHOUSE GASES. Direct *greenhouse gas* emissions from the combustion of non-renewable fuels on-site including, but not limited to, natural gas or oil.

SCOPE 2 GREENHOUSE GASES. *Greenhouse gas* emissions resulting from the generation of electricity, heat, or steam purchased from sources off-site.

PRIMARY ENERGY. The raw fuel that is burned to create heat and electricity, including, but not limited to, natural gas or fuel oil used in onsite generation.

SECONDARY ENERGY. The energy product (heat or electricity) created from a raw fuel, such as electricity purchased from the grid or heat received from a district steam system.

SECTION B103 PHASES

B103.1 The adopting *jurisdiction* shall select Phase 1, 2, 3, or 4 as the level of compliance for application of this chapter. Adoption of Phases 2, 3, or 4 requires that the lower phase(s) shall be applicable.

B103.2 Phase 1 . Owners of *buildings* with a *total building floor area* greater than 5,000 square feet, and owners of individual spaces with an area greater than 5,000 square feet within multiple-tenant *buildings*, shall develop a *greenhouse gas* inventory to calculate the carbon footprint of their *building* or space within [JURISDICTION TO INSERT] months of adoption of this code by the *jurisdiction* as follows:

The carbon footprint shall be calculated using The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, Revised Edition developed by the World Resources Institute or other accepted industry practices protocols. Energy data that was used to determine the carbon footprint of a *building* shall be made available to the *jurisdiction* by *building* owners.

Exception: The omission of *process loads* from the carbon footprint calculations when provisions, such as separate *metering*, have been installed that make it possible to calculate process energy loads separately from a *building's* operational energy loads, as *approved* by the *code official*.

B103.3 Phase 2. Within [JURISDICTION TO INSERT] year(s) of performing the GHG inventory and calculating the carbon footprint identified in Phase 1, *building* owners shall develop a Greenhouse Gas Reduction Plan (Plan) to reduce GHG emissions by [JURISDICTION TO INSERT] percent.

B103.4 Phase 3. Within X¹ year(s) of developing the GHG Reduction Plan, *building* owners shall fully implement the p Plan. *Building* owners shall submit semi-annual reports to the *jurisdiction* that identify progress being made towards fulfillment of the GHG Reduction Plan.

B103.5 Phase 4. *Building* owners shall continue to reduce GHG emissions [JURISDICTION TO INSERT] percent per year (over the baseline year when the GHG Reduction Plan was first implemented) until total *greenhouse gas* emissions have been reduced by X percent.

**SECTION B104
GREENHOUSE GAS REDUCTION METHODS**

B104.1 Reduction in GHG's can be achieved by any of the following methods:

1. Implementation of *building* energy efficiency measures including, but not limited to, increasing insulation levels, installing higher efficient lighting and HVAC systems
2. Installing renewable energy on the *building* or site
3. Purchasing energy from renewable sources as approved by the *jurisdiction*. When energy purchased from renewable resources is used as a part of the GHG Reduction Plan, alternate provisions shall be included in the Plan that must be implemented when renewable energy purchases have ceased.
4. Any other method *approved* by the *jurisdiction* that reduces the amount of greenhouse gases generated by the *building's* operation, maintenance, and ongoing occupancy.

**SECTION B105
REFERENCED STANDARDS**

The Greenhouse Gas Protocol	A Corporate Accounting and Reporting Standard Revised Edition developed by the World Resources Institute.....	B103.2
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APPENDIX C

SUSTAINABILITY MEASURES

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION C101 GENERAL

C101.1 Scope. The provisions of this chapter are designed to increase the efficiency and sustainability of systems in existing *buildings*. These provisions apply to commercial *buildings* greater than 5000 square feet.

C101.2 Intent. This chapter shall provide the basis by which a *jurisdiction* can implement measures to increase the water and energy efficiency, in existing *buildings*. This chapter further intends to provide a structure by which other features can be introduced into existing *buildings* for the purpose of making them more sustainable.

SECTION C102 EFFICIENCY AND SUSTAINABILITY MEASURES

C102.1 Additional efficiency and sustainability measures within this section shall be incorporated into existing *buildings* within [JURISDICTION TO INSERT] months of adoption of this appendix.

C102.2 Energy performance. Use one of the following four options to establish an acceptable level of energy use and measure energy efficiency performance:

Option 1: Receive an ENERGY STAR® rating of 75 or higher.

Option 2: Reduce energy use by [JURISDICTION TO INSERT] percent compared to *building* energy use in 2003 or a year thereafter with quality energy use data.

Option 3: Reduce energy use by [JURISDICTION TO INSERT] percent compared to the ASHRAE 90.1 2007 baseline *building* design if design information is available.

Option 4: Reduce energy use by [JURISDICTION TO INSERT] percent using an alternate metric *approved* by the *code official*.

Exception: Adopting jurisdictions that do not have regulatory authority to establish energy efficiency standards are exempt from the provisions of Section B105.2.

C 102.3 Integrated assessment, operation, and management. Use an integrated team to develop and implement policy regarding sustainable operations and maintenance including:

1. Assess existing condition and operational procedures of the *building* and major *building* and systems and identify areas for improvement

2. Establish operational performance goals for energy, water, material use and recycling, and indoor environmental quality, and ensure incorporation of these goals throughout the remaining lifecycle of the *building*.
3. Incorporate a *building* management plan to ensure that operating decisions and tenant education are carried out with regard to integrated, sustainable *building* operations and maintenance
4. Augment *building* operations and maintenance as needed using occupant feedback on work space satisfaction.

C102.4 Recommissioning. A recommissioning plan shall be developed and implemented by an *approved agency*. The recommissioning shall be tailored to the size and complexity of the *building* and its system components in order to optimize and verify performance of fundamental *building* systems. A final report documenting performance verification and correction of any discrepancies shall be filed with the jurisdiction upon request of the *code official*.

C 102.5 Water conservation.

C 102.5.1 Indoor water. One of the two following options shall be used to measure and reduce indoor *potable* water use:

Option 1: Reduce *potable* water use by 20 percent compared to a water baseline calculated for the *building*. The water baseline, for *buildings* with plumbing fixtures installed in 1994 or later, is 120 percent of the *International Plumbing Code 2006* fixture performance requirements. The water baseline for plumbing fixtures older than 1994 is 160 percent of the *International Plumbing Code 2006* fixture performance requirements, or;

Option 2: Reduce *building* measured *potable* water use by 20 percent compared to *building* water use in 2003 or a year thereafter with quality water data.

C102.5.2 Outdoor water. One of the three following options shall be used to measure and reduce outdoor *potable* water use:

Option 1: Reduce *potable* irrigation water use by 50 percent compared to conventional methods, or;

Option 2: Reduce *building* related *potable* irrigation water use by 50 percent compared to measured irrigation water use in 2003 or a year thereafter with quality water data, or;

Option 3: Use no *potable* irrigation water.

C102.5.3 Measurement of water use. Water *meters* for *building sites* with significant indoor and outdoor water use shall be used. If only one meter is installed, reduce *potable* water use (indoor and outdoor combined) by at least 20 percent compared to *building* water use in [year to be inserted by jurisdiction.]

C102.6 Indoor environmental quality enhancement. The indoor environmental quality of buildings shall be improved in accordance with Sections C102.6.1 through C102.6.6.

C102.6.1 Ventilation and thermal comfort. To the extent that is feasible, and as *approved* by the *code official*, compliance with ASHRAE 55 and 62.1 shall be required.

C102.6.2 Moisture control. A moisture control plan appropriate to the building shall be developed that includes measures to prevent *building* damage, minimize mold contamination, and reduce health risks related to moisture. For façade renovations, Dew Point analysis and a plan for cleanup or infiltration of moisture into *building* materials shall be included in the moisture control plan.

C102.6.3 Daylighting and lighting controls. Automated lighting controls including, but not limited to, occupancy and vacancy sensors with *manual-off* capability, shall be provided for appropriate spaces including, but not limited to, restrooms, conference, training, lunch, break and meeting rooms and offices. Daylighting or occupant controlled lighting shall be provided in accordance with one of the following:

1. Achieve a minimum daylight factor of 2 percent (excluding all direct sunlight penetration) in 50 percent of all space occupied for critical visual tasks, or;
2. Provide occupant controlled lighting, allowing adjustments to suit individual task needs, for 50 percent of *regularly occupied spaces*.

C102.6.4 Low-emitting materials. A plan shall be developed specifying the use of low VOC emitting materials for *building* modifications, maintenance, and cleaning. The plan shall specify the following materials and products to have low pollutant emissions: composite wood products, adhesives, sealants, interior paints and finishes, solvents, carpet systems, janitorial supplies, and furnishings. Standards for low-emitting materials shall be as required in Chapter 8 of this code.

C102.6.5 Integrated pest management. Integrated pest management techniques shall be specified that are appropriate to the building and building site and minimize pesticide usage.

C102.6.6 Environmental tobacco smoke control. Smoking within the *building* and within 25 feet of all *building* entrances, operable windows, and *building ventilation* intakes shall be prohibited.

C102.7 Reduced material environmental impact. The environmental impact of materials shall be reduced in accordance with this section.

C102.7.1 Waste and materials management. Where markets or on-site recycling exists, reuse and recycling services for *building* occupants shall be provided. Salvage, reuse and recycling services for waste generated from *building* operations, maintenance, repair and minor renovations, and discarded furnishings, equipment and property shall be provided, including, but not limited to, beverage containers and paper from *building* occupants, batteries, toner cartridges, outdated computers from equipment updates and construction materials from a minor renovation.

C102.7.2 Ozone depleting compounds. The use of ozone depleting compounds shall be prohibited where alternative environmentally preferable products are available, consistent with either the Montreal Protocol and Title VI of the Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account lifecycle impacts.

**SECTION C103
REFERENCED STANDARDS**

ASHRAE 55 – 2004	Thermal Environmental Conditions on Human Occupancy	C102.6.1
ASHRAE 62.1 – 2010	Ventilation for Acceptable Indoor Air Quality	C102.6.1
ASHRAE 90.1 – 2010	Energy Standard for Buildings Except Low-Rise Residential Buildings	C102.2
EPA	Energy Star	C102.2
IPC	International Plumbing Code 2012	C102.5.1
Montreal Protocol		C102.7.2
Clean Air Act 1990	Title VI of Clean Air Act Amendments of 1990...	C102.7.4

APPENDIX D

ENFORCEMENT PROCEDURES

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

D101 GENERAL

D101.1 Scope. The provisions of this appendix shall supplement the provisions of Chapter 1 and provide procedures to enforce continued compliance of *buildings, structures* and *building sites* constructed and protected under the provisions of this code.

D101.2 Intent. This appendix shall be construed to secure its expressed intent, which is to ensure public health, safety and welfare and protection of the environment insofar as they are affected by the continued occupancy and maintenance of *buildings* and *building sites*. Existing *buildings, structures* and *building site* improvements that do not comply with these provisions shall be *altered* or *repaired* to restore compliance with this code.

D102 APPLICABILITY

D102.1 General. Equipment, systems, devices, safeguards and protections required by this code or a previous code under which the *building, structure* or *building site* was constructed, *altered* or *repaired*; or under which portions of the *building site* were protected; shall be maintained.

D102.2 Owner responsibility. Except as otherwise specified in this code, the owner or the owner's designated agent shall be responsible for the maintenance of *buildings, structures* and *building sites*. No owner, operator, or occupant shall cause any service, facility, equipment or utility that is required under this code to be removed or shut off from or discontinued.

D102.3 Existing remedies. The provisions of this chapter shall not be construed to abolish or impair existing remedies of the *jurisdiction* or its officers or agencies relating to the removal or demolition of any *structure* or *building site* improvement that is dangerous, unsafe or causing irreparable harm to environmental systems.

D103 DEFINITIONS

D103.1 Definitions. The following words and terms shall, for the purposes of this chapter and used elsewhere in this code, have the meanings shown herein.

OWNER. Any person, agent, operator, firm or corporation having a legal or equitable interest in a *building site*; or recorded in the official records of the state, county or municipality as holding title to the *building site*; or otherwise having control of the *building site*, including the guardian of an estate of any person, and the executor or administrator of the estate of such person if ordered to take possession of real property by a court.

OPERATOR. Any person who has charge, care or control of a *building, structure* and *building site* that is let or offered for occupancy.

STRICT LIABILITY OFFENSE. An offense in which the prosecution in a legal proceeding is not required to prove criminal intent as a part of its case. It is enough to prove that the defendant either did an act that is prohibited, or failed to do an act that the defendant was legally required to do.

D104 DUTIES AND POWERS OF THE CODE OFFICIAL

D104.1 General. The *code official* is hereby authorized and directed to enforce the provisions of this chapter.

D104.2 Inspections. The *code official* is authorized to make all inspections necessary for administration of this chapter, to assure compliance with maintenance requirements of this code and to resolve identified violations.

D104.3 Right of entry. Where it is necessary to make an inspection to enforce the provisions of this code, or whenever the *code official* has reasonable cause to believe there exists in a *building* or *structure* or on a *building site* a condition in violation of the code, the *code official* is authorized to enter the *building site*, and if needed to enter the *building* or *structure* at reasonable times to inspect or perform the duties imposed by this code. Where the *building site* or *building* is occupied, the *code official* shall present identification credentials to the occupant and request entry. If the *building site* or *building* is unoccupied, the *code official* shall first make a reasonable effort to locate the owner or other person having charge or control of the *building site* or *building* and request entry. If entry is refused, the *code official* shall have recourse to the remedies provided by law to secure entry.

D104.4 Identification. The *code official* shall carry proper identification credentials when inspecting a *building* or *building site* in the performance of duties under this code.

D104.5 Notices and orders. The *code official* shall issue all necessary notices or orders to ensure compliance with this code.

D105 VIOLATIONS

D105.1 Unlawful acts. It shall be unlawful for an owner or an owner's designated agent to be in conflict with, or violation of, any of the provisions of this code.

D105.2 Notice of violation. The *code official* shall serve notice of the violation or issue an order in accordance with Section D106.

D105.3 Prosecution of violation. Any person failing to comply with a notice of violation or order served in accordance with Section D106 shall be deemed guilty of a misdemeanor or civil infraction as determined by the *jurisdiction*, and the violation shall be deemed a strict liability offense. If the notice of violation or order is not complied with, the *code official* shall institute the appropriate proceeding at law or in equity to restrain, correct or abate the violation. The expenses incurred by the *jurisdiction* during action taken by the *jurisdiction* on the *building site* or in the *building* shall be charged against the real estate of the *building site* and shall be a lien upon such real estate.

D105.4 Violation penalties. Any person who violates the provisions of this code, or fails to comply with the provisions of this code, shall be prosecuted within the limits provided by the laws of the state and *jurisdiction*. Each day that a violation continues after notice has been served in accordance with Section D106 shall be deemed a separate violation and offense.

D105.5 Abatement of violation. The imposition of penalties under the provisions of this code shall not preclude the legal officer of the *jurisdiction* from instituting appropriate action to restrain, correct or abate a violation, or to prevent illegal occupancy of a *building, structure* or *building site*, or to stop an illegal act, conduct, business or utilization of a *building, structure* or *building site*.

D106 NOTICES AND ORDERS

D106.1 Notice of violation. Whenever the *code official* determines that there has been a violation of this code or has grounds to believe that a violation has occurred, notice shall be given in the form and manner prescribed in Sections D106.2 and D106.3.

D106.2 Form of notice. A notice of violation prescribed in Section D106.1 shall be in accordance with the following:

1. Be in writing;
2. Include a real estate description of the *building site* sufficient for identification;
3. Include a statement of the violation or violations and why the notice is being issued;
4. Include a correction order allowing a reasonable time to make *repairs* and improvements required to bring the *building, structure* and *building site* into compliance with the provisions of this code;
5. Inform the property owner and those receiving the notice and order of the right to appeal; and

6. Include a statement of the right of the *jurisdiction* to file a lien in accordance with Section D105.3.

D106.3 Service. A notice of violation and order to comply shall be served in accordance with Sections D106.3.1 and D106.3.2.

D106.3.1 Recipient of notice. The notice of violation and order to comply shall be served on the person responsible for the violation of the code. When the person responsible for the violation is someone other than the owner of the *building* and *building site*, a copy of the notice shall also be served on the property owner.

D106.3.2 Method of service. Such notice and order to comply shall be deemed to be properly served if a copy is:

1. Delivered personally; or
2. Sent by certified or first-class mail addressed to the last known address.

If a notice served by mail is returned showing that the letter was not delivered, a copy of the notice and order shall be posted in a conspicuous place in or about the *building*, *structure* or *building site* affected by the notice.

D106.4 Unauthorized tampering. Notices, orders, signs, tags or seals posted or affixed by the *code official* shall not be mutilated, destroyed or tampered with, or removed without authorization from the *code official*.

D106.5 Penalties. Penalties for noncompliance with notices and orders shall be as set forth in Section D105.4.

D106.6 Transfer of ownership. It shall be unlawful of the owner of any *building*, *structure* or *building site* who has received a compliance order or upon whom a notice of violation has been served, to sell, transfer, mortgage, lease or otherwise dispose of the *building*, *structure* or *building site* to another until the provisions of the compliance order or notice of violation have been complied with, or until such owner shall first furnish the grantee, transferee, mortgagee or lessee a true copy of any compliance order or notice of violation issued by the *code official* and shall furnish to the *code official* a signed and notarized statement from the grantee, transferee, mortgagee or lessee, acknowledging the receipt of such compliance order or notice of violation and fully accepting the responsibility without condition for making corrections or *repairs* required by such compliance order or notice of violation.

D107 EMERGENCY MEASURES AND ABATEMENT

D107.1 Imminent hazard. When, in the opinion of the *code official*, there is an imminent hazard to the *building site* or to surrounding public and private property resulting from the failure of a *building* or *building site* system, including but not limited to: stormwater management systems; erosion control measures; *graywater* or *rainwater* collection systems; or dry vegetation used for vegetative roofs or *hardscape* shading; which endangers life or which will cause irreparable harm to environmental systems on, or adjacent to, the *building site*, the *code official* is hereby authorized and empowered to order immediate *repair* of these systems and measures to restore proper operation.

D107.2 Temporary safeguards. Notwithstanding other provisions of this code, whenever, in the opinion of the *code official*, there is an imminent hazard due to the failures of systems and measures, the *code official* shall order the necessary work done, whether or not the legal procedures specified in this chapter has been instituted; and shall cause such other action to be taken as the *code official* deems necessary to resolve the hazard.

D107.3 Closing streets. When necessary for public safety, the *code official* shall temporarily close or order the authority having *jurisdiction* to close sidewalks, streets, public ways and bicycle pathways, adjacent to the hazardous location.

D107.4 Emergency repairs. For the purposes of this section, the *code official* shall employ the necessary labor and materials to perform the required work as expeditiously as possible.

D107.5 Costs of emergency repairs. Costs incurred in the performance of the emergency work shall be paid by the *jurisdiction*. The legal counsel of the *jurisdiction* shall institute appropriate action against the owner of the *building site* for the recovery of the costs.

D107.6 Hearing. Any person ordered to take emergency measures shall comply with such order forthwith. Any person affected thereafter, upon application to the board of violation appeals shall be afforded a hearing as described in this code.

D108 MEANS OF APPEAL

D108.1 General. In order to hear and decide appeals of notices of violation and orders of compliance issued by the *code official* pursuant to this chapter, there shall be and hereby created a board of violation appeals. Where the board of appeals established under Section 108 is in compliance with the provisions of Sections D108.1 through D108.6, the board of appeals shall be permitted to serve as the board of violation appeals.

D108.2 Board of violation appeals. The board of violation appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure.

D108.2.1 Membership of the board. The board of violation appeals shall consist of a minimum of three members who are qualified by experience and training to pass on matters regulated by this code. Members shall be appointed to serve staggered and overlapping terms. Members of the board shall not be employees of the *jurisdiction*. The *code official* shall be an ex-officio member but shall have no vote on any matter before the board.

D108.2.2 Alternate members. The governing authority shall appoint two or more alternate members who shall be called by the chair of the board to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership.

D108.2.3 Board chair. The board shall annually select one of its members to serve as chair.

D108.2.4 Disqualification of member. A member shall not hear an appeal in which that member has a personal, professional or financial interest.

D108.2.5 Secretary. The *code official* shall designate a qualified person to serve as secretary to the board. The secretary shall file a detailed record of all proceedings in the office of the *code official*.

D108.3 Application for appeal. Any person receiving a notice of violation issued by the *code official* pursuant to this chapter, shall have the right to appeal to the board of violation appeals. The application for appeal shall be in writing and filed within 20 days after the day the notice of violation was served. An application for appeal shall be based on a claim that the requirements of this code are adequately satisfied.

D108.4 Stays of enforcement. Other than notices of *imminent hazard*, appeals of notices and orders shall stay the enforcement of the notice and order until the appeal is heard by the board of violation appeals.

D108.5 Hearing. Hearings of appeals shall be in accordance with Sections D108.5.1 through D108.5.5.

D108.5.1 Notice. The board shall meet upon notice from the chair, within 20 days of the filing of an appeal, or at stated periodic meetings. Notice of the board meeting shall be published in the newspaper of record for the *jurisdiction*. Written notice shall be provided to the owner of the *building site* subject to the notice of violation as well as any person cited in the notice of violation.

D108.5.2 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the *code official* and any person whose interests are affected shall be given an opportunity to be heard.

D108.5.3 Quorum. A quorum shall consist of not less than two-thirds of the board membership. A quorum shall be present in order for a hearing to proceed.

D108.5.4 Hearing procedures. The board shall adopt and make available to the public through the secretary procedures under which a hearing will be conducted. The procedures shall not require compliance under strict rules of evidence, but shall mandate that only relevant information be received.

D108.5.5 Postponement of hearing. When the full board is not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request postponement of the hearing.

D108.6 Board decision. The board of violations appeal shall either uphold, modify or reverse the decision of the *code official*. The board shall modify or reverse the decision of the *code official* only by a concurring vote of a majority of the total number of appointed board members. The decision of the board to uphold, modify or reverse the decision of the *code official* shall be in writing and shall direct actions appropriate to implement the decision.

D108.6.1 Records and copies. The decision and directive of the board shall be recorded. Copies shall be furnished to the appellant, the owner of the *building site* and to the *code official*.

D108.6.2 Implementation. The *code official* shall take immediate action in accordance with the decision of the board.

D108.7 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law.

