



# **2011 OREGON REACH CODE**

Based on the 2012 International Green  
Construction Code™ (IGCC™)

# 2011 OREGON REACH CODE

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By

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## PREFACE

Oregon has adopted the International Green Construction Code with amendments to serve as the Oregon Reach Code. Amendments were made to ensure compatibility with Oregon’s other codes and jurisdictional prerequisites. While Oregon retained much of the International Green Construction Code Public Version 2.0’s structure, Chapter 7 is based on the International Association of Plumbing and Mechanical Officials Green Plumbing and Mechanical Code.

### 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](http://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.

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## OREGON REACH CODE

The Oregon Reach Code was developed based on the Public Versions 1.0 and 2.0 of the International Green Construction Code and with the input of a policy advisory committee and technical sub-committee. The policy advisory committee was composed of: Bill Clemens, Oregon Building Officials Association (OBOA); David Cohan, Energy Efficiency Northwest Energy Efficiency Alliance (NEEA); Jim Denno, Oregon Department Of Energy (ODOE); Joe Esmonde, International Brotherhood Of Electrical Workers, Local 48; Franko Martinec, Port Of Portland; Tom Payne, Oregon Home Builders Association (OHBA); Kate Turpin, Sera Architects; Rob Yorke Associated Builders & Contractors (ABC). The Technical Sub-Committee Was Comprised Of: Curt Wilson, Pivot Architecture; Dana Troy Glumac; Jim Edleson New Buildings Institute; Franko Martinec, Port Of Portland; Mark Firestone, PAE Engineering; Mike Rosenberg PNNL. Oregon building code division staff Mark Heizer, Dana Fischer and Aeron Teverbaugh also served on the technical sub-committee.

## ROADMAP TO THE REACH CODE

While Oregon maintained much of the structure of the International Green Construction Code, the state's statutory framework resulted in a customization of the provisions. While, Chapter 3 is the core of the *International Green Construction Code*, Oregon does not allow for customization of the code to address local issues. Oregon did retain where possible the options for construction contained in Table 303.1, which introduces the concept of project electives, are fundamental to the understanding and use of this code.

Builders are required to pick two project electives, 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 designated as project electives and the provisions of chapter 9, are mandatory as applicable. 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*.

# Table of Contents

<b>CHAPTER 1: ADMINISTRATION .....</b>	<b>1</b>
SECTION 101: GENERAL	1
SECTION 102: APPLICABILITY	1
SECTION 103: DUTIES AND POWERS OF THE CODE OFFICIAL	4
SECTION 104: CONSTRUCTION DOCUMENTS	4
SECTION 105: APPROVAL	4
SECTION 106: PERMITS	5
SECTION 107: FEES	6
SECTION 108: BOARD OF APPEALS	6
SECTION 109: CERTIFICATE OF OCCUPANCY	6
<b>CHAPTER 2: DEFINITIONS .....</b>	<b>7</b>
SECTION 201: GENERAL	7
SECTION 202: DEFINITIONS	7
<b>CHAPTER 3 JURISDICTIONAL REQUIREMENTS AND PROJECT ELECTIVES .....</b>	<b>27</b>
SECTION 301: GENERAL	27
SECTION 302: JURISDICTIONAL REQUIREMENTS	27
SECTION 303: PROJECT ELECTIVES	29
SECTION 304: WHOLE BUILDING LIFE CYCLE ASSESSMENT	32
<b>CHAPTER 4: SITE DEVELOPMENT AND LAND USE .....</b>	<b>35</b>
SECTION 401: GENERAL	35
SECTION 402: PRESERVATION OF NATURAL RESOURCES	35
SECTION 403: TRANSPORTATION IMPACT	40
SECTION 404: HEAT ISLAND MITIGATION	42
SECTION 405: SITE LIGHTING	44
SECTION 406: DETAILED SITE DEVELOPMENT REQUIREMENTS	46
SECTION 407: PROJECT ELECTIVES	54
<b>CHAPTER 5: MATERIAL RESOURCE CONSERVATION AND EFFICIENCY .....</b>	<b>57</b>
SECTION 501: GENERAL	57
SECTION 502: MATERIAL AND WASTE MANAGEMENT	57
SECTION 503: MATERIAL SELECTION	58
SECTION 504: LAMPS	59
SECTION 505: SERVICE LIFE	59

SECTION 506: MOISTURE CONTROL AND MATERIAL STORAGE AND HANDLING 60

SECTION 507: STRAWBALE CONSTRUCTION 61

SECTION 508: PROJECT ELECTIVES 72

**CHAPTER 6: ENERGY CONSERVATION, EFFICIENCY AND ATMOSPHERIC QUALITY . 75**

SECTION 601: GENERAL 75

SECTION 602: ENERGY PERFORMANCE, PEAK POWER AND REDUCED CO2E EMISSIONS 75

SECTION 603: ENERGY USE AND ATMOSPHERIC IMPACTS 77

SECTION 604: ENERGY METERING, MONITORING AND REPORTING 84

SECTION 605: AUTOMATED DEMAND RESPONSE (AUTO-DR) INFRASTRUCTURE 87

SECTION 606: BUILDING ENVELOPE SYSTEMS 89

SECTION 607: BUILDING MECHANICAL SYSTEMS 91

SECTION 608: BUILDING SERVICE WATER HEATING SYSTEMS 97

SECTION 609: BUILDING ELECTRICAL POWER AND LIGHTING SYSTEMS 99

SECTION 610: SPECIFIC APPLIANCES AND EQUIPMENT 105

SECTION 611: BUILDING RENEWABLE ENERGY SYSTEMS 107

SECTION 612: ENERGY SYSTEMS COMMISSIONING AND COMPLETION 110

SECTION 613: JURISDICTIONAL REQUIREMENTS & PROJECT ELECTIVES 114

**CHAPTER 7: WATER RESOURCE CONSERVATION AND EFFICIENCY ..... 119**

SECTION 701: GENERAL 119

SECTION 702: FIXTURES, FITTINGS, EQUIPMENT AND APPLIANCES 119

SECTION 703: HVAC SYSTEMS AND EQUIPMENT 124

SECTION 704: WATER TREATMENT DEVICES AND EQUIPMENT 126

SECTION 705: SPECIFIC WATER CONSERVATION MEASURES 127

SECTION 706: NON-POTABLE WATER REQUIREMENTS 127

SECTION 707: RAINWATER COLLECTION AND DISTRIBUTION SYSTEMS 128

SECTION 708: GRAYWATER SYSTEMS 136

SECTION 709: RECLAIMED WATER SYSTEMS 142

SECTION 710: PROJECT ELECTIVES 144

**CHAPTER 8: INDOOR ENVIRONMENTAL QUALITY AND COMFORT ..... 147**

SECTION 801: GENERAL 147

SECTION 802: BUILDING CONSTRUCTION FEATURES, OPERATIONS AND MAINTENANCE FACILITATION 147

SECTION 803: HVAC SYSTEMS 147

SECTION 804: SPECIFIC INDOOR AIR QUALITY & POLLUTANT CONTROL MEASURES 149

SECTION 805: ASBESTOS USE PREVENTION 156

SECTION 806: MATERIAL EMISSIONS & POLLUTANT CONTROL	156
SECTION 807: ACOUSTICS	162
SECTION 808: DAYLIGHTING	165
SECTION 809: PROJECT ELECTIVES	167
<b>CHAPTER 9: COMMISSIONING, OPERATION AND MAINTENTANCE (Provided for reference only)</b>	<b>171</b>
SECTION 901: GENERAL	171
SECTION 902: APPROVED AGENCY	171
SECTION 903: COMMISSIONING	171
SECTION 904: BUILDING OPERATIONS, MAINTENANCE AND OWNER EDUCATION	177
<b>CHAPTER 10: EXISTING BUILDINGS</b>	<b>181</b>
SECTION 1001: GENERAL	181
SECTION 1002: ADDITIONS	181
SECTION 1003: ALTERATIONS TO EXISTING BUILDINGS	182
SECTION 1004: CHANGE OF OCCUPANCY	187
SECTION 1005: HISTORIC BUILDINGS	187
SECTION 1007: JURISDICTIONAL REQUIREMENTS	187
<b>CHAPTER 11 EXISTING BUILDING SITE DEVELOPMENT</b>	<b>189</b>
SECTION 1101: GENERAL	189
SECTION 1102: ADDITIONS	190
SECTION 1103: ALTERATIONS TO EXISTING BUILDING SITES	190
SECTION 1104: CHANGE OF OCCUPANCY	191
SECTION 1105: HISTORIC BUILDING SITES	191
<b>CHAPTER 12: REFERENCED STANDARDS</b>	<b>193</b>
<b>APPENDIX A: MATERIAL RESOURCE CONSERVATION AND EFFICIENCY</b>	<b>201</b>
SECTION A101.1: SCOPE	
SECTION A101.2: INTENT	
SECTION A102.1 CONSTRUCTION MATERIAL AND WASTE MANAGEMENT PLAN	
SECTION A102.2 BUILDING SITE WASTE MANAGEMENT PLAN	
SECTION A102.3 DEMOLITION OR DECONSTRUCTION	
<b>APPENDIX B: SITE LIGHTING</b>	<b>207</b>
SECTION B101: UPLIGHT	207
SECTION B102: LIGHT TRESSPASS AND GLARE	207

# CHAPTER 1 ADMINISTRATION

## PART 1 --- SCOPE AND APPLICATION

### SECTION 101 GENERAL

**101.1 Title.** These regulations shall be known as the Oregon Commercial Reach Code, hereinafter referred to as “this code.”

**101.2 Scope.** The provisions of this code shall apply to the design, construction, *addition, alteration, replacement, repair*, equipment, and site orientation, 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 *Building Code*.

This code shall not apply to the following:

1. Where an owner or designer has not opted to build under this code.
2. Any Group R, Residential occupancies except as provided for in Section 102.4.12.
3. 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 by the authority having jurisdiction.

**101.3 Intent.** This code shall be an optional set of construction standards and methods that are economically and technically feasible, to regulate the design and construction of buildings for the effective use of energy and the employment of renewable energy technologies. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve the effective use of energy, and to reduce the negative potential impacts of the built environment. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes and ordinances.

### SECTION 102 APPLICABILITY

**102.1 General.** This code is an overlay to the other Oregon Specialty 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.

**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 102.4.11, 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 referenced code or standard includes subject matter that is within the scope of this code or codes listed in Section 102.4 the provisions of this code or the code 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 *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 *Building Code* shall also apply.

**102.4.3 Fuel Gas.** The provisions of the *Mechanical 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 *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 *Oregon Plumbing Specialty 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. RESERVED**

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

**102.4.8 Performance. RESERVED**

**102.4.9 Existing buildings.** The provisions of the *International Existing Building Code* as amended by Oregon in Statewide Alternate Method OSSC 08-05, 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.

#### **102.4.10 Zoning. RESERVED**

**102.4.11 Residential occupancies.** The provisions of Chapter 13, the *Residential Reach Code* shall apply to the design and construction of *buildings* or portions thereof of detached one-and two-family dwellings and townhouses not more than three stories above grade in height with a separate means of egress.

**Exception:** Buildings permitted under the *Oregon Structural Specialty Code* shall comply with the commercial provisions.

**102.4.11.1 Residential mixed use occupancies.** The design and construction of residential portions of mixed use *buildings* shall comply with Section 102.4.11. The remainder of the *building* and the site on which the *building* is located shall comply with the provisions of this code. Where there are specific provisions provided in *Oregon Residential Reach Code* that regulate the design and construction of residential portions of the mixed occupancy, the provisions of the *Oregon Residential Reach Code* shall apply.

**Exception:** High-rise *buildings* as defined by the *Building Code* shall comply with the provisions of this code or the *Oregon Residential Reach 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 Building Code*, , the *International Existing Building Code as adopted by Oregon*, 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, except as provided in Section 102.4.11.

## **PART 2 --- ADMINISTRATION AND ENFORCEMENT**

### **SECTION 103 DUTIES AND POWERS OF THE CODE OFFICIAL**

**103.1 General.** The *code official* established in the *Building Code and Oregon Administrative Rules* is hereby authorized and directed to enforce the provisions of this code. The *code official* shall have the authority to render interpretations 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 contain the code and version under which the project is permitted. 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, and installed in accordance with such approval.

**105.2.1 Used materials, products and equipment.** The use of used materials, products and equipment which 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*, 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 Jurisdiction having authority for the intended work prescribed in an application.

**SECTION 108  
BOARD OF APPEALS**

**108.1 General.**

In order to hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of this code the local jurisdiction shall establish an appeals procedure.

**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 thereunder 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 Appeal of Decisions of Building Official.** ORS 455.475 provides an alternative appeals process to that set forth by the local municipality.

**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 therefore 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 *Building 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 *Oregon Structural Specialty Code, Oregon Energy Efficiency Specialty Code, Oregon Fire Code, Oregon Mechanical Specialty Code or Oregon Plumbing Specialty 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

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

**[B] ALTERATION.** Any construction or renovation to an *existing structure* other than *repair* or addition that requires a permit. Also, a change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation that requires a permit.

**[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.

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

**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.** The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

**[M] BTU.** Abbreviation for British thermal unit, which is the amount of heat required to raise the temperature of 1 pound (0.454 kg) of water from 59°F to 60°F (15° C to 16°) (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 CODE.** Means the Oregon Structural Specialty Code (OSSC).

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

**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* element(s) that enclose *conditioned space*. This boundary also includes the boundary between *conditioned space* and any exempt or unconditioned space.

**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.** See Building Official.

**COMMERCIAL BUILDING.** For this code, all *buildings* that are not included in the definition of *residential building*.

**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.

**COMPLEX MECHANICAL SYSTEM.** An HVAC system serving multiple zones per the *Energy Code*, Section 503.4. Not a Simple Mechanical System as defined by the *Energy Code*, Section 503.3.

**[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*, includes required completed checklist.

**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 *Energy 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 *Energy Code*. Occupant sensors are permitted to incorporate an integral maximum three (3) watt LED night light that functions when loads are shut off. [Section number based on change proposed for incorporation in the 2012 IECC].

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

**DAYLIT AREA.** That portion of a *building's* interior floor area that is regularly illuminated by natural light, as determined in accordance with Section 808.4.

**DAYLIGHT SATURATION.** The percentage of daytime hours throughout the year when 30 foot-candles (323 lux) of natural light is provided at a height of 30 inches (762 mm) above the floor. Partial credit is allowed for times when less than 30 foot-candles of natural light is provided. Credit is not allowed for times when 450 foot-candles or more of natural light is provided.

**DAYLIGHT ZONE, SIDELIGHTING.** The floor area adjacent to fenestration in an *unobstructed exterior wall*. This area extends back from the exterior wall to the nearest 56 inch high partition, up to 2 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, up to 0.5 times the height from the floor to the top of the fenestration.

**DAYLIGHT ZONE, TOPLIGHTING.** The floor area beneath a *skylight* or monitor in an *unobstructed roof*. This area extends laterally and longitudinally beyond the edge of the *skylight* or monitor to the nearest 56 inch high partition, up to 0.7 times the height from the floor to the bottom of the *skylight* well.

**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* apart, piece-by-piece, with the intent of recycling or salvaging as many of the materials 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.

**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.

**EFFECTIVE APERTURE.** The effective aperture for vertical fenestration is the area of glazing in the unobstructed wall times the visible transmittance (VT) of this glazing, divided by the floor area in the *daylight zone*. The effective aperture for *skylights* is the area of glazing in the unobstructed roof times the visible transmittance (VT) of this glazing, divided by the floor area in the *daylight zone*.

**ELECTRICAL CODE.** Means the *Oregon Electrical Specialty Code (OESC)*.

**ENERGY CODE.** Means the *Oregon Energy Efficiency Specialty Code (OEESC)*.

**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.

**ENCLOSED SPACE.** Means a single area without separation walls.

**[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.

**EQUIVALENT HEIGHT.** The continuous height, in vertical degrees, of an obstruction that provides the same obstructive effect as a series of obstructions of variable height. The line of equivalent height is drawn where the area of obstruction above equals the area of obstruction below. Determination shall be made on a floor by floor basis.

**[B] EXISTING STRUCTURE.** See *Building Code*.

**EXTERIOR WALL, FULLY 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*.

**EXTERIOR WALL, PARTIALLY OBSTRUCTED.** That portion of an exterior wall that is not a *fully obstructed exterior wall*, but which faces *buildings, structures*, or geological formations with an *equivalent height* more than 30 degrees above the horizon. For the purposes of this determination, the maximum allowed height 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.

**EXTERIOR WALL, UNOBSTRUCTED.** That portion of an exterior wall that is not an *obstructed exterior wall*, or a *partially obstructed exterior wall*.

**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.

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

**[B] FIREPLACE.** An assembly consisting of a hearth and fire chamber of noncombustible material and provided with a chimney, for use with solid fuels.

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

**[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.

**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* within the *jurisdiction*. 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.

**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.

**[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.

**LABORATORY EXHAUST.** Exhaust from fume hoods and laboratory process ventilation systems located in Group B, E and I-2 occupancies. Does not include exhaust from H Occupancy areas within these occupancies.

**LIFE CYCLE ASSESSMENT.** A technique to evaluate the relevant energy and material consumed and environmental emissions associated with the entire life of a *building*, product, process, 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.

**[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 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  $\leq 600$  Volts, and is rated for operation at a frequency of 60 Hertz.

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

**MECHANICAL CODE.** Means the *Oregon Mechanical Specialty Code (OMSC)*.

**MERV.** Duct system air filter minimum efficiency reporting value.

**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.

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

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

**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.

**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-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.

**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, 507, 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.

**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 ( $h \times ft^2 \times ^\circ F/Btu$ ) [ $(m^2 \times K)/W$ ].

**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.

**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.

**DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE OF BUILDING ENERGY SIMULATION.** A *building modeling professional* responsible for the review and coordination of the *building* energy simulation documents and files of the project, as determined by the *code official*, for compatibility with the design and simulation of *building* components and energy-using systems of the *building* or *structure*, including submittal documents prepared by others, deferred submittal documents and phased submittal documents. This *building modeling professional* is responsible for maintaining minimum competency in *building* energy simulation science in accordance with applicable certifications of minimum competence and nationally recognized standards. A *registered design professional* or a certified energy modeler as defined in the Whole Building Approach Instructions for Section 506 of the *Energy Code*.

**REGULARLY OCCUPIED SPACE.** A room or enclosed space which is regularly occupied for at least 1,000 daytime hours per year. Restrooms, locker rooms, showers, changing rooms, closets, corridors, stairwells, 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 internal heat of the earth. 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*.

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

**[E] RESIDENTIAL BUILDING.** For energy purposes only, detached one- and two-family dwellings, and multiple single-family dwellings (townhouses), *buildings* under the scope of the *Residential Code*, and Group R-2, R-3 and R-4 *buildings*, all of which are three stories or less in height above grade.

**RESIDENTIAL CODE.** Means *Oregon Residential Specialty Code (ORSC)*.

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

**ROOF, FULLY OBSTRUCTED.** A roof that is below ground and covered by soil.

**ROOF, PARTIALLY OBSTRUCTED.** That portion of the roof which 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, UNOBSTRUCTED.** A roof that is not a *fully obstructed roof* or a *partially obstructed roof*.

**SEQUENCE OF OPERATION (HVAC).** Generated as a fully descriptive, detailed account of the operation of HVAC systems, the *registered design professional* describes 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. A *sequence of operation* is developed during the design process, and finalized upon *commissioning*, when the operational details are initialized and validated. A *sequence of operation* is the final record of system operation, and is included on the control diagram 'as-built', or as part of the operation and maintenance (O&M) manuals that are turned over to the owner.

**[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, which 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.

**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.

**[E] STANDARD REFERENCE DESIGN.** A version of the *proposed design* that meets the minimum requirements of the *Energy Code* and the additional mandatory requirements of this code, and that is used to determine the maximum annual energy use for compliance based on total *building* performance.

**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.

**[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.

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

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

**[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 · ft<sup>2</sup> · °F) [W/(m<sup>2</sup> · K)].

**VEGETATIVE ROOF.**

**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.

**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.

**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.

## CHAPTER 3 JURISDICTIONAL REQUIREMENTS AND PROJECT ELECTIVES

### SECTION 301 GENERAL

**301.1 Scope.** This chapter contains requirements specific to Reach Code projects including elective requirements specific to the project and selected by the owner.

**301.1.1 Application.** The requirements contained in this code are applicable to buildings, or portions of buildings. These buildings shall meet either the requirements of ASHRAE/IESNA Standard 189.1, *Standard for the Design of High-Performance Green Buildings Except for Low-Rise Residential Buildings*.

**301.2 Mandatory and elective requirements.** This chapter 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.

**Exception:** *ASHRAE/IESNA Standard 189.1.*

### SECTION 302 JURISDICTIONAL REQUIREMENTS

RESERVED

### SECTION 303 PROJECT ELECTIVES

**303.1 Electives required.** A total of not less than 2 *project electives* indicated in Table 303.1 shall be selected by the owner. Such electives shall be applied as mandatory requirements to the project and shall be indicated to the *code official* by means of completion of a checklist to be included with the construction documents.

**Exception: Third Party Certification.** Where a project meets the criteria for certification under an approved high performance building program, and is certified by a third party evaluator qualified to perform a verification, as equivalent or better than a building constructed under the design requirements of section 602.2 then the project is deemed to meet the requirements of this code without additional project elective requirements.

**303.2 Project electives checklist.** The submitted *construction documents* shall include a completed copy of a checklist indicating which *project electives* that the owner has selected as a means to comply with Section 303.1. The *Project electives* selected shall be applied and enforced as mandatory requirements.

**TABLE 303.1  
PROJECT ELECTIVES CHECKLIST**

<b>Section</b>	<b>Description</b>
303.1	Third Party Certification <sup>1</sup>
404.3 & 405.6	Roof covering – vegetative roofs
<b>CH 5. MATERIAL RESOURCE CONSERVATION AND EFFICIENCY</b>	
508.2	Waste management (See 502.1 project elective must meet either a minimum of 50% diversion or where they exist, exceed jurisdictional requirements by 20%)
503.1	Reused, recycled content, recyclable, bio-based and indigenous materials (55-percent)
<b>CH 6. ENERGY CONSERVATION, EFFICIENCY AND EARTH ATMOSPHERIC QUALITY</b>	
	Project 25-percent improvement over the 2010 OEESC (except where ASHRAE 90.1-2007, Appendix G is used improvement must equal a 33-percent improvement) <sup>2</sup>
	Project 30-percent improvement over the 2010 OEESC (except where ASHRAE 90.1-2007, Appendix G is used improvement must equal a 38-percent improvement) <sup>1</sup>
	Mechanical System Improvement of at least 10% <sup>3</sup> (not available if project is using the exception to 607.1.1.1 or 607.1.1.2)
	Service Water Heating
	Lighting system efficiency (if project is using 607.1.1.1 LPD must be 10-percent lower than required by 607.1.1.1)
	Building thermal envelope systems (must exceed values of prescriptive envelope requirements by at least 10%)
	Passive design
612.1.5.4 612.1.5.5 612.2 612.3.4 612.3.5 612.1.2	Post Occupancy Commissioning
611.1	Project Renewables (if project is using 607.1.1.2 Renewable output must equal at least 1.75 Btu's, or not less than 0.50 watt, per square foot of conditioned floor area or provide not less than 2-percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated.)
<b>CH 7. WATER RESOURCE CONSERVATION AND EFFICIENCY</b>	
710.2 &3	Appliances (for occupancies listed under 613.5.2)
710.5	Non-potable water for plumbing fixture flushing water project elective
710.8	Non-potable water for industrial process makeup water
710.11	Graywater collection
<b>CH 8 INDOOR ENVIRONMENTAL QUALITY AND COMFORT</b>	
808.3	Daylighting

1. This elective is the equivalent of 2 project electives
2. Based on the Whole Building Approach
3. See tables associated with section 607.2.4.

**SECTION 304  
WHOLE BUILDING LIFE CYCLE ASSESSMENT**

**RESERVED**

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## **CHAPTER 4 SITE DEVELOPMENT AND LAND USE**

### **SECTION 401 GENERAL**

**401.1 Scope and intent.** This chapter provides requirements for the development of *building* and *building sites* that encourage energy efficiency and potable and non-potable water conservation.

**401.2 Other regulations.** Where differences occur between the provisions of this code and the provisions of other referenced codes the provisions of the most restrictive code or regulation shall apply. Locally adopted land use, zoning or site development regulations shall apply.

### **SECTION 402 PRESERVATION OF NATURAL RESOURCES**

**402.1 General.** RESERVED.

**402.2 Protection by Area.** RESERVED.

**402.2.1 Floodplains.** RESERVED.

**402.2.1.1 Development in flood hazard areas.** RESERVED.

**402.2.1.2 Floodplain preservation.** RESERVED.

**402.2.2 Surface water protection.** RESERVED.

**402.2.3 Conservation area.** RESERVED.

**402.2.4 Park land.** RESERVED.

**402.2.5 Agricultural land.** RESERVED.

**402.2.6 Greenfield sites.** RESERVED.

**402.3 Site design and development.** RESERVED.

**402.3.1 Predesign site inventory and assessment.** RESERVED.

**402.3.2 Stormwater management.** RESERVED.

**402.3.3 Irrigation systems.** Irrigation systems for exterior landscaping shall comply with Sections 402.3.3.1 and 402.3.3.2.

**402.3.3.1 Water for outdoor landscape irrigation systems.** Water used in outdoor landscape irrigation systems shall comply with Sections 402.3.3.1.1 through 402.3.3.1.4.

**402.3.3.1.1 Potable water.** Developments shall reduce their use of *Potable* water for landscape irrigation by 50-percent.

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

1. During the establishment phase of newly planted landscaping. The establishment phase shall be not longer than the following:
  - a. 3 years for trees
  - b. 2 years for shrubs
  - c. 1 year for herbaceous cover plant
2. To irrigate food production.
3. *Potable* water is permitted for landscape irrigation when *approved* by local ordinance or regulation.

**402.3.3.1.2 Graywater systems.** RESERVED.

**402.3.3.1.3 Municipal reclaimed water.** Shall comply with the Oregon Department of Environmental Quality regulations and the provisions of the *Oregon Plumbing Specialty Code*.

**402.3.3.1.4 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.

**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 drip irrigation, soaker hoses, subsurface and surface irrigation, where practicable. Landscape irrigation systems shall not direct spray onto *building* exterior surfaces 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* using 20 gallons a day or more shall be supplied with either municipally reclaimed or collected *rainwater* complying with Section 402.3.3.1. Signage in accordance with the plumbing code, 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.** RESERVED.

**402.3.5.1 Landscape, soil and water quality protection plan.** RESERVED.

**402.3.5.2 Vegetation and soil protection.** RESERVED.

**402.3.5.3 Topsoil protection.** RESERVED.

**402.3.5.4 Soil reuse and restoration.** RESERVED.

**402.3.5.5 Imported soils.** RESERVED.

**402.3.5.6 Invasive species.** RESERVED.

**402.3.5.7 Documentation.** RESERVED.

**402.3.6 Building site waste management plan.** RESERVED (SEE APPENDIX A).

### **SECTION 403 TRANSPORTATION IMPACT**

**403.1 Walkways and bicycle paths.** RESERVED.

**403.2 Changing and shower facilities.** RESERVED.

**403.3 Bicycle parking and storage.** RESERVED.

**403.3.1 Short term bicycle parking.** RESERVED.

**403.3.2 Long term bicycle parking.** RESERVED.

**403.4 Vehicle parking.** RESERVED.

**403.4.1 High occupancy vehicle parking.** RESERVED.

**403.4.2 Low emission, hybrid, and electric vehicle parking.** RESERVED.

### **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 *Energy 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-ft<sup>2</sup> (12 W/m<sup>2</sup>\*k).

**404.2.2 Shading structures.** Where shading is provided by a structural device or element, such device or element shall comply with all of the following:

1. Where open trellis-type free standing structures such as, but not limited to, covered walkways, and trellises or pergolas, are covered with native plantings, they 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. *Construction documents* shall be submitted that show the planting location and anticipated five year canopy growth of all trees and that show the contributions of existing tree canopies; and;
2. 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 five year growth canopy. Duplicate shading credit shall not be granted for those areas where multiple trees shade the same *hardscape*.

**404.2.4 Open-grid pavers and open-graded aggregate.** Open-grid pavers and open-graded aggregate shall be permitted where the use of these types of *hardscapes* do 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.** Where a building owner chooses roof coverings as a project elective, not less than 75 percent of the roof surfaces of a *building* shall comply with 404.3.2.

Exception: Portions of roof surfaces where *solar thermal* collectors and *solar photovoltaic* 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.** RESERVED.

**404.3.1.1 Roof products testing.** RESERVED.

**404.3.1.2 Solar reflectance index.** RESERVED.

**404.3.2 Vegetative roofs.** Roofs shall be covered with either an *extensive* or *intensive vegetative roof*. *Vegetative roofs* shall comply with Section 405.6.

## SECTION 405 DETAILED SITE DEVELOPMENT REQUIREMENTS

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

**405.2 Subsurface graywater irrigation systems.** RESERVED. See Department of Environmental Quality rules, OAR 340-053.

**405.2.1 Estimating graywater discharge.** RESERVED.

**405.2.2 Percolation tests.** RESERVED.

**405.2.2.1 Percolation tests and procedures.** RESERVED

**405.2.2.1.1 Percolation test hole.** RESERVED.

**405.2.2.1.2 Test procedure, sandy soils.** RESERVED.

**405.2.2.1.3 Test procedure, other soils.** RESERVED.

**405.2.2.1.4 Mechanical test equipment.** RESERVED.

**405.2.3 Permeability evaluation.** RESERVED.

**405.2.4 Subsurface landscape irrigation site location.** RESERVED.

**405.2.5 Installation.** RESERVED.

**405.2.5.1 Absorption area.** RESERVED.

**405.2.5.2 Seepage trench excavations.** RESERVED.

**405.2.5.3 Seepage bed excavations.** RESERVED.

**405.2.5.4 Excavation and construction.** RESERVED.

**405.2.5.5 Aggregate and backfill.** RESERVED.

**405.2.6 Distribution piping.** RESERVED.

**405.3 Vegetation and soil protection.** RESERVED.

**405.4 Soil reuse and restoration.** RESERVED.

**405.4.1 Preparation.** RESERVED.

**405.4.2 Restoration.** RESERVED.

**405.4.2.1 Organic matter.** RESERVED.

**405.4.2.2 Additional soil restoration criteria.** RESERVED.

**405.4.3 Engineered growing media.** RESERVED.

**405.4.4 Documentation.** RESERVED.

**405.5 Landscape, soil and water quality protection plan.** RESERVED.

**405.6 Vegetative roofs.** *Extensive and intensive vegetative roofs*, where provided in accordance with Section 404.3 shall comply with ASTM E2396; ASTM E2397; ASTM E2398 and ASTM E2400 or, 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 complete coverage 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. There shall be a diversity of types and species of plants.

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 provide a wind erosion blanket that protects the engineered soil medium until the plants are established. The engineered soil medium shall be not less than 3 inches in depth in all areas.
3. All roof penetrations, changes in elevation and parapet walls shall be provided with a non-vegetated buffer not less than 12 inches wide. 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.

Plantings shall be managed to maintain the function of the vegetative roof.

**SECTION 406  
PROJECT ELECTIVES**

**RESERVED**

## CHAPTER 5 MATERIAL RESOURCE CONSERVATION AND EFFICIENCY

### SECTION 501 GENERAL

**501.1 Scope.** SEE APPENDIX A.

### SECTION 502 MATERIAL AND WASTE MANAGEMENT

**502.1 Construction material and waste management plan.** SEE APPENDIX A.

**502.2 Post construction waste recycling.** Post occupancy recycling areas shall be provided in accordance with ORS 455.422.

**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 where the Materials Selection project elective is chosen by the building owner.

**Exception:** Electrical and mechanical equipment and controls, plumbing fixtures, fire detection and alarm 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 materials cost, shall comply with Section 503.2.1, 503.2.2, , 503.2.4 or 503.2.5. Compliance shall be demonstrated in accordance with those sections singularly or in combination. Each individual material item shall be applied to not more than one section from Sections 503.2.1 through 503.2.5.

**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 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.** RESERVED.

**503.2.4 Bio-based materials.** Where *bio-based* materials are used they shall comply with one or more of the following:

1. 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.** RESERVED.

**504.2 Straight fluorescent lamps.** RESERVED.

**504.3 Compact Fluorescent Lamps.** RESERVED.

#### **SECTION 505 SERVICE LIFE**

**505.1 Building service life plan.** RESERVED.

**505.1.1 Core, shell and site hardscape components.** RESERVED.

#### **SECTION 506 CONSTRUCTION PHASE MATERIAL STORAGE, HANDLING AND MOISTURE CONTROL**

**506.1 Storage and handling of materials.** RESERVED.

**506.2 Construction phase moisture control.** RESERVED.

**506.3 Moisture control preventative measures.** RESERVED.

#### **SECTION 507 Strawbale Construction**

**507.1 Scope.** RESERVED.

**507.2 Bales.** RESERVED.

**507.2.1 Shape.** RESERVED.

- 507.2.2 Size. RESERVED.**
- 507.2.3 Ties. RESERVED.**
- 507.2.4 Moisture content. RESERVED.**
- 507.2.5 Density. RESERVED.**
- 507.2.6 Partial bales. RESERVED.**
- 507.2.7 Types of straw. RESERVED.**
- 507.2.8 Protection of bales prior to installation. RESERVED.**
- 507.2.9 Unacceptable bales. RESERVED.**
- 507.3 Moisture control. RESERVED.**
  - 507.3.1 Moisture content of bales. RESERVED.**
  - 507.3.2 Moisture barriers and vapor retarders. RESERVED.**
  - 507.3.3 Horizontal surfaces. RESERVED.**
  - 507.3.4 Bale and concrete separation. RESERVED.**
  - 507.3.5 Separation of plaster and earth. RESERVED.**
  - 507.3.6 Shower walls, steam rooms. RESERVED.**
- 507.4 Structure. RESERVED.**
  - 507.4.1 Foundations. RESERVED.**
  - 507.4.2 Wall height. RESERVED.**
  - 507.4.3 Configuration of bales. RESERVED.**
  - 507.4.4 Pre-compression of strawbale walls. RESERVED.**
  - 507.4.5 Voids and stuffing. RESERVED.**
  - 507.4.6 Plaster skins. RESERVED.**
    - 507.4.6.1 Straightness. RESERVED.**
    - 507.4.6.2 Plaster and membranes. RESERVED.**
  - 507.4.7 Transfer of loads to plaster skins. RESERVED.**
  - 507.4.8 Support of plaster skins. RESERVED.**
    - 507.4.8.1 Support of plaster skins for structural walls. RESERVED.**
    - 507.4.8.2 Support of plaster skins for non-structural walls. RESERVED.**
  - 507.4.9 Loadbearing strawbale walls. RESERVED.**
  - 507.4.10 Lateral load resisting strawbale walls. RESERVED.**
  - 507.4.11 Design coefficients and factors for seismic design. RESERVED.**
  - 507.4.12 Resistance to out-of-plane lateral loads. RESERVED.**
  - 507.4.13 Prescriptive design for plastered structural strawbale walls. RESERVED.**
    - 507.4.13.1 Loads and other limitations. RESERVED.**
    - 507.4.13.2 Gravity load bearing walls. RESERVED.**

- 507.4.13.3 Braced panels. RESERVED.**
- 507.4.14 Connection of framed walls to strawbale walls. RESERVED.**
- 507.4.15 Alternate performance design criteria. RESERVED.**
- 507.5 Finishes. RESERVED.**
  - 507.5.1 Vapor retarders. RESERVED.**
  - 507.5.2 Plaster. RESERVED.**
  - 507.5.3 Plaster and membranes. RESERVED.**
  - 507.5.4 Lath and mesh for plaster. RESERVED.**
  - 507.5.5 Plaster on non-structural walls. RESERVED.**
  - 507.5.6 Plaster on structural walls. RESERVED.**
  - 507.5.7 Clay, earth and earthen plaster. RESERVED.**
    - 507.5.7.1 Mesh. RESERVED.**
    - 507.5.7.2 Thickness. RESERVED.**
    - 507.5.7.3 Rain-exposed. RESERVED.**
    - 507.5.7.4 Prohibited finish coat. RESERVED.**
    - 507.5.7.5 Additives. RESERVED.**
    - 507.5.7.6 Separation of wood and clay plaster. RESERVED.**
  - 507.5.8 Soil-cement plaster, earth-cement, stabilized earth or pise. RESERVED.**
    - 507.5.8.1 General. RESERVED.**
    - 507.5.8.2 Mesh. RESERVED.**
    - 507.5.8.3 Thickness. RESERVED.**
  - 507.5.9 Gypsum plaster. RESERVED.**
  - 507.5.10 Lime plaster. RESERVED.**
  - 507.5.11 Cement-lime plaster. RESERVED.**
  - 507.5.12 Cement plaster. RESERVED.**
  - 507.5.13 Finishes over plaster. RESERVED.**
  - 507.5.14 Prohibited plasters and finishes. RESERVED.**
  - 507.5.15 Separation of wood and plaster. RESERVED.**
- 507.6 Fire Resistance. RESERVED.**
  - 507.6.1 Clay plaster. RESERVED.**
  - 507.6.2 Cement plaster. RESERVED.**
  - 507.6.3 Rating with other finishes. RESERVED.**
- 507.7 Permitted types of construction. RESERVED.**
- 507.8 Openings in rated walls. RESERVED.**
- 507.9 Clearance to fireplaces and chimneys. RESERVED.**

**507.10 Electrical. RESERVED.**

**507.10.1 Wiring. RESERVED.**

**507.10.2 Wiring attachment. RESERVED.**

**507.10.3 Attachment of electrical boxes. RESERVED.**

**507.10.4 Attachment of service and subpanels. RESERVED.**

**507.11 Thermal Insulation. RESERVED.**

**507.11.1 Wall assembly R-value. RESERVED.**

**507.11.2 Unit R-value. RESERVED.**

**SECTION 508  
PROJECT ELECTIVES**

**RESERVED**

## CHAPTER 6 ENERGY CONSERVATION, EFFICIENCY AND ATMOSPHERIC QUALITY

### SECTION 601 GENERAL

**601.1 Scope.** This chapter shall regulate the design, construction, and functional testing of commercial *buildings* and *building sites* for the effective use of energy.

**601.2 Intent.** The intent of this chapter is to reduce the energy consumption of commercial *buildings* and *building sites*. This chapter is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve reduced energy use. For *historic buildings* and *building sites*, input from the *code official* shall be sought.

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

### SECTION 602 ENERGY PERFORMANCE, PEAK POWER

**602.1 Zero energy performance index (zEPI).** RESERVED.

**602.2 Compliance paths.** New *buildings*, existing *building additions*, and *alterations* to existing *buildings* over 70,000 square feet in *total building floor area* or 50,000 square feet for buildings with Complex Mechanical Systems, and their associated *building sites* shall comply with Section 602.2.2.. All other *buildings*, *additions* or *alterations* shall comply with Sections 602.2.1 or 602.2.2.

**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.

**602.2.2 Performance-based compliance.** *Buildings* designed on a performance basis shall comply with Sections 604, 605, 609, 610, and 612 of this code.

**602.2.2.1 Minimum performance.** The *building* shall be designed and constructed to deliver 18 percent less energy use than that of a baseline building complying with the *Energy Code* and mandatory requirements of this code. Documentation per Section 603. Alternate compliance method: An energy model submitted under an alternate program using ASHRAE 90.1-2007, Appendix G modeling guidelines, showing 26 percent less energy use than a baseline building.

**602.2.2.2 Building peak energy demand.** RESERVED.

**602.2.2.3 Annual direct and indirect CO<sub>2</sub>e emissions.** RESERVED.

**602.2.2.4 Additional Mandatory requirements.** The following sections are to be included in all Performance-based compliance projects when applicable: 606.1.2, 606.1.3, 607.3, 608, 609.6. These energy measures may not be counted toward the modeled energy savings goal under Section 602.2.2.1.

**602.2.3 Outcome based compliance.** RESERVED.

**602.2.3.1 Maximum energy use.** RESERVED.

**602.2.3.2 Building peak energy demand.** RESERVED.

**602.2.3.3 CO<sub>2</sub>e Emissions.** RESERVED.

**602.2.4 Energy use intensity (EUI).** RESERVED.

**602.2.4.1 EUI determination.** RESERVED.

**602.3 Documentation and verification for alterations to existing buildings.** RESERVED.

**602.3.1 Determination of energy savings.** RESERVED.

**602.3.2 Measurement-based compliance.** RESERVED.

**602.3.3 Third-party certification-based compliance.** RESERVED.

## **SECTION 603 ENERGY USE AND ATMOSPHERIC IMPACTS**

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

**603.1.1 Annual energy use** RESERVED.

**603.1.2 Documentation procedures.** The annual energy use of the *building* and *building site* shall be documented in accordance with Section 506.1 of the *Energy Code, ASHRAE 90.1 Appendix G or L as necessary to meet a third party verified certification program.*

**603.1.3 Annual direct and indirect CO<sub>2</sub>e emissions.** RESERVED.

**603.1.3.1 On-site electricity.** RESERVED.

**603.1.3.2 On-site non-renewable fuels.** RESERVED.

**603.1.4 Annual direct and indirect CO<sub>2</sub>e emissions associated with on-site use of fossil fuels and purchased district energy.** RESERVED.

**603.2 Determination of and compliance with building annual net energy performance and peak net energy demand requirements.** RESERVED.

**603.2.1 Design.** RESERVED.

**603.2.2 Construction.** RESERVED.

**603.2.3 Commissioning.** RESERVED.

**603.2.4 Annual operations.** RESERVED.

**603.3 Calculation procedures.** The annual energy use of the *building and building site* shall be calculated in accordance with Section 506 of the *Energy Code*, including the modifications to the Whole Building Analysis (WBA) procedures of the *Energy Code*.

**603.3.1 Electrical system efficiency performance path.** RESERVED.

**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 of the *Energy 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 *building modeling professional as outlined under the Whole Building Approach guidelines*, the *code official* shall be authorized to require the owner to engage and designate on the *building permit* application a *building modeling professional* who shall act as the *building modeling professional in responsible charge of building energy simulation*. If the circumstances require, the owner shall designate a substitute *building modeling professional in responsible charge of building energy simulation* who shall perform the duties required of the original *building modeling professional in responsible charge of building energy simulation*. The *code official* shall be notified in writing by the owner if the *building modeling 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.** RESERVED.

## **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.** RESERVED.

**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 associated with the energy use of the whole *building* and its systems.

**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. 5. 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 604.3.5 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.** RESERVED.

**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 and large miscellaneous/building operation loads.** This category shall include the energy used by any end-use activity within the building—such as, but not limited to, data centers, elevators, escalators, swimming pools, manufacturing equipment, laboratory equipment, medical equipment, and commercial kitchens—that exceeds 5% of the total connected peak demand for each energy type.

**604.3.6 Miscellaneous loads.** RESERVED.

**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 604.4.6. 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. Each energy use type metering shall be determined at a minimum of one hour intervals. Electric power shall also determine peak electrical provided to the building at 15-minute intervals.

**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 *Mechanical 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 *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 *Electrical Code*.

**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 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.** RESERVED.

**604.4.7.3 Waste heat.** RESERVED.

**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.** RESERVED.

**604.5 Energy load type sub-metering.** For *buildings* that are 70,000 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 70,000 square feet.** For *buildings* that are less than 70,000 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.** RESERVED.

**604.7 Energy display.** A readily accessible display or internet website shall be made available to the Owner and building Tenants. 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 and monthly 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 less than 50,000 Square Feet.*
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 *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 *Energy Code* Section 502 and the provisions of this section.

**606.1.1 Insulation and fenestration criteria.** The *building thermal envelope* shall meet the requirements of 606.1.1(1) and 606.1.1(2). Assemblies must meet either the prescriptive R-value requirements or the U-value for the assembly. A building trade-off is allowed: the sum of U-value \* Area for each assembly type for the Design Case building must be less than the sum of the U-value \* Area for the building using the U-values from Tables 606.1.1 and 606.1.2.

**606.1.1.1 Permanent shading devices for fenestration.** Vertical fenestration within 45 degrees of the nearest west, and south 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* with a mean roof height exceeding that permitted by Table 1504.8 of the *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.
4. Buildings where the Window Wall Ratio is less than 20% on the walls within 45 degrees of the nearest west and south cardinal ordinate.
5. Renovations, remodels or additions.

**TABLE 606.1.1(1)  
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES**

CLIMATE ZONE	5 AND MARINE 4	
	All other	Group R
<b>Roofs</b>		
Insulation entirely above deck	R-30 ci/U=0.032	R-30 ci/U=0.032
Metal buildings (with R-3.5 thermal blocks <sup>a,b</sup> )	R-19 + R11 Ls/U=0.035	R-19 + R11LsU=0.035
Attic and other	R-49/U=0.021	R-49/U=0.021
<b>Walls, Above Grade</b>		
Mass	R-11.4 ci/U=0.090	R-15.2 ci/U=0.060
Metal Building	R-19 ci (R-15.8 Zone 4 Marine)/U=0.050 (U=0.060 Zone 4C)	R-19 ci (R-15.8 Zone 4 Marine) )/U=0.050 (U=0.060 Zone 4C)
Metal Framed	R-13 + R-12.5 ci/U=0.049	R-13 + R-12.5 ci/U=0.049
Wood framed and other	R-13 + R-10 ci/U=0.040	R-13 + R-12.5 ci/U=0.040
<b>Walls, Below Grade</b>		
Below-grade wall	R-7.5 ci/C=0.119	R-7.5 ci/C=0.119
<b>Floors</b>		
Mass	R-14.6 ci/U=0.057	R-14.6 ci/U=0.057

Joist/Framing (steel/wood)	R-38/U=0.027	R-38/U=0.027
<b>Slab on Grade Floors</b>		
Unheated slabs	R-15 for 24 in below/F=0.528	R-20 for 24 in below/F=0.528
Heated slabs	R-15 for 48 in below/F=0.688	R-20 for 48 in below/F=0.688
<b>Opaque Doors</b>		
Swinging	U-0.50	U-0.50
Roll-up or sliding	U-0.50	U-0.50

- a) When using R-value compliance method, a thermal spacer block is required, otherwise use the U-factor compliance method.  
b) Assembly descriptions can be found in OEESC Chapter 5.

**TABLE 606.1.1(2)**  
**BUILDING ENVELOPE REQUIREMENTS: FENESTRATION**

CLIMATE ZONE					5 AND MARINE 4		
<b>Vertical fenestration (30% maximum of above-grade wall)</b>							
<b>U-factor</b>							
<b>Framing materials other than metal with or without metal reinforcement or cladding</b>							
U-factor					0.30		
<b>Metal framing with or without thermal break</b>							
Curtain wall/storefront and fixed metal U-factor					0.40		
Entrance door U-factor					0.80		
All other U-factor <sup>a</sup>					0.46		
<b>SHGC-all frame types<sup>b</sup></b>							
				0.40			
SHGC: PF < 0.25					0.40		
SHGC <sup>b</sup> : 0.25 ≤ PF < 0.5					0.50 / 0.54		
SHGC <sup>b</sup> : PF ≥ 0.5					0.54 / 0.72		
<b>Skylights (3% maximum)</b>							
U-factor					0.60		
SHGC					0.40		

- a. All others includes operable windows and nonentrance doors.  
b. SHGC reduction allowed for projection factors (PF). First value is for glazing facing all other directions than North. Second value is for glazing facing within 45-degrees of true North

**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.

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/ft<sup>2</sup> (4.57 m<sup>3</sup>/hr/m<sup>2</sup>) 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 by a qualified individual in accordance with ASTM E779.

**Exception:** Buildings greater than 20,000 Sq. Ft.

**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 *Energy 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.** Shall comply with Section 502.4.6 of the *Energy Code*. Exception 3 shall not apply to any space less than 3,000 square feet (298 m<sup>2</sup>) when the space is an atrium 3 stories

or higher or when door(s) from an elevator or stair shaft(s) serving 3 stories or more opens into the space.

**606.1.3 Minimum Skylight Fenestration Area.** In *enclosed spaces* greater than 10,000 square feet, (900m<sup>2</sup>), directly under a roof with ceiling heights greater than 15 ft (4.6 m), and used for or as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail, distribution/sorting area, transportation, or workshop, the total *daylight zone under skylights* shall be a minimum of half the floor area and provide a minimum *skylight area to daylight zone under skylights* of 3% with a skylight VT of at least 0.40.

Skylights shall have a glazing material or diffuser with a measured haze value greater than 90% when tested according to ASTM D1003. General lighting in the daylight area shall be controlled as described in *The Energy Code* Section 505.2.2.3. The skylight area shall not exceed 5% of the gross roof area.

**Exceptions:**

1. Where the designed *general lighting* power densities less than 0.5 W/ft<sup>2</sup> (5.4 W/m<sup>2</sup>).
2. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
3. Where the daylight area under rooftop monitors is greater than 50% of the enclosed space floor area.

**SECTION 607  
BUILDING MECHANICAL SYSTEMS**

**607.1 Prescriptive compliance.** Where buildings are designed using the prescriptive-based compliance path in accordance with Section 602.2.1, *building* mechanical systems shall meet the provisions of the *Energy Code* for such systems and the provisions of this section.

**607.1.1 Increased Building Efficiency:** HVAC Equipment shall meet the requirements of Section 607.2. In addition, the building shall be designed with either Section 607.1.1.1, 607.1.1.2, or 607.1.1.3 efficiency improvement measures.

**607.1.1.1 Lighting Power Density Improvement.** The total building Lighting Power Density shall be 10 percent less than the Lighting Power Density required under Section 609.1.

**607.1.1.2 Building Renewable Energy System.** The total minimum ratings of on-site renewable energy systems shall comply with one of the following:

1. Provide not less than 1.75 Btu's, or not less than 0.50 watts, per square foot of conditioned floor area.
2. Provide not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated by the prescriptive requirements of Chapter 6.

**607.1.1.3 Increased Mechanical Efficiency.** Increased Efficiency may be met by complying with HVAC equipment efficiency improvements listed in Section 607.2.4.

**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 *Energy 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.** RESERVED.

**607.2.3 HVAC system controls.** RESERVED.

**607.2.3.1 Programmable thermostats.** RESERVED.

**607.2.4 HVAC Equipment Performance Improvement.** When Section 607.1.1.3 is followed, HVAC equipment shall meet or exceed the requirements of the following tables. Where equipment is not listed, the equipment shall exceed the latest federal efficiency standards by 10%.

**TABLE 607.2.4 (1)**

**UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY <sup>a</sup>
Air conditioners, Air cooled	< 65,000 Btu/hd	Split system	For zones 1 to 5: 15.0 SEER, 12.5 EER
		Single package	For zones 1 to 5: 15.0 SEER, 12.0 EER
	≥ 65,000 Btuh/h and < 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 EER <sup>b</sup> , 12.54 IEER <sup>b</sup>
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split system and single package	For zones 1 to 5: 10.8 EER <sup>b</sup> , 11.3 IEER <sup>b</sup>

	≥ 760,000 Btu/h		For zones 1 to 5: 10.2 EER <sup>b</sup> , 10.7 IEER <sup>b</sup>
Air conditioners, Water and evaporatively cooled		Split system and single package	14.0 EER

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

a. IEERs are only applicable to equipment with capacity modulation. Zones refer to Climate Zones From Section 303.1

b. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

**TABLE 607.2.4 (2)**  
**UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY**  
**OPERATED, EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY <sup>a</sup>
Air cooled (Cooling mode)	< 65,000 Btu/h	Split system	For zones 1 to 5: 15.0 SEER, 12.5 EER
		Single package	For zones 1 to 5: 15.0 SEER, 12.0 EER
	≥ 65,000 Btu/h and < 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 SEER, 12.4 EER
	≥ 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 SEER, 12.4 EER
Water SOURCES (Cooling mode)	< 135,000 Btu/h	85°F entering water	14.0 EER
Air cooled (Heating mode)	< 65,000 Btu/h (Cooling capacity)	Split system	For zones 1 to 5: 9.0 HSPF
		Single package	For zones 1 to 5: 8.5 HSPF
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.4 COP
		17°F db/15°F wb outdoor air	2.4 COP
	≥ 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.2 COP
		77°F db/15°F wb outdoor air	2.1 COP
Water SOURCES (Heating mode)	< 135,000 Btu/h (Cooling capacity)	70°F entering water	4.6 COP

For SI: °C = [(°F) - 32] / 1.8, 1 British thermal unit per hour = 0.2931 W.

db = dry-bulb temperature, °F; wb = wet-bulb temperature, °F

a. IEERs and Part load rating conditions are only applicable to equipment with capacity modulation. Zones refer to Climate Zones From Section 303.1

**TABLE 607.2.4 (3)**  
**PACKAGED TERMINAL AIR CONDITIONERS AND**  
**PACKAGED TERMINAL HEAT PUMPS**

EQUIPMENT TYPE	SIZE CATEGORY	MINIMUM EFFICIENCY
Air conditioners	< 7,000 Btu / h	11.9 EER
& Heat Pumps (Cooling Mode)	7,000 Btu / h and < 10,000 Btu / h	11.3 EER
	10,000 Btu / h and < 13,000 Btu / h	10.7 EER

	> 13,000 Btu / h	9.5 EER
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**TABLE 607.2.4 (4)**  
**WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS,**  
**WARM AIR DUCT FURNACES AND UNIT HEATERS, EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Warm air furnaces, gas fired <sup>a</sup>	< 225,000 Btu/h	—	For zones 3 & 4 90 AFUE or 90 Et <sup>c</sup> For zones 8 are 92 AFUE or 92 Et <sup>c</sup>	DOE 10 CFR Part 430 or ANSI Z21.47
	≥ 225,000 Btu/h	Maximum capacity	90% E <sub>c</sub> <sup>b</sup>	ANSI Z21.47
Warm air furnaces, oil fired <sup>a</sup>	< 225,000 Btu/h	—	For zones 3 to 8 are 85 AFUE or 85 Et <sup>c</sup>	DOE 10 CFR Part 430 or UL 727
	≥ 225,000 Btu/h	Maximum capacity	85% E <sub>t</sub> <sup>b</sup>	UL 727
Warm air duct furnaces, gas fired <sup>a</sup>	All capacities	Maximum capacity	90% E <sub>c</sub>	ANSI Z83.8
Warm air unit heaters, gas fired	All capacities	Maximum capacity	90% E <sub>c</sub>	ANSI Z83.8
Warm air unit heaters, oil fired	All capacities	Maximum capacity	90% E <sub>c</sub>	UL 731

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

E<sub>t</sub> = Thermal efficiency.

E<sub>c</sub> = Combustion efficiency (100% less flue losses).

a. Efficient furnace fan: Fossil fuel furnaces in zones 3 to 8 shall have a furnace electricity ratio not greater than 2% and shall include a manufacturer's designation of the furnace electricity ratio.

-b. Units must also include an IID (intermittent ignition device), have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

c. Where there are two ratings for units not covered by the National Appliance Energy Conservation Act of 1987 (NAECA) (3-phase power or cooling capacity greater than or equal to 65,000 Btu/h [19 kW]) units shall be permitted to comply with either rating.

**TABLE 607.2.4 (5)**  
**BOILER, EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	Fuel	SIZE CATEGORY	TEST PROCEDURE	MINIMUM EFFICIENCY
Steam	Gas	< 300,000 Btu / h	DOE 10 CFR Part 430	83% AFUE
		> 300,000 Btu / h and > 2.5 mBtu/h	DOE 10 CFR Part 431	81% Et
		>2.5 mBtu/h		82% E <sub>c</sub>
	Oil	< 300,000 Btu / h	DOE 10 CFR Part 430	85% AFUE
		> 300,000 Btu / h and > 2.5 mBtu/h	DOE 10 CFR Part 431	83% Et
		>2.5 mBtu/h		84% E <sub>c</sub>
Hot Water	Gas	< 300,000 Btu / h	DOE 10 CFR Part 430	97% AFUE
		> 300,000 Btu / h and > 2.5 mBtu/h	DOE 10 CFR Part 431	97% Et
		>2.5 mBtu/h		94% E <sub>c</sub>
	Oil	< 300,000 Btu / h	DOE 10 CFR Part 430	90% AFUE
		> 300,000 Btu / h and > 2.5 mBtu/h	DOE 10 CFR Part 431	88% Et
		>2.5 mBtu/h		87% E <sub>c</sub>

Et = Thermal efficiency.

Ec = Combustion efficiency (100% less flue losses).

**TABLE 607.2.4 (6)**  
**CHILLERS - EFFICIENCY REQUIREMENTS<sup>a,b</sup>**

EQUIPMENT TYPE	SIZE CATEGORY	REQUIRED EFFICIENCY - CHILLERS		OPTIONAL COMPLIANCE PATH - MINIMUM EFFICIENCY - CHILLERS WITH VSD	
		Full Load (KW /TON)	IPLV (KW /TON)	Full Load (KW /TON)	IPLV (KW /TON)
Air Cooled w/ Condenser	All	1.2	1.0	N/A	N/A
Air Cooled w/o Condenser	All	1.08	1.08	N/A	N/A
Water Cooled, Reciprocating	All	0.840	0.630	N/A	N/A
Water Cooled, Rotary Screw and Scroll	< 90 tons	0.780	0.600	N/A	N/A
	<sup>3</sup> 90 tons and < 150 tons	0.730	0.550	N/A	N/A
	<sup>3</sup> 150 tons and < 300 tons	0.610	0.510	N/A	N/A
	> 300 tons	0.600	0.490	N/A	N/A
Water Cooled, Centrifugal	< 150 tons	0.610	0.620	0.630	0.400
	<sup>3</sup> 150 tons and < 300 tons	0.590	0.560	0.600	0.400
	300 tons and < 600 tons	0.570	0.510	0.580	0.400
	> 600 tons	0.550	0.510	0.550	0.400

a. Compliance with full load efficiency numbers and IPLV numbers are both required.

b. Only Chillers with Variable Speed Drives (VSD) may use the optional compliance path-for chiller efficiency.

N/A – No credit can be taken for this option

**TABLE 607.2.4 (7)**  
**ABSORPTION CHILLERS - EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	MINIMUM EFFICIENCY FULL LOAD COP (IPLV)
Air Cooled, Single Effect	0.60, allowed only in heat recovery applications
Water Cooled, Single Effect	0.70, allowed only in heat recovery applications
Double Effect - Direct Fired	1.0 (1.05 )
Double Effect - Indirect Fired	1.20

**607.3 Ventilation (Reference also OEESC 503.2.5).** Ventilation, either natural or mechanical, shall be provided in accordance with Chapter 4 of the *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 *Mechanical Code*, or the minimum required by Section 6.3 of ASHRAE 62.1.

**607.3.1 Excess Ventilation.** Ventilation rates shall not be designed to exceed the minimum requirements of the *Mechanical Code* or ASHRAE 62.1. Where the design ventilation exceeds the minimum, the system shall have an energy recovery ventilation system meeting the performance requirements of Section 503.2.6 of the *Energy Code*.

**607.4 Duct and plenum insulation, sealing and testing. (Reference also OEESC 503.2.7)** Supply and return air ducts and plenums, and air handlers and filter boxes shall be insulated and sealed in accordance with the *Energy Code* except as noted herein.

**607.4.1 Duct Air Leakage Testing (Reference also OEESC 503.2.7.1.3).** 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.

$$F = C_L P^{0.65}, \quad \text{(Equation 6-7)}$$

Where:

F = maximum permitted leakage in cfm/100 ft<sup>2</sup> duct surface area;

C<sub>L</sub> = 4, duct leakage class, cfm/100 ft<sup>2</sup> 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 (Reference also OEESC 503.2.8).** 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<sup>a</sup>**

Fluid	Conductivity Btu-in./(h-ft <sup>2</sup> -F)	Wall Thickness <sup>d</sup> of Pipe Insulation Relative to Nominal Pipe Diameter <sup>b, c</sup>
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-ft<sup>2</sup>-°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 (Reference also OEESC 503.3.1 and 503.4).** Economizers shall meet the requirements of the *Energy Code*, except as noted herein.

**607.6.1 Air Economizer systems (Reference also OEESC 503.3.1 and 503.4.1).** 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:** Per *Energy Code* Sections 503.3.1 and 503.4.1.

**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 607.6.1.1.3(1)  
HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS**

CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
4c, 5b,	Fixed dry bulb Differential dry bulb Electronic enthalpy <sup>a</sup> Differential enthalpy Dew-point and dry-bulb temperatures	Fixed enthalpy

- 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
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**TABLE 607.6.1.1.3(2)  
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS**

		(ECONOMIZER OFF WHEN)	
		EQUATION	DESCRIPTION
Fixed dry bulb	4c, 5b,	$T_{OA} > 75^{\circ}\text{F}$	Outdoor air temperature exceeds 75°F
Differential dry bulb	4c, 5a,	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature
Electronic Enthalpy	All	$(T_{OA}, RH_{OA}) > A$	Outdoor air temperature/RH exceeds the "A" setpoint curve <sup>a</sup>
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. 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 (Reference also OEESC 503.4).** Economizer systems for HVAC equipment shall be designed in accordance with Sections 607.6.2.2 through 607.6.2.4.

**607.6.2.1 Design capacity.** RESERVED.

**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. (Reference also OEESC 503.4.1)** 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) Systems. (Reference also OEESC 503.4.2)** VAV systems shall comply with sections 607.7.1 through 607.7.3.

**607.7.1 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.

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.

**607.7.2 VAV Reheat.** Reheating of VAV primary air is prohibited. Space heating shall be furnished separately from the VAV system.

**Exception:** Only the minimum ventilation air required by Chapter 4 of the *Mechanical Code* or other code may be reheated.

**607.2.3 VAV System Ventilation Optimization:** Individual zone boxes of a multiple-zone VAV system shall report to a central control panel that automatically reduces outdoor air intake flow below design rates in response to changes in *system ventilation efficiency* as defined by ASHRAE Standard 62.1, Appendix A.

**Exceptions:**

1. Dual VAV systems with zonal transfer fans that recirculate air from other zones without directly mixing it with outdoor air, dual-duct dual-fan VAV systems, and VAV systems with fan-powered terminal units.
2. Systems required to have Exhaust Air Energy Recovery complying with OEESC Section 503.2.6.

**607.8 Kitchen exhaust systems (Reference also OEESC 503.2.5.2).** Kitchen exhaust systems shall meet the provisions of the *Energy 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 be UL 710 listed and have a maximum exhaust rate in accordance with Table 607.8.1.

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
Eye brow	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 *Energy Code* except as noted herein.

**607.9.1 Laboratory exhaust systems.** RESERVED

**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 602.2.1 service water heating systems shall meet the provisions of the *Energy Code* for such systems and the provisions of this section.

**608.2 Service water heating (SWH) equipment performance requirements. (Reference also OEESC 504.2)**Service water heating equipment shall comply with Sections 608.2.1.

**608.2.1 Equipment covered by Federal standards.** Equipment covered by Federal minimum efficiency standards shall meet the minimum efficiency requirements of the *Energy Code*.

**608.2.2.1 Water heater controls for dwelling units.** RESERVED

**608.2.2.2 Pools, hot tubs and spas. (Reference also OEESC 504.7)**Pools, hot tubs and spas shall meet the efficiency requirements of the *Energy Code*.

**608.3.1 Pools in conditioned space.** RESERVED.

**608.4 Snowmelt systems.** Snow melt systems shall comply with the requirements of the *Energy Code*.

**608.5 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 insulation totals not more than 3.5 (kWh/m<sup>2</sup>/day) or if other renewable option is selected as a project elective indicated on the checklist required under Section 303.

**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 thermal hot water system electrical rough-in.** Conduit not less than ¾ inch in size shall be installed from the electric service panel or room that provides the electric service to the water heating equipment room that will be served by the solar hot water system.

**608.5.2.1 Control 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 F, Laundries.

**608.7 Service water heating piping insulation (Reference also OEESC 504.5).** Where service water heating insulation is required by the *Energy Code*, 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. Hot water piping runouts installed within exterior walls 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 (Reference also OEESC 504.6).** 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 *Energy Code* for such systems and the provisions of Section 609.

**609.1.1 Lighting Power Density (LPD) Table.** Calculation of interior LPD allowance shall be per Tables 609.1.1 (a) and 609.1.1(b), superseding OEESC tables 505.2(a) and 505.2(b).

**TABLE 609.1.1(a)**  
**INTERIOR LIGHTING POWER ALLOWANCES**

LIGHTING POWER DENSITY	
Building Area Type	(W/ft <sup>2</sup> )
Automotive Facility	0.79
Convention Center	1.08
Court House	1.05
Dining: Bar Lounge/Leisure	0.99
Dining: Cafeteria/Fast Food	0.90
Dining: Family	0.89
Dormitory	0.61
Exercise Center	0.88
Gymnasium	1.00
Healthcare—clinic	0.87
Hospital	1.08
Hotel	0.88
Library	1.17
Manufacturing Facility	1.24
Motel	0.88
Motion Picture Theater	0.83
Multifamily	0.58
Museum	1.04
Office	0.90
Parking Garage	0.26
Penitentiary	1.00
Performing Arts Theater	1.39
Police / Fire Station	0.89
Fire Station	0.74
Post Office	0.87
Religious Building	1.05
Retail	1.32
School/University	0.99
Sports Arena	0.78

Town Hall	0.92
Transportation	0.77
Warehouse	0.66
Workshop	1.20

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m<sup>2</sup>.

**TABLE 609.1.1(b)**  
**SPACE-BY-SPACE METHOD MAX.**  
**ALLOWABLE LIGHTING POWER DENSITY (LPD)**

Common Space Types	LPD (W/ft <sup>2</sup> ) <sup>1</sup>
Office-enclosed <sup>2</sup>	0.97
Office-open plan <sup>2</sup>	0.93
Conference/Meeting/Multipurpose <sup>3</sup>	1.11
Classroom/Lecture/Training	1.23
Lobby	1.28
For Hotel	1.1
For Performing Arts Theater	3.24
For Motion Picture Theater	1.01
Audience/Seating Area	0.84
For Gymnasium	0.4
For Exercise Center	0.27
For Convention Center	0.7
For Religious Buildings	1.60
For Sports Complex	0.4
For Performing Arts Theater	2.52
For Motion Picture Theater	1.11
For Transportation	0.46
Atrium-first three floors	0.6
Atrium-each additional floors	0.16
Lounge/Recreation	1.16
For Hospital	0.71
Dining Area <sup>2</sup>	
For Hotel/Motel	1.23
For Bar Lounge/Leisure Dining	1.4
For Family Dining	2.1
Food Preparation	1.07
Laboratory	1.4
Restrooms	0.82
Dressing/Locker Room	0.52
Corridor/Transition	0.41
For Hospital	0.94
For Manufacturing Facility	0.41
Stairs-active	0.49
Active Storage	0.66
For Hospitals	0.79
Inactive Storage	0.26

For Museum	0.66
Electrical/Mechanical	1.24
Workshop <sup>4</sup>	1.64
Building Specific Space Types	
Courthouse/Police Station	
Courtroom	1.78
Judges Chambers	1.18
Gymnasium/Exercise Center	
Playing Area	1.35
Exercise Area	0.76
Fire Stations	
Fire Station Engine Room	0.64
Sleeping Quarters	0.27
Post Office – Sorting Area	1.01
Convention Center – Exhibit Space <sup>3</sup>	1.09
Library <sup>2</sup>	
Card File and Cataloging	0.96
Stacks	1.47
Reading Area	1.07
Hospital	
Emergency	2.34
Recovery	0.74
Nurse Station	0.85
Exam/Treatment Room	1.26
Pharmacy	0.99
Patient Room	0.59
Operating Room	1.92
Nursery	0.48
Medical Supply	1.23
Physical Therapy	0.80
Radiology	0.35
Laundry-Washing	0.52
Automotive – Service/Repair	0.63
Museum	
General Exhibition	1.0
Restoration	1.58
Bank/Office – Banking Activity Area	1.31
Religious Buildings	
Worship-pulpit, choir	2.29
Fellowship Hall	0.81
Retail	
Mall Concourse	1.5
Fitting Room	1.06
Sports Arena Complex	
Ring Sports Area	2.70
Court Sports Area	2.00
Indoor Plying Field Area	1.35
Warehouse	
Fine Material Storage	1.24

Medium/Bulky Material Storage	0.81
Parking Garage – Garage Area	0.2
Transportation	
Airport - Concourse	0.57
Air/Train/Bus – Baggage Area	0.89
Terminal – Ticket Counter	1.31

For SI: 1 foot = 304.8 mm, 1 square foot = 0.929 m<sup>2</sup>, W/m<sup>2</sup> = W/ft<sup>2</sup> X 10.764

<sup>1</sup> The watts per square foot may be increased by 2 percent per foot of ceiling height above 20 feet unless specified differently by another footnote.

<sup>2</sup> The watts per square foot of room may be increased by 2 percent per foot of ceiling height above 9 feet.

<sup>3</sup> Hotel banquet room, conference rooms, or exhibit hall watt per square foot of room may be increased by 2 percent per foot of ceiling height above 12 feet.

<sup>4</sup> Spaces used specifically for manufacturing are exempt.

**609.2 Sleeping unit controls (Reference also OEESC 505.2.3).** *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 (Reference also OEESC 505.2.2.1).** *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. Storage and stack areas not open to the public.

Lighting in means of egress shall comply with the luminance or uniformity criteria required by the *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 (Reference also OEESC 505.2.4).** 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. Lighting shall be turned on no earlier than 6:00 am or within 30 minutes of the start of facility operations, whichever is later.

**609.5 Automatic daylight controls (Reference also OEESC 505.2.2.3).** *Automatic daylight controls* shall be provided in all *daylight zones* with minimum *fenestration* as specified in 505.2.2.3 of the *Energy Code* and Section 808.

**Exceptions:** In addition to exceptions listed in *Energy Code* Section 505.2.2.3, 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*.

**609.6 Plug load controls.**

At least 50% of all 125 volt 15- and 20- Ampere receptacles installed in the following space types:

1. Private Offices.
2. Computer Classrooms.

Shall be controlled by an automatic control device that shall function on:

- a. A scheduled basis using a time-of-day operated control device that turns receptacles off at specific programmed times. An independent program schedule shall be provided for areas of no more than 25,000 Sq. Ft. but not more than one floor; or
- b. An occupant sensor that turns off receptacles within 30 minutes of all occupants leaving a space; or
- c. A signal from another control or alarm system that indicates the area is unoccupied.

**Exception:** Receptacles for the following shall not require an automatic control device:

- a. Receptacles specifically designated for equipment requiring 24 hour operation.
- b. Spaces where an automatic shutoff would endanger the safety or security of the room or building occupant(s).
- c. Receptacles equipped with portable occupancy sensor or time clock device, for example, power strips with occupancy sensor.

**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.** RESERVED.

**609.6.3 Computer office equipment.** RESERVED.

**609.6.4 Audio and visual systems.** RESERVED.

**609.6.5 Water dispensers.** RESERVED.

**609.6.6 Refrigerator and freezer cases.** RESERVED.

**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 *Energy 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 101.4.5 of the *Energy 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 (Reference also OEESC 507.1).** 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.** RESERVED.

**609.8.1.3 Voltage drop in branch circuits.** RESERVED.

**609.9 Exterior lighting. (Reference also OEESC 505.6)** All exterior lighting shall comply with Section 505.6 of the *Energy Code*.

**609.10 Verification of lamps and ballasts.** RESERVED.

**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

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(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
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

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).

**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 *Energy 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.

**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**

<b>Residential products</b>	<b>Commercial products</b>
Battery chargers <sup>a</sup>	Beverage vending machines <sup>a</sup>
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 <sup>a</sup>	
Room air conditioners	
Ranges and ovens	

<sup>a</sup> 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 *Energy Code*, *Mechanical Code*, *Oregon Plumbing Specialty Code* and *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 m<sup>3</sup>/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 in buildings serving 5-levels or more 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*.

**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. RESERVED.**

## **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 designed and constructed in such a way as to accommodate the future installation of one or more renewable energy systems in accordance with this section. Building project design shall show allocated space and pathways for installation of on-site renewable energy systems and associated infrastructure.

Space designated on plans shall be permanently designated in the building and verified prior to issuance of certificate of occupancy. Wall mounting space shall be designated with temporary backer board, labeled to designate future equipment. Equipment floor space, including service clearances, shall be painted on floors.

Renewable energy systems shall be designed to 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 *metering* of these systems as *approved* by the code official.

### **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.
2. Buildings using Section 607.1.1.2 to comply with Section 607.
3. For building occupancies listed below, where at least ten percent of the *building's* annual estimated hot water energy usage is met by a geothermal or solar water heating systems designed, constructed and installed in accordance with manufacturer's instructions.
  - a. Group A-2, Restaurants and Banquet halls.
  - b. Group F, Laundries.
  - c. Group R-1, Boarding houses (transient), Hotels (transient), Motels (transient).
  - d. Group R-2 occupancies.
  - e. Group A-3, Health Clubs and Spas.
  - f. Group I-2, Hospitals, Mental hospitals and Nursing homes.

**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 602.2.2, performance-based compliance, shall be designed and constructed in such a way as to accommodate the future installation of 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 602.2.1, Prescriptive compliance, shall be designed and constructed in such a way as to accommodate the future installation of 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.

**611.2 Solar photovoltaic systems.** *Solar photovoltaic* systems shall be designed, 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*.

**611.2.1 Requirements.** The installation, inspection, maintenance, repair and replacement of *solar photovoltaic systems* and all system components shall comply with the *Oregon Solar Installation Specialty Code* and the *Oregon Electric Specialty Code*.

**611.2.1.1 Roof-mounted solar photovoltaic systems.** Where *solar photovoltaic systems* may be installed on a roof, the roof shall be constructed to support the loads imposed by such modules. Sufficient space on the roof shall be set aside to accommodate the clearances from roof features required by the.

**611.2.2 Performance verification.** Where a Photovoltaic system has been installed, either to meet the project elective in Section 303 or to meet 607.1.1.2, the 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, 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*.

**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.** RESERVED.

**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 according to the *Building Code*.

**611.3.1.3 Solar photovoltaic modules.** RESERVED.

**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.

**611.4 Solar water heating equipment.** Under this section a building shall be designed and constructed in such a way as to accommodate not less than ten percent of the building's annual estimated hot water energy usage to be met by on-site solar water heating equipment.

**611.5 Renewable energy system performance monitoring and metering.** Where installed as a project elective under Section 303 or to meet 607.1.1.2 renewable energy systems shall be *metered* 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.** RESERVED.

## SECTION 612 ENERGY SYSTEMS COMMISSIONING AND COMPLETION

**612.1 Mechanical systems commissioning and completion requirements.** Prior to final inspection, the building owner or owner's representative shall provide evidence of receipt of a mechanical systems functional performance testing in a preliminary acceptance report and completion of the mechanical system installation to the code official and in accordance with the *Energy Code*. Construction documents shall clearly indicate provisions for testing 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 to the code official upon request.

**612.1.1 Commissioning plan.** For buildings over 50,000 sq. ft. with complex mechanical systems, a *commissioning* plan shall be developed by a *registered design professional* or approved *entity* 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 *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.** Construction documents shall require functional testing of the equipment and systems. Results shall be reported in a Preliminary Acceptance Report per Section 612.1.4. 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. Parties responsible for testing shall be designated on the construction documents.

**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 Section 607.6.1.1 and manufacturer's specifications.

**612.1.4 Preliminary acceptance report.** A preliminary report of *functional* test procedures and results shall be certified by the *registered design professional* or *approved entity* and provided to the

*building* owner. The report shall be identified as “Preliminary Acceptance 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 Acceptance Report.

**612.1.4.2 Copy.** RESERVED.

**612.1.4.3 Certification.** RESERVED.

**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*.

For buildings with Complex Mechanical Systems over 50,000 sq. ft., 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 (Project Elective).** If selected by the Owner as a project elective under Section 303, 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.

**612.1.5.5 Post occupancy re-commissioning (Project Elective).** If selected by the Owner as a project elective under Section 303, the *commissioning* activities specified in Sections 612.1.3 and 612.1.5.4 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 Post-Commissioning sequence of operation (Project Elective).** If selected by the Owner as a project elective under Section 303, plans and specifications shall require that a *sequence of operation* shall be developed and finalized upon final *commissioning*, when the operational details are initialized and validated. The *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.

**612.3 Lighting and electrical systems functional testing and completion requirements.** Prior to issuance of *certificate of occupancy*, the *registered design professional* or approved entity shall provide evidence of lighting and electrical systems *functional testing* in accordance with the *Energy Code* and the provisions of this section.

Construction documents shall specify the provisions for *testing* 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 612.3.4 and 612.3.5.

**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 registered design professional or *approved entity* conducting functional *testing* 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 *Energy Code*. The registered design professional or approved entity shall confirm the installation of luminaires, type; lamps, type, wattage, and ballasts, type and

performance for not less than one representative luminaire of each type, for consistency with the approved *construction documents*.

**612.3.3 Functional testing.** Lighting controls shall be tested in accordance with this Section.

**612.3.3.1 Occupant sensors.** It shall be verified that the functional testing in accordance with *Energy Code* Section 505.2 has been performed.

**612.3.3.2 Automatic daylight controls.** *Automatic daylight controls* shall be tested 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 *Energy 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.

**612.3.3.5 Egress lighting interlock.** For buildings with egress lighting required to be shut off during unoccupied periods per Section 505.2.1.1 of the *Energy Code*, the operation of interlocks and relays to turn on the egress lights during emergency conditions shall be tested and verified.

**612.3.4 Post-commissioning documentation.** (Project Elective). If selected by the Owner as a project elective under Section 303, the following documentation shall be provided to the *building* owner in accordance with Section 903.

1. Settings determined during *commissioning* activities outlined in Section 612.3.3.

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.** (Project Elective). If selected by the Owner as a project elective under Section 303, 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 or approved entity* shall provide evidence of *building thermal envelope* systems *commissioning* and completion to the building owner in accordance with the *Energy 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 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 registered design professional or *approved entity* 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 *Energy Code* and this code.

## SECTION 613 JURISDICTIONAL REQUIREMENTS & PROJECT ELECTIVES

**613.1 General.** Section 613 *project electives* related to energy conservation and efficiency. *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 Energy Use reporting.** The Owner participates in the US Department of Energy's Energy Star Portfolio Manager program and reports annual energy use.

**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* 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* 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 Section 613.2.3.1 shall be generated.

**613.2.3.1 Annual net energy use.** The Energy Use associated with the operation of the *building* and the *buildings* on the site, as determined in accordance with Section 603.1., shall be reported by the *building* owner or the owner's registered agent to the Energy Star Portfolio Manager program and release and report the building's annual Energy Use Intensity (EUI).

Where there are multiple *buildings* on a *building site*, each *building* shall have its energy use reported separately. Where there are energy uses associated with the *building site* other than the *buildings* on the site, the energy use 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 1<sup>st</sup> of the following year.

**613.3 Energy use reduction project electives.** *Project electives* for *buildings* pursuing performance-based compliance in accordance with Section 602.3.2 shall be in accordance with calculation procedures specified in Section 603.3. One project elective for designing to 25% better than the *Energy Code*. A second project elective for designing to 30% better than the *Energy Code*.

**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 *Energy 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 *Energy 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**

<b>Product Type</b>	<b>Minimum EER</b>	<b>Minimum COP</b>	<b>Test Procedure</b>
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 *Energy 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 *Energy 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.** RESERVED.

**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*;
5. Group A-3, Health Clubs and Spas; and
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 *Energy 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 *Energy 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 *Energy 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.

**613.8 Full Commissioning project elective.** Buildings seeking a full commissioning elective shall develop a commissioning plan per Section 612.1.1 and comply with all of Section 612, including Sections 612.1.5.4, 612.1.5.5, 612.2, 612.3.4 and 612.3.5.

**613.9 Building Energy Renewable Systems project elective.**

Each building or building site seeking this project elective shall be equipped with one or more renewable energy systems in accordance with Section 611.2, 611.3, and 611.4 that have the capacity to provide at least two percent of the annual energy used within the building for mechanical and service water heating equipment and lighting regulated in Chapter 5 of the IECC, and that capacity shall be demonstrated in accordance with 611.1.1 or 611.1.2. These systems shall be metered in accordance with Section 604.4.7.

**Exception:** Buildings using Section 607.1.1.2 to comply with Section 607 shall provide at least four percent of the annual energy use within the building for mechanical and service water heating equipment and lighting regulated in Chapter 5 of the IECC.

**613.9.1 Building performance-based compliance.** Performance-based compliance shall be based on building annual energy use calculations in accordance with Section 603.

**613.9.2 Building prescriptive compliance.** Prescriptive compliance, shall be based on building annual energy use calculations in accordance with Section 603 or demonstrate that the renewable energy system provides not less than 0.30 watts per square foot of conditioned floor area.

**613.10 Enhanced Envelope.** Each building seeking this project elective shall increase the envelope values 10% over the prescriptive requirements listed in 606.1.

## CHAPTER 7 WATER RESOURCE CONSERVATION AND EFFICIENCY

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### SECTION 701 GENERAL

**701.1 Scope.** The provisions of this chapter establish the means of conserving potable and non-potable water used in and around a building.

### SECTION 702 FIXTURES, FITTINGS, EQUIPMENT AND APPLIANCES

**702.1 General.** The maximum water consumption of fixtures and fittings shall comply with all of the following:

1. The maximum flow rates of fixtures and fittings shall comply with the flow rates specified in Section 702.2 through Section 702.8.
2. The aggregate consumption of all fixtures and fittings shall be at least 20 percent reduction of the calculated total daily water use in accordance with Tables 702.1.3(1) and 702.1.3(2).

#### **702.1.1 Water Savings Calculation.**

**702.1.2 Purpose.** The purpose of this Section is to provide a means of estimating the water savings when installing plumbing and fixture fittings that use less water than the maximum required by Energy Policy Act of 1992 and 2005 and the plumbing code.

**702.1.3 Calculation of Water Savings.** Table 702.1.3(1) and Table 702.1.3(2) shall be used to establish the aggregate consumption of all fixtures and fittings. Table 702.1.3(1) shall be used to establish the baseline water use and Table 702.1.3(2) shall be used to calculate the required reduction according to Section 702.1.

Water consumption shall be determined by the following equation:

$$\text{Consumption} = (\text{Flow rate}) \times (\text{Duration}) \times (\text{Occupants}) \times (\text{Daily uses})$$

<b>TABLE 702.1.3(1) WATER USE BASELINE<sup>5</sup></b>					
<b>FIXTURE TYPE</b>	<b>MAXIMUM FLOW-RATE CONSUMPTION<sup>2</sup></b>	<b>DURATION</b>	<b>ESTIMATED DAILY USES PER PERSON</b>	<b>OCCUPANTS<sup>3, 4</sup></b>	<b>DAILY WATER USES (gallons)</b>
Showerheads	2.5 gpm @ 80 psi	8 minutes	1		
Private or Private Use Lavatory Faucets	2.2 gpm @ 60 psi	0.25 minutes	4		
Residential Kitchen Faucets	2.2 gpm @ 60 psi	4 minutes	1		
Wash Fountains	2.2 gpm / 20 [rim space (inches) @ 60 psi]	–	–		

Lavatory Faucets in other than Residences, Apartments, and Private Bathrooms in Lodging Facilities (See Section 402.4.2)	0.5 gpm	0.25 minutes	4		
Metering Faucets	0.25 gallons /cycle	0.25 minutes	3		
Metering Faucets for Wash Fountains	0.25 gpm / 20 [rim space (inches) @ 60 psi]	0.25 minutes	-		
Water Closets	1.6 gallons per flush	1 flush	1 male <sup>1</sup>		
			3 female		
Urinals	1.0 gallons per flush	1 flush	2 male		
Total Daily Volume					
Annual Work Days					
Total Annual Usage					

For SI units: 1 gallon per minute = 0.06 L/s, 1 gallon = 3.785 L

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.89 kPa, 1 gallon = 3.785 L

<sup>1</sup> The daily use number shall be increased to three if urinals are not installed in the room.

<sup>2</sup> The maximum flow rate or consumption is from the Energy Policy Act.

<sup>3</sup> For residential occupancies, the number of occupants shall be based on two persons for the first bedroom, and one additional person for each additional bedroom.

<sup>4</sup> For non-residential occupancies, refer to the plumbing code, for occupant load factors.

<sup>5</sup> When determining calculations, assume one use per person for metering or self closing faucets.

**TABLE 702.1.3(2)  
WATER SAVINGS CALCULATOR**

FIXTURE TYPE	CONSUMPTION (gallons per minute)	DURATION (minutes)	DAILY USES	OCCUPANTS <sup>2, 3</sup>	DAILY WATER USES (gallons)
Showerheads		8 minutes	1		
Private or Private Use Lavatory Faucets		0.25 minutes	4		
Residential Kitchen Faucets		4 minutes	1		
Wash Fountains		-	-		
Lavatory Faucets in other than Residences, Apartments, and Private Bathrooms in Lodging Facilities (See Section 402.4.2)		0.25 minutes	4		
Metering Faucets		0.25 minutes	1 Cycle		
Metering Faucets for Wash Fountains		0.25 minutes	-		
Water Closets		1 flush	1 male <sup>1</sup>		
			3 female		
Urinals		1 flush	2 male		
Total Daily Volume					
Annual Work Days					
Total Annual Usage					
Annual Savings					
% Reduction <sup>4</sup>					

For SI units: 1 gallon per minute = 0.06 L/s, 1 gallon = 3.785 L

1 The daily use number shall be increased to three if urinals are not installed in the room.

2 For residential occupancies, the number of occupants shall be based on two persons for the first bedroom, and one additional person for each additional bedroom.

3 For non-residential occupancies, refer to the plumbing code, for occupant load factors.

4 To calculate % Reduction use:  $[(TDV_B - TDV_S) / TDV_B] \times 100$  Where:  $TDV_B$  = Baseline Total Daily Volume and  $TDV_S$  = Water Savings Total Daily Volume.

**702.2 Water Closets.** No water closet shall have a flush volume exceeding 1.6 gallons per flush (gpf) (6.1 Lpf).

**702.2.1 Gravity, Pressure Assisted and Electro-Hydraulic Tank Type Water Closets.** Gravity, pressure assisted, and electro-hydraulic tank type water closets shall have a maximum effective flush volume of not more than 1.28 gallons (4.84 L) of water per flush in accordance with ASME A112.19.2/CSA B45.1 or ASME A112.19.14 and shall also be listed to the EPA WaterSense Tank-Type High Efficiency Toilet Specification. The effective flush volume for dual flush toilets is defined as the composite, average flush volume of two reduced flushes and one full flush.

**702.2.2 Flushometer-Valve Activated Water Closets.** Flushometer-valve activated water closets shall have a maximum flush volume of not more than 1.6 gallons (6.1 L) of water per flush in accordance with ASME A112.19.2/CSA B45.1.

**702.3 Urinals.** Urinals shall have a maximum flush volume of not more than 0.5 gallon (1.9 L) of water per flush in accordance with ASME A112.19.2/CSA B45.1 or IAPMO Z124.9. Flushing urinals shall be listed to the EPA WaterSense Flushing Urinal Specification.

**702.3.1 Nonwater Urinals.** Nonwater urinals shall be listed and comply with the applicable standards referenced in Table 14-1. Nonwater urinals shall have a barrier liquid sealant to maintain a trap seal. Nonwater urinals shall permit the uninhibited flow of waste through the urinal to the sanitary drainage system. Where nonwater urinals are installed they shall have a water distribution line rough-in to the urinal location to allow for the installation of an approved backflow prevention device in the event of a retrofit. A rough-in is not required where non water urinals are installed with at least one water supplied fixture rated at not less than 1 water drainage fixture unit (WDFU) shall be installed upstream on the same drain line to facilitate drain line flow and rinsing.

**702.4 Lavatory Faucets.** The maximum water flow rate of faucets shall be in accordance with Section 702.4.1 through Section 702.4.2.

**702.4.1 Lavatory Faucets in Residences, Apartments, and Private Bathrooms in Lodging Facilities, Hospitals, and Patient Care Facilities.** The flow rate for lavatory faucets installed in residences, apartments, and private bathrooms in lodging, hospitals, and patient care facilities (including skilled nursing and long-term care facilities) shall not exceed 1.5 gallons per minute (gpm) (0.09 L/s) at 60 pounds-force per square inch (psi) (414 kPa) in accordance with ASME A112.18.1/CSA B125.1 and shall be listed to the EPA WaterSense High-Efficiency Lavatory Faucet Specification.

**702.4.2 Lavatory Faucets in Other Than Residences, Apartments, and Private Bathrooms in Lodging Facilities.** Lavatory faucets installed in bathrooms of buildings or occupancies other than those specified in Section 702.4.1 shall be in accordance with Section 702.4.2.1 or Section 702.4.2.2.

**702.4.2.1 Maximum Flow Rate.** The flow rate shall not exceed 0.5 gpm (0.03 L/s) at 60 psi (414 kPa) in accordance with ASME A112.18.1/CSA B125.1.

**702.4.2.2 Metering Faucets.** Metering faucets shall deliver not more than 0.25 gallons (0.95 L) of water per cycle.

**702.5 Showers.**

**702.5.1 Showerheads.** Showerheads shall comply with the requirements of the Energy Policy Act of 1992, except that the flow rate shall not exceed 2.0 gpm (0.13 L/s) at 80 psi (552 kPa), when listed to ASME A112.18.1/CSA B125.1.

**702.5.2 Multiple Showerheads Serving One Shower Compartment.** The total allowable flow rate of water from multiple showerheads flowing at any given time, with or without a diverter, including rain systems, waterfalls, bodysprays, and jets, shall not exceed 2.0 gpm (0.13 L/s) per shower compartment, where the floor area of the shower compartment is less than 1800 square inches (1.161 m<sup>2</sup>). For each increment of 1800 square inches (1.161 m<sup>2</sup>) of floor area thereafter or part thereof, additional showerheads are allowed, provided the total flow rate of water from all flowing devices shall not exceed 2.0 gpm (0.13 L/s) for each such increment.

**Exceptions:**

(1) Gang showers in non-residential occupancies. Singular showerheads or multiple shower outlets serving one showering position in gang showers shall not have more than 2.0 gpm (0.13 L/s) total flow.

(2) Where provided, accessible shower compartments shall not be permitted to have more than 4.0 gpm (0.25 L/s) total flow, where one outlet is the hand shower. The hand shower shall have a control with a nonpositive shutoff feature.

**702.5.3 Bath and Shower Diverters.** The rate of leakage out of the tub spout of bath and shower diverters while operating in the shower mode shall not exceed 0.1 gpm (0.006 L/s) in accordance with ASME A112.18.1/CSA B125.1.

**702.5.4 Shower Valves.** Shower valves shall meet the temperature control performance requirements of ASSE 1016 or ASME A112.18.1/CSA B125.1 when tested at 2.0 gpm (0.13 L/s).

**702.6 Commercial Pre-Rinse Spray Valves.** The flow rate for a pre-rinse spray valve installed in a commercial kitchen to remove food waste from cookware and dishes prior to cleaning shall not be more than 1.6 gpm (0.10 L/s) at 60 psi (414 kPa). Where pre-rinse spray valves with maximum flow rates of 1.3 gpm (0.08 L/s) or less are installed, the static pressure shall be not less than 30 psi (207 kPa). Commercial kitchen pre-rinse spray valves shall be equipped with an integral automatic shutoff.

**702.7 Emergency Safety Showers and Eye Wash Stations.** Emergency safety showers and emergency eye wash stations shall not be limited in their water supply flow rates.

**702.8 Drinking Fountains.** Drinking fountains shall be self-closing.

**702.9 Installation.** Water-conserving fixtures and fixture fittings shall be installed in accordance with the manufacturers' instructions to maintain their rated performance.

**704.0 Water Pressure.**

**704.1 Maximum.** Where static water pressure in the water supply piping is in excess of 85 psi (586 kPa) in single pressure zone systems, pressure regulators preceded by an adequate strainer shall be installed at points in the system to reduce the static pressure to 80 psi (552 kPa) or less.

**705.0 Water Softeners and Treatment Devices.**

**705.1 Water Softeners.** Actuation of regeneration of water softeners shall be by demand initiation. Water softeners shall be listed to NSF/ANSI Standard 44. Water softeners shall have a rated salt efficiency exceeding 3400 grains (gr) (0.2200 kg) of total hardness exchange per pound (lb) (0.5 kg) of salt, based on sodium chloride (NaCl) equivalency, and shall not generate more than 5 gallons (19 L) of water per 1000 grains (0.0647 kg) of hardness removed during the service cycle.

**705.2 Water Softener Limitations.** In residential buildings, where the supplied potable water hardness is equal to or less than 8 grains per gallon (gr/gal) (137 mg/L) measured as total calcium carbonate

equivalents, water softening equipment that discharges water into the wastewater system during the service cycle shall not be allowed, except as required for medical purposes.

**705.3 Point-of-Use Reverse Osmosis Water Treatment Systems.** Reverse osmosis water treatment systems installed in residential occupancies shall be equipped with automatic shutoff valves to prevent discharge when there is no call for producing treated water. Reverse osmosis water treatment systems shall be listed to meet NSF/ANSI Standard 58 or WQA S-3---2000.

## **706.0 Occupancy Specific Water Efficiency Requirements.**

### **706.1 Commercial Food Service.**

**706.1.1 Ice Makers.** Ice makers shall be air cooled and shall be in accordance with energy star for commercial ice machines.

**Exception:** Where ice makers are cooled with non-potable water, water cooling shall be allowed.

**706.1.2 Food Steamers.** Food steamers shall not use more than 2.0 gallons per hour (gph) (7.6 L/h) per compartment.

**706.1.3 Combination Ovens.** Combination ovens shall not consume more than 10 gph (38 L/h) in the full operational mode.

**706.1.4 Grease Interceptors.** Grease interceptor maintenance procedures shall not include post-pumping/cleaning refill using potable water. Refill shall be by connected appliance accumulated discharge only.

### **706.2 Medical and Laboratory Facilities.**

**706.2.1 Steam Sterilizers.** Controls shall be installed to limit the discharge temperature of condensate or water from steam sterilizers to 140°F (60°C) or less. Venturi-type vacuum system shall not be utilized with vacuum sterilizers.

**706.2.2 X-Ray Film Processing Units.** Processors for X-ray film exceeding 6 inches (152 mm) in any dimension shall be equipped with water recycling units.

**706.2.3 Exhaust Hood Liquid Scrubber Systems.** Liquid scrubber systems for exhaust hoods and ducts shall be of the recirculation type. Liquid scrubber systems for perchloric acid exhaust hoods and ducts shall be equipped with a timer-controlled water recirculation system. The collection sump for perchloric acid exhaust systems shall be designed to automatically drain after the wash down process has completed.

### **707.0 Fountains and Other Water Features.**

**707.1 Use of Alternate Water Source for Special Water Features.** Special water features such as ponds and water fountains shall be required to comply with Department of Health Services rules and regulations.

### **708.0 Meters.**

**708.1 Required.** A water meter shall be required for buildings connected to a public water system, including municipally supplied reclaimed (recycled) water. In other than single-family houses, multi-family structures of three stories or fewer above grade, and modular houses, a separate meter or submeter shall be installed in the following locations:

- (1) The water supply to an irrigation system for irrigated landscape with an accumulative area exceeding 15,000 square feet (1394 m<sup>2</sup>).
- (2) The makeup water supply to cooling towers, evaporative condensers, and fluid coolers.

- (3) The makeup water supply to one or more boilers collectively exceeding 1,000,000 British thermal units per hour (Btu/h) (293 kW).
- (4) The water supply to a water-using process where the consumption exceeds 1,000 gallons per day (gal/d) (0.0438 L/s), except for manufacturing processes.
- (5) The water supply to each building on a property with multiple buildings where the water consumption exceeds 500 gal/d (0.021 L/s).
- (6) The water supply to an individual tenant space on a property where any of the following applies:
  - (a) Water consumption exceeds 500 gal/d (0.021 L/s) for that tenant.
  - (b) Tenant space is occupied by a commercial laundry, cleaning operation, restaurant, food service, medical office, dental office, laboratory, beauty salon, or barbershop.
  - (c) Total building area exceeds 50 000 square feet (4645 m<sup>2</sup>).
- (7) A makeup water supply to a swimming pool.
- (8) The makeup water supply to an evaporative cooler having an air flow exceeding 30,000 cubic feet per minute (ft<sup>3</sup>/min) (14 158.2 L/s).

**708.2 Consumption Data.** A means of communicating water consumption data from submeters to the water consumer shall be provided.

**708.3 Access.** Meters and submeters shall be accessible.

**709.0 HVAC Water Efficiency.**

**709.1 Once-Through Cooling.** Once-through cooling using potable water is prohibited.

**709.2 Cooling Towers and Evaporative Coolers.** Cooling towers and evaporative coolers shall be equipped with makeup water and blow down meters, conductivity controllers and overflow alarms. Cooling towers shall be equipped with efficiency drift eliminators that achieve drift reduction to 0.002 percent of the circulated water volume for counterflow towers and 0.005 percent for cross-flow towers.

**709.3 Cooling Tower Makeup Water.** Not less than five cycles of concentration is required for air-conditioning cooling tower makeup water having a total hardness of less than 11 gr/gal (188 mg/L) expressed as calcium carbonate. Not less than 3.5 cycles of concentration is required for air-conditioning cooling tower makeup water having a total hardness equal to or exceeding 11 gr/gal (188 mg/L) expressed as calcium carbonate.

**Exception:** Air-conditioning cooling tower makeup water having discharge conductivity range not less than 7 gr/gal (120 mg/L) to 9 gr/gal (154 mg/L) of silica measured as silicon dioxide.

**709.4 Use of Reclaimed (Recycled) and On-Site Treated Non-Potable Water for Cooling.** Reserved

**709.4.1 Drift Eliminator.** RESERVED.

**709.4.2 Disinfection.** RESERVED.

**710.0 Water-Powered Sump Pumps.** Sump pumps powered by potable or reclaimed (recycled) water pressure are not permitted.

**711.0 Water Heating Design, Equipment and Installation.**

**711.1 Maximum Volume of Hot Water.** The maximum volume of water contained in hot water distribution lines between the water heater and the fixture stop or connection to showers, kitchen faucets, and lavatories shall be determined in accordance with Sections 711.1.1, 711.1.2, or 711.1.3. The water volume shall be calculated using Table 711.1.

TABLE 711.1  
WATER VOLUME FOR DISTRIBUTION PIPING MATERIALS  
OUNCES OF WATER PER FOOT LENGTH OF PIPING

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NOMINAL SIZE (inch)	COPPER M	COPPER L	COPPER K	CPVC CTS SDR 11	CPVC SCH 40	PEX-AL-PEX	PE-AL-PE	PEX CTS SDR 9
$\frac{3}{8}$	1.06	0.97	0.84	NA	1.17	0.63	0.63	0.64
$\frac{1}{2}$	1.69	1.55	1.45	1.25	1.89	1.31	1.31	1.18
$\frac{3}{4}$	3.43	3.22	2.90	2.67	3.38	3.39	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	5.56	5.56	3.91
1 $\frac{1}{4}$	8.70	8.36	8.09	6.61	9.66	8.49	8.49	5.81
1 $\frac{1}{2}$	12.18	11.83	11.45	9.22	13.20	13.88	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	21.48	21.48	13.86

For SI units: 1 foot = 304.8 mm, 1 ounce = 29.573 mL

**711.1.1 Central Core/Remote Manifold.** Central core and remote manifold plumbing system hot water distribution line volume to each qualified fixture shall not exceed volume of 32 ounces (oz) (946 mL).

**711.1.2 Central Manifold.** Central manifold plumbing system hot water system (also referred to as parallel piping or home run), including the supply line from the hot water source to the manifold, the internal volume of the manifold, and the lines to each qualified fixture shall not exceed a volume of 32 oz (946 mL).

**711.1.3 Recirculation Loop.** Run out lines from hot water recirculation loop shall not exceed a volume of 16 oz (473 mL). Residential hot water recirculation systems are limited to those that utilize on-demand activation of the circulating pump.

## 712.0 Hot Water Circulating Systems.

### 712.1 Pump Operation.

### 712.2 Demand Controlled.

**712.3 Recirculation System Balancing.** Systems with multiple recirculation zones shall be balanced to uniformly distribute hot water, or they shall be operated with a pump for each zone.

**Exception:** Systems with multiple recirculation zones that are designed to distribute hot water with differing temperatures.

**712.4 Flow Balancing Valves.** Flow balancing valves shall be factory preset automatic flow control valves, flow regulating valves, balancing valves with memory stop.

**712.5 Air Elimination.** Provision shall be made for the elimination of air from the return line of a recirculation system.

**712.6 Maximum Volume of Hot Water.** The maximum volume of water contained in hot water distribution lines between the water heater and the fixture stop or connection to showers, kitchen faucets, and lavatories shall be determined in accordance with Section 711.1.

## 713.0 Service Water Heating System Controls.

### 713.1 Temperature Controls.

**713.2 Temperature Maintenance Controls.** Systems designed to maintain usage temperatures in hot-water pipes, such as recirculating hot-water systems or heat trace, shall be equipped with automatic time switches or other controls that can be set to switch off the usage temperature maintenance system during extended periods when hot water is not required. [ASHRAE 90.1:7.4.4.2]

**713.3 Outlet Temperature Controls.** Temperature controlling means shall be provided to limit the maximum temperature of water delivered from lavatory faucets in public facility restrooms to 110°F (43°C). [ASHRAE 90.1:7.4.4.3]

**713.4 Circulating Pump Controls.** When used to maintain storage tank water temperature, recirculating pumps shall be equipped with controls limiting operation to a period from the start of the heating cycle to a maximum of 5 minutes after the end of the heating cycle. [ASHRAE 90.1:7.4.4.4]

**714.0 Insulation.** Hot water supply and return piping shall be thermally insulated. The wall thickness of the insulation shall be equal to the nominal diameter of the pipe up to 2 inches (50 mm). The wall thickness shall be not less than 2 inches (51 mm) for nominal pipe diameters exceeding 2 inches (50 mm). The conductivity of the insulation [k-factor (Btu•in/(h•ft<sup>2</sup>•°F))], measured radially, shall be less than or equal to 0.28 [Btu•in/(h•ft<sup>2</sup>•°F)] [0.04 W/(m•k)]. Hot water piping to be insulated shall be installed such that insulation is continuous. Pipe insulation shall be installed to within ¼ of an inch (6.4 mm) of all appliances, appurtenances, fixtures, structural members, or a wall where the pipe passes through to connect to a fixture within 24 inches (610 mm). Building cavities shall be large enough to accommodate the combined diameter of the pipe plus the insulation, plus any other objects in the cavity that the piping must cross. Pipe supports shall be installed on the outside of the pipe insulation.

**Exceptions:**

- (1) Where the hot water pipe is installed in a wall that is not of sufficient width to accommodate the pipe and insulation, the insulation thickness shall be permitted to have the maximum thickness that the wall can accommodate and not less than ½ of an inch (12.7 mm) thick.
- (2) Hot water supply piping exposed under sinks, lavatories, and similar fixtures.
- (3) Where hot water distribution piping is installed within attic, crawlspace, or wall insulation.
  - (a) In attics and crawlspaces the insulation shall cover the pipe not less than 5½ inches (140 mm) further away from the conditioned space.
  - (b) In walls, the insulation must completely surround the pipe with not less than 1 inch (25.4 mm) of insulation.
  - (c) If burial within the insulation will not completely or continuously surround the pipe, then these exceptions do not apply.

**715.1 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.

**715.1 Appliances. Project Elective.**

Where a building owner opts for the plumbing appliances project elective, and the building is an occupancy listed under 613.5.2, then 710.1.2 and 710.1.3 apply.

**715.1.2 Dishwashers.** Residential and commercial dishwashers shall be in accordance with the Energy Star program requirements.

**715.1.3 Clothes Washers.** Residential clothes washers shall be in accordance with the Energy Star program requirements. Commercial clothes washers shall be in accordance with Energy Star program requirements, where such requirements exist.

**715.2 Indoor water use.** This section contains *project electives* related to indoor water use.

**715.2.1 Water conservation tier project electives.** RESERVED.

**715.3 On-site wastewater treatment project elective.** RESERVED.

**715.4 Non-potable outdoor water supply project elective.** RESERVED.

**715.4.1 Labeling and signage.** RESERVED.

**715.5 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.

**715.5.1 Water quality.** *Non-potable* water for water closet and urinal flushing shall meet the requirements of Statewide Alternate Method(s) 080-1, 08-2, 08-3 or 08-4 as applicable.

**715.5.2 Filtration required.** RESERVED.

**715.5.3 Labeling and signage.** RESERVED.

**715.6 Automatic fire sprinkler system project elective.** RESERVED.

**710.6.1 Emergency power.** RESERVED.

**710.6.2 Source volume indication.** RESERVED.

**715.7 Non-potable water supply to fire pumps project elective.** RESERVED.

**715.7.1 Labeling and signage.** RESERVED.

**715.8 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 meet the requirements of Statewide Alternate Method 08-4.

**715.8.1 Labeling and signage.** RESERVED.

**715.9 Efficient hot water distribution system project elective.** RESERVED.

**715.9.1 Volume calculation.** RESERVED.

**715.10 Non-potable water for cooling tower makeup water project elective.** RESERVED.

**715.11 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, and clotheswashers and laundry trays, shall be collected for reuse onsite in accordance with the requirements of Statewide Alternate Method 08-2.

## 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.

**801.2 Indoor air quality management plan required.** RESERVED.

### SECTION 802 BUILDING CONSTRUCTION FEATURES,

**802.1 Scope.** To facilitate the energy efficient operation of the *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.** RESERVED.

**803.1.1 Duct openings.** RESERVED.

**803.1.2 Indoor air quality during construction.** RESERVED.

**803.1.2.1 Ventilation.** RESERVED.

**803.1.2.2 Protection of HVAC system openings.** RESERVED.

**803.1.2.3 Return air filters.** RESERVED.

**803.1.3 Construction phase ductless system or filter.** RESERVED.

**803.2 Thermal environmental conditions for human occupancy.** RESERVED

**803.3 Environmental tobacco smoke control.** RESERVED.

**803.4 Isolation of pollutant sources.** RESERVED.

**803.4.1 Print, copy and janitorial rooms and garages.** RESERVED.

**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.** RESERVED.

**804.1.1 Installation.** RESERVED.

**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 *Mechanical 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.

**804.2 Radon mitigation.** RESERVED.

**804.2.1 Subfloor preparation.** RESERVED.

**804.2.2 Soil-gas-retarder.** RESERVED.

**804.2.3 Entry routes. RESERVED.**

**804.2.3.1 Floor openings. RESERVED.**

**804.2.3.2 Concrete joints. RESERVED.**

**804.2.3.3 Condensate drains. RESERVED.**

**804.2.3.4 Sumps. RESERVED.**

**804.2.3.5 Foundation walls. RESERVED.**

**804.2.3.6 Dampproofing. RESERVED.**

**804.2.3.7 Air-handling units. RESERVED.**

**804.2.3.8 Ducts. RESERVED.**

**804.2.3.9 Crawl space floors. RESERVED.**

**804.2.3.10 Crawl space access. RESERVED.**

**804.2.4 Passive submembrane depressurization system. RESERVED.**

**804.2.4.1 Ventilation. RESERVED.**

**804.2.4.2 Soil-gas-retarder. RESERVED.**

**804.2.4.3 Vent pipe. RESERVED.**

**804.2.5 Passive subslab depressurization system. RESERVED.**

**804.2.5.1 Vent pipe. RESERVED.**

**804.2.5.2 Multiple vent pipes. RESERVED.**

**804.2.6 Vent pipe drainage. RESERVED.**

**804.2.7 Vent pipe accessibility. RESERVED.**

**804.2.8 Vent pipe identification. RESERVED.**

**804.2.9 Combination foundations. RESERVED.**

**804.2.10 Power source. RESERVED.**

**804.3 Building flush out. RESERVED.**

**804.4 Building Entrances. RESERVED.**

**804.4.1 Scraper Surface. RESERVED.**

**804.4.2 Absorption Surface. RESERVED.**

**804.4.3 Finishing Surface RESERVED.**

**SECTION 805  
ASBESTOS USE PREVENTION**

**805.1 Scope. RESERVED.**

**SECTION 806  
MATERIAL EMISSIONS & POLLUTANT CONTROL**

**806.1 Emissions from glued wood products. RESERVED.**

**806.2 Adhesives and sealants. RESERVED.**

**806.2.1 Single-ply roof membrane adhesives. RESERVED.**

**806.3 Architectural paints and coatings. RESERVED.**

**806.4 Flooring RESERVED.**

**806.5 Acoustical ceiling tiles and wall systems. RESERVED.**

**806.6 Insulation. RESERVED.**

**SECTION 807  
ACOUSTICS**

**807.1 Sound transmission. RESERVED.**

**807.2 Exterior sound transmission. RESERVED.**

**807.3 Interior sound transmission. RESERVED.**

**807.4 Mechanical and emergency generator equipment and systems. RESERVED.**

**807.4.1 Separating assemblies. RESERVED.**

**807.4.2 Mechanical and emergency generator equipment outside of buildings. RESERVED.**

**807.4.3 HVAC background sound. RESERVED.**

**807.5 Special inspections for sound transmission. RESERVED.**

**807.5.1 Testing for mechanical and emergency generator equipment outside of buildings. RESERVED.**

**807.5.2 Testing for building system background noise. RESERVED.**

## 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 when chosen by a building owner as a project elective. 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 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 12<sup>th</sup> 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.

$$\text{required } \textit{daylit area} \geq 50\% \times \text{TDP}$$

**(Equation 8-1)**

The total daylight potential (TDP) is a weighted average of the individual daylight potentials for each floor:

$$\text{TDP} = \sum (\text{DP}_1 \div \text{FA}_1/\text{TF}) + (\text{DP}_2 \div \text{FA}_2/\text{TF}) +$$

DP <sub>1</sub>	=	1 – [(OW <sub>1</sub> / TW <sub>1</sub> ) ÷ (OR <sub>1</sub> / TR <sub>1</sub> )].
OW <sub>1,2,...</sub>	=	The length of <i>obstructed exterior wall</i> for each floor.
TW <sub>1,2,...</sub>	=	The total length of exterior wall for each floor.
OR <sub>1,2,...</sub>	=	The <i>obstructed roof area</i> immediately above each floor.
TR <sub>1,2,...</sub>	=	The total roof area immediately above each floor.
FA <sub>1,2,...</sub>	=	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**

**RESERVED**

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## CHAPTER 9 COMMISSIONING, OPERATION AND MAINTENANCE

***THIS CHAPTER IS PROVIDED FOR REFERENCE ONLY. IT IS NOT ADOPTED AS A REQUIREMENT OF THE CODE.***

### SECTION 901 GENERAL

**901.1 Scope.** The provisions of this chapter are intended to facilitate the acceptance testing, 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 entity.** An *approved entity* 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 entity*.

**902.1.1 Independence.** An *approved entity* shall be objective, competent and independent from the contractor responsible for the work being inspected. The entity shall also disclose possible conflicts of interest so that objectivity can be confirmed.

**902.1.2 Equipment.** An *approved entity* shall have adequate equipment to perform the required *commissioning*. The equipment shall be periodically calibrated.

**902.1.3 Personnel.** An *approved entity* shall employ experienced personnel educated in conducting, supervising and evaluating functional 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 entity* 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 entity* 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 entity* provided those personnel meet the qualification requirements of this section to the satisfaction of the *code official*. The *approved entity* 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 entity* shall keep records of the *commissioning* required by Table 903.1. The *approved entity* 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.	
<b>Chapter 4: Site development and land use</b>						
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 activities	Periodic for 24 months	402.3.6
Hardscape and shading	X	X	Field inspection	During	24 months	404.2

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
provided by structures and vegetation			and report	construction and installation		
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
<b>Chapter 5: Materials</b>						
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
<b>Chapter 6 - Energy</b>						
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 test reports	During commissioning	Annually	604, 611
Mechanical systems completion – all buildings						
a. Air system balancing – provide the	X	None	Inspection and verification	During construction and prior to	None	612.1.2.1 and through

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
means for system balancing				occupancy		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 agent	After installation of HVAC systems and prior to occupancy	TBD	612.1.2
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	X	X	HVAC system installer/contractor or commissioning	After installation of HVAC systems and prior to	TBD	612.1.3.2

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
control systems			agent	occupancy		
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
<b>Ch 6 - Lighting</b>						
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 appliances to switched receptacles		X	Field Inspection	None	18-24 months	609.6
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	Post Installation	18-24 months	612.2

Construction or System requiring Verification	Pre Occ.	Post Occ.	Method	Occurrence		Section/ Ref. Std.
				Pre Occ.	Post Occ.	
			Commissioning Agent			
<b>Chapter 7: Water</b>						
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
<b>Chapter 8: IEQ</b>						
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
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:
  - 1.1 Vegetative shading, vegetative roofs and natural resource protections and setbacks.
  - 2.2 Water conserving landscape and irrigation systems.
    - a. Stormwater management systems.

- b. Permanent erosion control measures.
  - c. 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.

a. Floor finishes.

b. Fireplaces and combustion appliances.

c. Radon mitigation system.

d. 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, and addition* of existing *buildings and structures*.

**1001.2 Building operation.** Existing *buildings* and parts thereof, shall be operated 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 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, and additions* 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.

*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.

*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*.

**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. *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*. Alterations permitted under this code shall comply with and be verified through an approved third party.

**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.

**1003.1.1 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 1003.1.1.1, and 1003.1.1.2 or 1003.1.1.3.

**1003.1.1.1 Determination of energy Use .** Prior to alteration, the building owner shall enter into the Energy Star Portfolio Manager the building specifications, and have a Level 1 ASHRAE energy audit performed by a qualified third party.

**1003.1.1.2 Measurement-based compliance.** Measurement-based compliance shall be performed by an *approved entity* 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, unless there is a change in occupancy, as determined by the Portfolio Manager program. Altered portions of the building must meet or exceed the provisions of this code or obtain an Energy Star Energy Performance Score of at least 90 as verified by a qualified third party evaluator.

**1003.1.1.3 Third-party certification-based compliance.** Certification-based compliance performed by an *approved entity* that by reason of measurement, simulation, comparative studies, or other *approved* means, document that the *building* as altered meets the requirements of an approved high performance building certification.

**1003.2 Minimum energy, HVAC and water requirements.** RESERVED.

**1003.2.1 Heating, ventilation and air conditioning.** RESERVED.

**1003.2.2 Service water systems.** RESERVED.

**1003.2.3 Motor-driven equipment.** RESERVED.

**1003.3 Additional requirements.** RESERVED.

**1003.3.1 Energy audit and report.** RESERVED.

**1003.3.2 Metering devices.** RESERVED.

**1003.3.3 Heating, ventilation and air conditioning.** RESERVED.

**1003.3.4 Service water systems. RESERVED.**

**1003.3.5 Lighting. RESERVED.**

**1003.3.6 Commercial refrigeration equipment. RESERVED.**

**1003.3.7 Motor-driven equipment. RESERVED.**

**1003.3.8 Swimming pools and spas. RESERVED.**

**1003.3.9 Unconditioned attic insulation. RESERVED.**

**1003.3.10 Asbestos-containing products. RESERVED.**

**SECTION 1004  
CHANGE OF OCCUPANCY**

**1004.1 Change of occupancy. RESERVED.**

**SECTION 1005  
HISTORIC BUILDINGS**

**1005.1 Historic buildings. RESERVED.**

**SECTION 1006  
PROJECT ELECTIVES**

**1006.1 General. RESERVED.**

# **CHAPTER 11 EXISTING BUILDING SITE DEVELOPMENT**

## **SECTION 1101 GENERAL**

**1101.1 Scope. RESERVED.**

**1101.2 Operation and maintenance. RESERVED.**

**1101.3 Compliance. RESERVED.**

**1101.4 Building site materials, systems and landscaping. RESERVED.**

**1104.4.1 Existing materials, assemblies, configurations and systems. RESERVED.**

**1101.4.2 New and replacement materials, assemblies, configurations and systems. RESERVED.**

## **SECTION 1102 ADDITIONS**

**1102.1 General. RESERVED.**

## **SECTION 1103 ALTERATIONS TO EXISTING BUILDING SITES**

**1103.1 General. RESERVED.**

**1103.2 Changes to hardscapes and surface vehicle parking. RESERVED.**

## **SECTION 1104 CHANGE OF OCCUPANCY**

**1104.1 Conformance. RESERVED.**

**1104.2 Building site improvements. RESERVED.**

## **SECTION 1105 HISTORIC BUILDING SITES**

**1105.1 Historic building sites. RESERVED.**

## 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 Geoechange Heat Pumps. . . . .	Table 607.2.2.1, Table 613.4.2.3

### ANSI

American National Standards Institute  
25 West 43<sup>rd</sup> 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 <sup>st</sup> 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	Referenced
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reference number	Title	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- <a href="http://www.epa.gov/Ozone/title6/phaseout/22phaseout.html">http://www.epa.gov/Ozone/title6/phaseout/22phaseout.html</a> .....	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.	
Water Sense Feb-2007	Determination of Volatile Matter Content, Water Content, Density, Volume Solids And Weight Solids of Surface Coatings.....	806.2
Water Sense October-2007	High Efficiency Toilet Specification.....	Table 702.1, Table 702.1.1(3)
Water Sense October-2009	Lavatory Faucet Specification.....	Table 702.1
Water Sense March 2010	Flushing Urinal Specification.....	Table 702.1
	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  
6<sup>th</sup>Floor  
Washington, DC 20001

Standard reference	Referenced in code
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number	Title	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, 17<sup>th</sup> 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	Referenced
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reference number	Title	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 17<sup>th</sup> Street, NW, Suite 700  
Washington, DC 20006

Standard reference	Referenced in code
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number	Title	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 <sup>st</sup> 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

## Chapter 13 Residential Provisions

### SECTION 1301

#### SCOPE

**1301.1** General. The provisions of this chapter are voluntary and replace specific requirements of the Oregon Residential Specialty Code. The provisions of this code shall promote increased conservation of energy within a dwelling over the requirements of the Oregon Residential Specialty Code. Materials, methods, or techniques not addressed in this code shall be installed in accordance with the requirements set forth in the Oregon Building Code.

All conditioned spaces within low-rise residential dwellings, built to this code, shall comply with one of the following:

1. Prescriptive Compliance Path:

Residential dwellings using the prescriptive path shall comply with the provisions in section 1303.

2. Selective Compliance Path:

Residential dwellings using the selective path shall comply with the provisions in section 1304.

3. Alternative Systems Analysis:

Residential dwellings using the energy performance path shall comply with the provisions in section 1305.

4. Additions, Alterations, and Change of Occupancies shall comply with the provisions of 1306.

### SECTION 1302 DEFINITIONS

**AFUE (ANNUAL FUEL UTILIZATION EFFICIENCY).** The energy output divided by the energy input, calculated on an annual basis and including part load and cycling effects. AFUE ratings shall be determined using the U.S. Department of Energy test procedures (10 CFR Part 430) and listings in the Gas Appliance Manufacturers Association (GAMA) Consumer Directory of Certified Furnace and Boiler Efficiency Ratings.

**ASHRAE.** The American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc.

**AUTOMATIC.** A self-acting device, operating by its own mechanism when actuated by some impersonal influence, such as a change in current strength, pressure, temperature or mechanical configuration. (See also "Manual.")

**BASEMENT WALL.** The opaque portion of walls which encloses a basement and is partially or totally below grade walls.

**BELOW GRADE WALLS.** The walls or the portion of walls entirely below the finished grade or which extend 2 feet (610 mm) or less above the finish grade.

**BTU (British Thermal Unit).** The amount of heat required to raise the temperature of 1 pound (0.454 kg) of water (about 1 pint) from 59°F to 60°F (15°C to 16°C).

**BUILDING ENVELOPE.** That element of a building which encloses conditioned spaces through which thermal energy may be transmitted to or from the exterior or to or from unconditioned spaces.

**CLAY.** Soil that contains a majority of particles smaller than 2 µm. (per ISO 14688 ) that also exhibit a high plasticity Index (per ASTM D 4318).

**CLAY SLIP.** A suspension of clay particles in water.

**CLAY SOIL.** Soil containing 50% or more clay per volume.

**COLLECTION METHOD.** The method of transport between the Commode and the Composting Chamber.

**COMMUNE.** The lavatory fixture exposed to Composting Toilet System users.

**COMPOST ADDITIVES.** Carbonaceous bulking material such as sawdust, leaves, or any other material added to Composting Chamber to maintain aerobic conditions within Composting Toilet System.

**COMPOSTING CHAMBER.** Container in which human wastes, toilet paper, and organic matter is transformed into Humus through aerobic decomposition.

**COMPOSTING TOILET SYSTEM.** The Commode, Collection Method, Composting Chamber, and Management Plan for the decomposition of human wastes, toilet paper, and organic matter into Humus through aerobic decomposition.

**CONDITIONED SPACE.** A space within the building, separated from unconditioned space by the exterior envelope which by introduction of conditioned air, by heated and/or cooled surfaces, or by air or heat transfer from directly conditioned spaces is maintained at temperatures of 55°F (13°C) or higher for heating and/or 85°F (29.4°C) or below for cooling. (Enclosed corridors between conditioned spaces shall be considered as conditioned space. Spaces where temperatures fall between this range by virtue of ambient conditions shall not be considered as conditioned space.)

**ENERGY CONTROL DEVICE.** A device which is installed within a dwelling that can provide near real-time data on whole dwelling energy consumption and is intended to operate energy consuming appliances and/or devices for a dwelling in order to reduce energy consumption. Consumption control systems are also known as Building Automation Control (BAC) or Building Management Control Systems (BMCS).

**EXTERIOR DOOR.** A permanently installed operable barrier by which an entry is closed and opened. Exterior doors include doors between conditioned and unconditioned spaces, such as a door between a kitchen and garage.

**EXTERIOR ENVELOPE.** See “Building Envelope.”

**EXTERIOR WALL.** Any member or group of members, which defines the exterior boundaries of the conditioned space and which has a slope of 60 degrees or greater with the horizontal plane.

**EXTERIOR WINDOW.** An opening, especially in the wall of a building, for admission of light or air that is usually closed by casement or sashes containing transparent material (such as glass) and in some cases capable of being opened and shut. All areas, including frames, in the shell of a conditioned space that let in natural light, including skylights, sliding glass doors, glass block walls and the glazed portions of the doors.

When calculating the energy performance of the exterior envelope, the area of the window shall be the total area of glazing measured using the rough opening dimensions, and including the glass, sash and frame.

**FENESTRATION.** Windows and doors in the exterior envelope. See the definitions for “Exterior Door” and “Exterior Window.”

**FLOOR AREA.** The area included within the surrounding exterior walls of a building or portion thereof, exclusive courts. The floor area of a building or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above.

**GLAZING.** All areas including frames in the shell of a conditioned space that let in natural light, including windows, clerestories, skylights, sliding glass doors, glass block walls and the glazed portion of doors.

**GROSS AREA OF EXTERIOR WALLS.** Consists of wall areas, as measured on the exterior, including foundation walls above grade; peripheral edges of floors; window areas, including sash; and door areas, where such surfaces are exposed to outdoor air and enclose a heated or mechanically cooled space.

**HEATED SPACE.** A space within a building served by a mechanical, electrical or combustion source of heat. Spaces within a basement shall be defined as heated when any of the following apply: the space is finished, or has heating registers or contains heating devices.

**HIGH-EFFICACY LAMPS.** Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps or lamps with a minimum efficacy of:

1. 60 lumens per watt for lamps over 40 watts.
2. 50 lumens per watt for lamps over 15 watts to 40 watts.
3. 40 lumens per watt for lamps 15 watts or less.

**HSPF (HEATING SEASONAL PERFORMANCE FACTOR).** The total heating output of a heat pump during its normal annual usage period for heating divided by the total electric power input in watt-hours during the same period.

**HUMUS.** Soil-like product created through the decomposition of wastes, toilet paper, and organic matter.

**HVAC (HEATING, VENTILATING AND AIR-CONDITIONING) SYSTEM.** Refers to the equipment, distribution network, and terminals that provide either collectively or individually the processes of heating, ventilating, and/or air-conditioning processes to a building.

**INFILL.** Light Straw Clay mixture which is placed between the structural members of a building.

**LIGHT STRAW CLAY.** A mixture of straw and clay compacted to form an insulated wall between or around structural members and around wall openings. Also known as Clay-Straw, Clay-Fiber, Straw-Clay, or SLC.

**LIQUID DIVERSION.** Method for separating liquid and solid components.: method for separating liquid and solid components.

**MANUAL.** (non-automatic) Action that requires human intervention as the basis for control. (See “Automatic.”)

**MANAGEMENT PLAN.** A plan for regularly scheduled actions that maintain safety and aerobic conditions within the Composting Toilet System.

**MONOLITHIC.** A continuous wall without seams.

**NON-LOAD BEARING.** Not bearing the weight of the building other than the weight of the light straw clay itself and its finish.

**R (THERMAL RESISTANCE).** See “Thermal Resistance.”

**RESIDENTIAL BUILDINGS.** Buildings and structures, or portions thereof, housing Group R, occupancies which are three stories or less in height.

**STRAW.** The dry stems of cereal grains after the seed heads have been removed.

**THERMAL RESISTANCE (R).** The measure of the resistance of a material or building component to the passage of heat, has the value of  $(\text{hr.}\cdot\text{ft.}^2\cdot\text{°F})/\text{Btu}$ , and is the reciprocal of thermal conductance.

**THERMAL TRANSMITTANCE (U).** The coefficient of heat transfer. It is the time rate of heat flow per unit area under steady state conditions from the fluid on the warm side of the barrier to the fluid on the cold side, per unit temperature difference between the two fluids,  $\text{Btu}/(\text{hr.}\cdot\text{ft.}^2\cdot\text{°F})$ .

**THERMOSTAT.** An instrument which measures changes in temperature and controls a device or devices to maintain a desired temperature.

**TOTAL SOLAR RESOURCE FRACTION.** The fraction of usable solar energy that is received by the solar panel/collector throughout the year. This accounts for the impacts due to external shading, collector tilt and collector orientation.

**U (THERMAL TRANSMITTANCE).** See “Thermal Transmittance.”

**VAULTED CEILING.** A residential building with a ceiling with a minimum slope of 2 in 12.

**VOID.** Any space in a light straw clay wall that allows a 2” sphere to be inserted.

**WINDOW.** See “Exterior Window.”

**ZONE.** A space or group of spaces within a building with heating or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

### **Section 1303 Prescriptive Compliance Path**

**1303.1 Prescriptive Compliance Path.** Residential dwellings shall comply with Table 1303.1(1), one “Envelope Enhancement Measure” from Table 1303.1(2) and one “Conservation Measure” from Table 1303.1(2), and the requirements of this section.

Exception:

1. Dwelling units that are 1,500 square feet or less of conditioned floor area, shall not be required to meet the envelope requirements specified in Table 1303.1(1). Dwelling units using this exception shall comply with Table N1101.1(1), Prescriptive Envelope Requirements, of the Oregon Residential Specialty Code.
2. Dwelling that are greater than 5,000 square feet of conditioned floor area shall select one additional measure from the “Conservation Measure” section of Table 1303.1(2).

**1303.1.1** Residential dwellings, built to this section, shall provide a means for the installation of future onsite energy generation facilities. The means shall be provided by complying with either of the following:

1. Photovoltaic: The dwelling shall be provided with a minimum  $\frac{3}{4}$  inch conduit or a  $\frac{3}{4}$  inch chase terminating, in accordance with the building code, in an accessible area of the attic space and near the electrical panel. Electrical panels shall be sized to accommodate a minimum 40 Amp solar feed, and room shall be reserved for a double pole, 40 amp 240 volt breaker on the opposite end from the main service feeder. Each termination shall be clearly labeled, "Future Renewable Access"; or
2. Solar Hot Water: The dwelling shall be provided with a space for at least a  $\frac{3}{4}$  inch supply and return pipe and insulation. Proposed route shall have a minimum  $\frac{1}{4}$  inch per foot slope from accessible attic space or roof and the water heater location. Terminating ends of the chase shall be capped and labeled clearly, "Future Renewable Access", in accordance with the building code. The installation of an insulated  $\frac{3}{4}$  inch supply and return pipe, capped, terminated, and labeled at each end shall be considered an acceptable alternative to a chase.

Exception:

1. Where using available tools for calculating the solar resource, the solar resource fraction is less than 75.
2. Where solar photovoltaic or solar hot water is installed under Table 1303.1(2).

### **1303.2 Envelope.**

**1303.2.1 EXTERIOR ENVELOPE REQUIREMENTS.** Exterior building envelope shall comply with Table 1303.1(1) or may be demonstrated using Table 1303.2(1). The requirements specified in Table 1303.1(2) shall apply to both Tables 1303.1(1) and 1303.2(1).

### **1303.3 Plumbing.**

<Reserved>

### **1303.4 Mechanical.**

<Reserved>

### **1303.5 Electrical.**

**1303.5.1 High-efficacy lighting.** The provisions of this section apply to lighting equipment, related controls and electric circuits serving all conditioned and unconditioned interior floor space and exterior building facades of all dwelling units and guest rooms within residential buildings and structures, or portions thereof. A minimum of seventy-five (75) percent of the permanently installed lighting fixtures shall contain high-efficacy lamps. Screw-in compact florescent lamps comply with this requirement.

The building official shall be notified in writing at the final inspection that a minimum of seventy-five (75) percent of the permanently installed lighting fixtures have met this requirement.

**TABLE 1303.1(1)**  
**PRESCRIPTIVE ENVELOPE REQUIREMENTS <sup>a</sup>**

Building Component	Standard Base Case		Log Homes Only	
	Required Performance	Equiv. Value <sup>b</sup>	Required Performance	Equiv. Value <sup>b</sup>
Wall insulation-above grade	U-0.060	R-21 <sup>c</sup>	<sup>d</sup>	<sup>d</sup>
Wall insulation-below grade <sup>e</sup>	F-0.565	R-15	F-0.565	R-15
Flat ceilings, or <sup>f</sup>	U-0.025	R-49	???	???
Advanced framed flat ceilings <sup>f</sup>	U-0.026	R-38	U-0.025	R-49
Vaulted ceilings <sup>g</sup>	U-0.042	R-38 <sup>g</sup>	U-0.027	R-38A <sup>h</sup>
Under floors	U-0.028	R-30	U-0.028	R-30
Slab edge perimeter	F-0.520	R-15	F-0.520	R-15
Heated slab interior <sup>i</sup>	n/a	R-10	n/a	R-10
Windows <sup>j</sup>	U-0.30	U-0.30	U-0.30	U-0.30
Window area limitation <sup>j, k</sup>	n/a	n/a	n/a	n/a
Skylights <sup>l</sup>	U-0.50	U-0.50	U-0.50	U-0.50
Exterior doors <sup>m</sup>	U-0.20	U-0.20	U-0.54	U-0.54
Exterior doors w/>2.5 ft <sup>2</sup> glazing <sup>n</sup>	U-0.32	U-0.32	U-0.32	U-0.32
Forced air duct insulation	n/a	R-8	n/a	R-8

- <sup>a</sup> As allowed in Section RC201.2.1, thermal performance of a component may be adjusted provided that overall heat loss does not exceed the total resulting from conformance to the required *U*-value standards. Calculations to document equivalent heat loss shall be performed using the procedure and approved *U*-values contained in Table RC201.1(1).
- <sup>b</sup> R-values used in this table are nominal, for the insulation only in standard wood framed construction and not for the entire assembly.
- <sup>c</sup> Wall insulation requirements apply to all exterior wood framed, concrete or masonry walls that are above grade. This includes cripple walls and rim joist areas. R-19 Advanced Frame or 2 x 4 wall with rigid insulation may be substituted if total nominal insulation R-value is 18.5 or greater.
- <sup>d</sup> The wall component shall be a minimum solid log or timber wall thickness of 3.5 inches.
- <sup>e</sup> Below-grade wood, concrete or masonry walls include all walls that are below grade and does not include those portions of such wall that extend more than 24 inches above grade.
- <sup>f</sup> Insulation levels for ceilings that have limited attic/rafter depth such as dormers, bay windows or similar architectural features totaling not more than 150 square feet in area may be reduced to not less than R-21. When reduced, the cavity shall be filled (except for required ventilation spaces). Advanced framing construction for ceilings as defined in Section N1104.6 of the Oregon Residential Specialty Code.
- <sup>g</sup> The maximum vaulted ceiling surface area shall not be greater than 50 percent of the total heated space floor area unless area has a U-factor no greater than U-0.031. The U-factor of 0.042 is representative of a vaulted scissor truss. A 10-inch deep rafter vaulted ceiling with R-30 insulation is U-0.033 and complies with this requirement, not to exceed 50 percent of the total heated space floor area.
- <sup>h</sup> A=advanced frame construction, which shall provide full required insulating value to the outside of exterior walls.
- <sup>i</sup> Heated slab interior applies to concrete slab floors (both on and below grade) that incorporate a radiant heating system within the slab. Insulation shall be installed underneath the entire slab.
- <sup>j</sup> Sliding glass doors shall comply with window performance requirements. Windows exempt from testing in accordance with NF1111.2 Item 3 shall comply with window performance requirements if constructed with thermal break aluminum or wood, or vinyl, or fiberglass frames and double-pane glazing with low-emissivity coatings of 0.10 or less. Buildings designed to incorporate passive solar elements may include glazing with a U-factor greater than 0.35 by using Table N1104.1(1) to demonstrate equivalence to building envelope requirements.
- <sup>k</sup> Reduced window area may not be used as a trade-off criterion for thermal performance of any component.
- <sup>l</sup> Skylight area installed at 2% or less of total heated space floor area may have a U-factor of 0.60. Skylight U-factor is tested in the 20 degree overhead plane per NFRC standards.
- <sup>m</sup> A maximum of 28 square feet of exterior door area per dwelling unit can have a U-factor of 0.54 or less.
- <sup>n</sup> Glazing that is either double pane with low-e coating on one surface, or triple pane shall be deemed to comply with this U-0.32 requirement.

**Table 1303.1(2)**  
**Additional Measures**

Envelope Enhancement Measure (Select One)	Measure Description
1	<b>High efficiency walls &amp; windows:</b> (Cannot be used with Conservation Measure 2) Exterior walls – U-0.047 / (See Table 1303.2(2) for examples) Windows – Max 15% of conditioned area; or Windows – U-0.25
2	<b>High efficiency thermal envelope UA:</b> (Cannot be used with Conservation Measure 2) Proposed UA is 15% lower than the Code UA when calculated in Table N1104.1(1)
3	<b>Building tightness testing, ventilation &amp; duct sealing:</b> (Cannot be used with Conservation Measure 1 or 6) A mechanical exhaust, supply, or combination system providing whole-building ventilation rates specified in table 1303.1(3), or ASHRAE 62.2, and The dwelling shall be tested with a blower door and found to exhibit no more than 4.0 air changes per hour <sup>f</sup> and Performance tested duct systems <sup>b</sup>
4	<b>HVAC within conditioned space:</b> (Cannot be used with Conservation Measure 1 or 3) All ducts and air handler are contained within building envelope <sup>l</sup>

Conservation Measure (Select One)	1	<b>High efficiency gas forced air system and Duct Sealing:</b> Gas-fired furnace with minimum AFUE of 90% <sup>a</sup> , and Performance tested duct systems <sup>b</sup> .
	2	<b>High efficiency gas forced air system:</b> Gas-fired furnace with minimum AFUE of 95% <sup>a</sup> ,
	3	<b>High efficiency electric forced air system:</b> Air-source heat pump with minimum HSPF of 9.0, designed at 30° balance point, or Closed-loop ground source heat pump with minimum COP of 3.0; and Performance tested duct systems <sup>b</sup> .
	4	<b>HVAC within conditioned space:</b> All ducts and air handler are contained within building envelope <sup>l</sup>
	5	<b>Ductless mini-split heat pump:</b> Replace electric resistance heating in at least the primary zone of dwelling with at least one ductless mini-split heat pump having a minimum HSPF of 8.5. Unit shall not have integrated backup resistance heat, and the unit (or units, if more than one is installed in the dwelling) shall be sized to have capacity to meet the entire dwelling design heat loss rate. Conventional electric resistance heating may be provided for any secondary zones in the dwelling.
	6	<b>High efficiency water heating &amp; lighting:</b> Natural gas/propane water heating with min EF of 0.81, and A minimum 90 percent of permanently installed lighting fixtures as CFL or linear fluorescent or a min efficacy of 40 lumens per watt as specified in section RC201.5 <sup>c</sup>
	7	<b>Energy management device, windows &amp; duct sealing:</b> Whole building energy management device that is capable of monitoring or controlling energy consumption, and Performance tested duct systems <sup>b</sup> , and Windows U-Value= 0.25
	8	<b>Solar photovoltaic:</b> Minimum 1.5 watt / sq ft conditioned floor space <sup>g</sup>
	9	<b>Solar water heating:</b> Minimum of 40 ft <sup>2</sup> of gross collector area <sup>h</sup>

For SI: 1 square foot = 0.093 m<sup>2</sup>, 1 watt per square foot = 10.8 W/m<sup>2</sup>.

- Furnaces located within the building envelope shall have sealed combustion air installed. Combustion air shall be ducted directly from the outdoors.
- Documentation of Performance Tested Ductwork shall be submitted to the Building Official upon completion of work. This work shall be performed by a contractor certified by the Oregon Department of Energy's (ODOE) Residential Energy Tax Credit program and documentation shall be provided that work demonstrates conformance to ODOE duct performance standards.
- Section 1303.5.1 requires 75 percent of permanently installed lighting fixtures to be CFL or linear fluorescent or a min. efficacy of 40 lumens per watt. Each of these additional measures adds an additional percent to the 1303.5.1 requirement.
- A=advanced frame construction, which shall provide full required ceiling insulation value to the outside of exterior walls.
- The maximum vaulted ceiling surface area shall not be greater than 50 percent of the total heated space floor area unless vaulted area has a U-factor no greater than U-0.026.
- Building tightness test shall be conducted with a blower door depressurizing the dwelling 50 Pascals from ambient conditions. Documentation of blower door test shall be submitted to the Building Official upon completion of work.
- Solar electric system size shall include documentation indicating that Total Solar Resource Fraction is not less than 75%.
- Solar water heating panels shall be Solar Rating and Certification Corporation (SRCC) Standard OG-300 certified and labeled, with documentation indicating that Total Solar Resource Fraction is not less than 75%.
- A total of 5%, five percent, of an HVAC systems ductwork shall be permitted to be located outside of the conditioned space. Ducts located outside the conditioned space shall have insulation installed as required in this code.

**TABLE 1303.1(3)**  
**VENTILATION AIR REQUIREMENTS, cfm**

Floor Area (ft <sup>2</sup> )	Bedrooms				
	0-1	2-3	4-5	6-7	>7
<1500	30	45	60	75	90
1501-3000	45	60	75	90	105
3001-4500	60	75	90	105	120
4501-6000	75	90	105	120	135
6001-7500	90	105	120	135	150
>7501	105	120	135	160	185

**TABLE 1303.2(1)  
RESIDENTIAL THERMAL PERFORMANCE CALCULATIONS**

BUILDING COMPONENTS <sup>b</sup>	Standard base case <sup>a</sup>			Proposed alternative			
	Areas <sup>c</sup>	U-factor	Areas x U	R-value <sup>d</sup>	Areas <sup>c</sup>	U-factor <sup>e</sup>	Areas x U
Flat ceilings		0.025					
Vaulted ceilings <sup>f</sup>		0.042					
Conventional wood-framed walls		0.060					
Underfloor		0.028					
Slab edge		(perimeter ft. =) F=0.52 <sup>g</sup>					
Windows		0.30					
Skylights		0.50					
Exterior doors <sup>i</sup>		0.20					
Doors with >2.5 ft <sup>2</sup> glazing		0.32					
		<b>CODE UA =</b>			<b>Proposed UA <sup>j</sup> =</b>		

<sup>a</sup> Base path 1 represents Standard Base Case from Table ORSC N1101.1(1).

<sup>b</sup> Performance trade-offs are limited to those listed in column 1. Heat plant efficiency, duct insulation levels, passive and active solar heating, air infiltration and similar measures including those not regulated by code may not be considered in this method of calculation.

<sup>c</sup> Areas from plan take-offs. All areas must be the same for both Standard Base Case and Proposed Alternate. The vaulted ceiling surface area for Standard Base Case must be the actual surface area from the plan take-off not to exceed 50 percent of the total heated space floor area. Any areas in excess of 50 percent for Base Case must be entered at U-0.031 (R-38) with "Flat Ceilings" area.

<sup>d</sup> Minimum Component Requirements: Walls R-15; Floors R-21; Flat Ceilings R-38; Vaults R-21; Below-Grade Wood, Concrete or Masonry Walls R-15; Slab Edge R-10; Duct Insulation R-8. R-values used in this table are nominal, for the insulation only and not for the entire assembly. Window and skylight U-values shall not exceed 0.65 (CL65). Door U-values shall not exceed 0.54 (Nominal R-2). A maximum of 28 square feet of exterior door area per dwelling unit can have a U-factor of 0.54 or less and shall not be included in calculations.

<sup>e</sup> U-values for wood frame ceilings, walls and floor assemblies shall be as specified in Table N1104.1(2). U-values for other assemblies, which include steel framing, brick or other masonry, stucco, etc., shall be calculated using standard ASHRAE procedures.

<sup>f</sup> Vaulted area, unless insulated to R-38, U-0.031, may not exceed 50 percent of the total heated space floor area.

<sup>g</sup> F=The heat loss coefficient, BTU/hr./ft.<sup>2</sup>/°F, per foot of perimeter.

<sup>h</sup> Whenever skylight area for Proposed Alternative exceeds 2 percent of the total heated space floor area, enter 2 percent of area under Standard Base Case at U-0.60 then the remaining area under Standard Base Case at U-0.50. For Proposed Alternative skylights, enter the actual skylight area and U-factor of those to be installed in residence.

<sup>i</sup> A maximum of 28 square feet of exterior door area per dwelling unit can have a U-factor of 0.54 or less. Default U-factor for an unglazed wood door is 0.54.

<sup>j</sup> Proposed UA must be less than or equal to Code UA.

## Section 1304 Selective Compliance Path

**1304.1 Selective Compliance Path.** Residential dwellings electing to build to the selective compliance path shall comply with the requirements of the Oregon Residential Specialty Code and follow the additional requirements of this section.

**1304.1.1** Residential dwellings, built to this section, shall provide a means for the installation of future onsite energy generation facilities. The means shall be provided by complying with either of the following:

1. Photovoltaic: The dwelling shall be provided with a minimum ¾ inch conduit or a ¾ inch chase terminating, in accordance with the building code, in an accessible area of the attic space and near the electrical panel. Electrical panels shall be sized to accommodate a minimum 40 Amp solar feed, and room shall be reserved for a double pole, 40 amp 240

volt breaker on the opposite end from the main service feeder. Each termination shall be clearly labeled, "Future Renewable Access"; or

3. Solar Hot Water: The dwelling shall be provided with a space for at least a ¾ inch supply and return pipe and insulation. Proposed route shall have a minimum ¼ inch per foot slope from accessible attic space or roof and the water heater location. Terminating ends of the chase shall be capped and labeled clearly, "Future Renewable Access", in accordance with the building code. The installation of an insulated ¾ inch supply and return pipe, capped, terminated, and labeled at each end shall be considered an acceptable alternative to a chase.

Exception:

1. Where using available tools for calculating the solar resource, the solar resource fraction is less than 75.
2. Where solar or another renewable is actually installed per Table 1304.2(2).

**1304.2 Additional measures.** In addition to the requirements of Chapter 11 of the Oregon Residential Specialty Code, dwellings shall install additional energy conservation measures, in accordance with Table RC301.2(1), from the provisions in Table RC301.2(2).

**Table 1304.2(1)  
Additional Measures Required**

Conditioned Space (Square Footage)	Number of Points Required
≤ 1,500	8
1,501-2,250	10
2,251 – 5,000	15
≥ 5,001	20

**Table 1304.2(2)  
Measures Table**

Measure #	Measure	Pts	Measure Notes:
<b>Envelope Measures</b>			
1	Walls - U- 0.047	5	
	Walls - U- 0.038	9	
	Walls - U- 0.027	15	
2	BIBS wall insulation (blown in blanket)	2	
3	Ceiling - U- 0.027 (vaulted only)	2	
	Ceiling - U- 0.025 (R38 advanced flat)	3	
	Ceiling - U- 0.020 (R49 advanced flat)	6	
	Ceiling - U- 0.017 (R60 advanced flat)	7	
4	Windows - .25 (area-weighted average)	9	
	Windows - .22 (area-weighted average)	11	
	Windows - .20 (area-weighted average)	13	
	Windows max 12% of floor area	6	

5	Floor - R38	1	
6	Envelope UA is 5% lower than 2011 code	6	
	Envelope UA is 10% lower than 2011 code	10	
	Envelope UA is 15% lower than 2011 code	15	
	Envelope UA is 20% lower than 2011 code	18	
7	5.0 ACH, proper ventilation required	6	
	4.0 ACH, proper ventilation required	13	
	3.0 ACH, balanced ventilation required	19	
	<2.0 ACH, balanced ventilation required	26	
<b>HVAC Measures</b>			
8	Gas fired furnace w/ minimum AFUE of 95%	5	
	Air sourced heat pump w/ HSPF 8.5	2	
	Air sourced heat pump w/ HSPF 9.0	3	
	Ductless mini split for at least 1 living zone(w/min HSPF of 8.5)	10	
	Closed loop ground source w/ COP 3.3	14	
9	ECM motor on any forced air furnace	1	
10	Ducts sealed with mastic	3	
	Performance tested ducts and sealing with mastic	8	
	Ducts and HVAC in condition space	9	
11	Heat Recovery Ventilator	4	
	Energy Recovery Ventilator	4	
12	Direct-Vent Fireplace installed with Electronic ignition and controlled by a thermostat.	1	Points are awarded to only one fireplace if multiple are installed.
<b>Plumbing Measures</b>			
13	Water heating gas EF > 0.88	15	
	Water heating gas EF >= .81	12	
	Water heating gas EF >= .67	5	
	water heating electric EF .95	1	
	Water heating heat pump EF 2.0 or COP 2.5	13	
14	Insulate all hot water lines (R4 min)	1	
15	Lower flow showerheads (< 1.75 gpm)	2	
16	Drain-water heat recovery system	4	
<b>Onsite Generation</b>			
17	Solar 1.0 watt/sqft of conditioned space	19	
	Solar 1.5 watt/sqft of conditioned space	28	
18	Solar water 40 sqft of collector area	15	
<b>Miscellaneous Measures</b>			
19	75% CFL	1	
	90% CFL	2	
20	Meets Energy Star Standards	12	
21	Energy Star Thermal by-pass check list	3	

**SECTION 1305**  
**ALTERNATIVE SYSTEMS ANALYSIS**

**1305.1 General.** The building official shall approve alternative designs, when it has been demonstrated that the proposed annual energy consumption will be lower than the annual energy consumption if the dwelling was designed in accordance with the provisions of Chapter 11 of the Oregon Residential Specialty Code. Dwellings shall provide a reduction in the projected annual energy consumption as specified in Table 1305.1.

**Table 1305.1**  
**Annual Energy Consumption Reduction**

Conditioned Space (Square Footage)	Percentage Below the ORSC
≤ 1,500	8
1,501-2,250	10
2,251 – 5,000	15
≥ 5,001	20

**1305.1.1** Residential dwellings, built to this section, shall provide a means for the installation of future onsite energy generation facilities. The means shall be provided by complying with either of the following:

1. Photovoltaic: The dwelling shall be provided with a minimum ¾ inch conduit or a ¾ inch chase terminating, in accordance with the building code, in an accessible area of the attic space and near the electrical panel. Electrical panels shall be sized to accommodate a minimum 40 Amp solar feed, and room shall be reserved for a double pole, 40 amp 240 volt breaker on the opposite end from the main service feeder. Each termination shall be clearly labeled, "Future Renewable Access"; or
2. Solar Hot Water: The dwelling shall be provided with a space for at least a ¾ inch supply and return pipe and insulation. Proposed route shall have a minimum ¼ inch per foot slope from accessible attic space or roof and the water heater location. Terminating ends of the chase shall be capped and labeled clearly, "Future Renewable Access", in accordance with the building code. The installation of an insulated ¾ inch supply and return pipe, capped, terminated, and labeled at each end shall be considered an acceptable alternative to a chase.

Exception:

1. Where using available tools for calculating the solar resource, the solar resource fraction is less than 75.
2. Where solar or another renewable is actually installed.

**1305.1 Design parameters.** The baseline design, conforming to requirements specified in the Oregon Residential Specialty Code and the proposed design shall be analyzed using the same procedures. The analyses shall use equal floor area, equal fenestration area, equal orientation,

and equal environmental requirements. The foundation type of the dwelling shall be consistent between the baseline design and the proposed design. Changes in foundation materials shall be permitted within a foundation type. The comparison shall be expressed in millions of Btu (MBTU) per year.

**1305.1.1 Allowable Trade-Offs.** When satisfying the energy consumption savings set forth in section **1305.1**, trade-offs to the requirements of the Oregon Residential Specialty Code shall be allowed as specified in this section. Trade-offs in this analysis shall be from building envelope components, HVAC distribution systems, or a combination thereof.

**Exception:** HVAC Equipment efficiencies may be allowed when the efficiencies comply with those set forth in Table 1303.1(2), and the distribution system is <5% of the duct area is outside conditioned space or tested to demonstrate duct leakage that does not exceed 7% of nominal system design flow rate.

**1305.1 Documentation.** Proposed alternative designs for the Reach Code shall be accompanied by an energy analysis comparison report prepared by a registered design professional, certified home energy rater/auditor, or other approved energy analysis organization. The report shall provide sufficient technical detail describing the differences between the two building, systems designs, and the data used in and resulting from the comparative analysis.

*Where the dwelling proposes a u-factor for an envelope component that does not meet the performance requirements in Table N1101.1(1) of the Oregon Residential Specialty Code, the dwelling shall demonstrate compliance by completing Table N1104.1(1).*

## **Section 1306 Additions, Alterations, and Change of Occupancies**

**1306.1 General.** Additions, Alterations, and Change of Occupancies shall comply with the provisions of this code and the provisions of the Oregon Residential Specialty Code.

**1306.1 Additions.** Additions to existing buildings or structures may be made without making the entire building or structure comply, if the new additions comply with the requirements of this section, Table RC201.1(1), and the requirements of the Oregon Residential Specialty Code.

**1306.1.1 Large Additions.** Additions that are equal to or more than 40 percent of the existing building heated floor area or 600 square feet in area, whichever is less, shall be required to comply with Tables RC201.1(1) and RC201.1(2)

**1306.1.2 Small Additions.** Additions that are less than 40 percent of the existing building heated floor area or less than 600 square feet in area, whichever is less, shall be required to select one measure from Table 1303.1(2) or comply with Table 1306.2.2.

**Exception:** Additions that are less than 15 percent of existing building heated floor area or 200 square feet in area, whichever is less, shall not be required to comply with Table 1303.1(2) or Table 1306.2.2.

**TABLE 1306.2.2  
SMALL ADDITION ADDITIONAL MEASURES (Select Two)**

<b>1</b>	Increase the ceiling insulation of the existing portion of the home as specified in Table N1101.2.
<b>2</b>	Replace all existing single-pane wood or aluminum windows to the u-value as specified in Table N1101.2.
<b>3</b>	Insulate the floor system as specified in Table N1101.2 and install 50 percent of permanently installed lighting fixtures as CFL or linear fluorescent or a min. efficacy of 40 lumens per watt as specified in Section N1107.2.
<b>4</b>	Test the entire dwelling with a blower door and exhibit no more than 7.0 air changes per hour @ 50 Pascal's.
<b>5</b>	Seal and performance test the duct system.
<b>6</b>	Replace existing 78% AFUE or less gas furnace with a 92% AFUE or greater system.
<b>7</b>	Replace existing electric radiant space heaters with a ductless mini split system with a minimum HSPF of 8.5.
<b>8</b>	Replace existing electric forced air furnace with an air source heat pump with a minimum HSPF of 8.5.
<b>9</b>	Replace existing water heater for a natural gas/propane water heater with min EF of 0.67.
<b>10</b>	Install a solar water heating system with a minimum of 40 ft <sup>2</sup> of gross collector area.

**1306.1 Alteration and repair.** Alterations or repairs, which affect components of existing conditioned spaces, those components shall comply with chapter 11 of the Oregon Residential Specialty Code.

**Exception:** The minimum component requirements as specified in Table 1306.1 shall be used to the maximum extent practical.

**TABLE 1306.1  
EXISTING BUILDING COMPONENT REQUIREMENTS**

<b>Building Components</b>	<b>Required Performance</b>	<b>Equiv. Value</b>
Wall Insulation	U-0.60	R-15+3.5 or R-21
Flat Ceiling	U-0.025	R-49
Vaulted Ceiling ≥ 10 inches nominal rafter depth.	U-0.040	R-25
Vaulted Ceiling ≥ 8 inches nominal rafter depth.	U-0.047	R-21
Under floor ≥10 inches nominal joist depth.	U-0.028	R-30
Under floor ≥8 inches nominal joist depth.	U-0.032	R-25
Slab edge perimeter	F-0.52	R-15
Windows	U-0.30	U-0.30
Skylights	U-0.60	U-0.60
Exterior Doors	U-0.20	R-5
Exterior Doors w/> 2.5 ft <sup>2</sup> glazing	U-0.40	R-2.5

Forced Air Ducts	n/a	R-8
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<sup>a</sup>The addition of exterior insulation is only required when the dwelling is also receiving a whole dwelling siding replacement. If a whole dwelling siding replacement is not being completed, the cavity shall be filled as feasible.

**1306.1 Change of Use or Occupancy.** A building that changes use or occupancy, without any changes to the components shall comply with Table RC503.1 to the greatest extent practical.

## **Section 1307 Alternate Methods and Materials**

**1307.1 Alternate Methods and Materials.** The materials, methods, or techniques contained in this section maybe used when building to the provisions of the Reach Code. Materials, methods, or techniques used to satisfy the requirements of this code shall be documented within the construction documents.

### **1307.2 Structural.**

**1307.2.1 Structural Sheathing Applied Over Foam.** When designed by a registered design professional, the application of structural sheathing installed over foam sheathing shall be allowed.

### **1307.3 LIGHT STRAW CLAY**

**1307..3.1 Scope.** This appendix shall govern the use of light straw clay as a non-loadbearing building material and system. Unless stated otherwise in this section, the provisions of the *Oregon Residential Specialty Code, Oregon Mechanical Specialty Code, Oregon Plumbing Specialty Code, Oregon Electrical Specialty Code and all other applicable codes* shall apply to buildings using light straw clay.

#### **1307.3.2 Non-loadbearing Light Straw Clay Construction.**

**1307.3.2.1 General.** Light straw clay shall not be used to support the weight of the building beyond the weight of the light straw clay material and its finish. The light straw clay either surrounds or acts as infill between the structural members.

**1307.3.2.2 Structure.** The structural support of the building shall be designed in accordance with the *Oregon Residential Specialty Code*.

#### **1307.3.3 Material Specifications.**

**1307.3.3.1 Straw.** Straw shall be wheat, rye, oats, rice or barley, and shall be free of visible decay and insects. Alternative cellulose materials such as wood chips may be substituted for straw when approved by a building official.

**1307.3.3.2 Clay soil.** Soil used for the clay slip in the light straw clay mix shall have a minimum clay content of 50% by volume, as determined by ASTM E2392.

**1307.3.3.3 Light straw clay mixture.** All straw stems shall be mixed with clay slip until they are thoroughly and evenly coated such that there is no more than 5% uncoated straw. Additionally, all straw, when compressed in the wall cavity, shall not have any excess moisture such that free water will not be squeezed from the light straw clay.

#### **1307.3.4 Wall Construction.**

**1307.3.4.1 Wall thickness.** Light straw clay walls shall be 12 inches thick.

**1307.3.4.2 Distance above grade.** Light straw clay shall not be used below grade. The foundation shall be constructed so that the bottom of the light straw clay wall is at least 8 inches above final exterior grade.

**1307.3.4.3 Moisture barrier.** An ORSC approved moisture barrier shall extend across the full width of the foundation stem wall between the light straw clay wall and the stem wall. All penetrations through the moisture barrier, as well as all joints in the barrier, shall be sealed with asphalt, caulking or an ORSC approved sealant.

**1307.3.4.4 Sill plate.** A sill plate shall be used over the moisture barrier and foundation stem wall in accordance with ORSC R319.1. Sill plates shall be fastened in accordance with the ORSC R403.1.8 and R602.11.

**1307.3.4.5 Perimeter insulation.** Foundation thickness may be reduced by up to 3" less than the light straw clay in order to accommodate perimeter insulation.

**1307.3.4.6 Wood and light straw clay contact.** Untreated wood structural and non-structural members in exterior and interior walls may be in direct contact with light straw clay. Wood framing dryness per ORSC R109.1.4 and ORSC 318.2 prior to application of light straw clay.

**1307.3.4.7 Non-wood structural members.** Non-wood structural members in contact with light straw clay in exterior walls shall be

resistant to corrosion or coated to prevent corrosion with an approved coating.

### **1307.3.5 Wall Reinforcing.**

**1307.3.5.1 Vertical reinforcing and blocking.** Vertical wall reinforcing shall be a minimum of 2x4s at 32 inches on center, or per an approved design by an architect or an engineer. This vertical reinforcing shall be horizontally blocked every 8 feet with minimum 2x4 blocks.

**1307.3.5.2 Stabilizing bars.** Non-structural horizontal bars to stabilize the light straw clay infill shall be installed at 24 inches on center and secured to vertical members. Stabilizing bars may be of any of the following:  $\frac{3}{4}$  in bamboo,  $\frac{1}{2}$  inch fiberglass rod, 1" wood dowels, wood 1x2.

### **1307.3.6 Monolithic Walls.**

**1307.3.6.1 Formwork.** Formwork shall be sufficiently strong to resist bowing when the light straw clay is compacted into the forms.

**1307.3.6.2 Installation of light straw clay.** Forms shall be uniformly loaded with light straw clay and be evenly tamped to achieve stable, monolithic walls that are free of voids. Light straw clay shall be installed in lifts of no more than 6 inches and shall be thoroughly tamped before additional material is added.

**1307.3.6.3 Removal of formwork.** Formwork shall be removed from walls within 24 hours after tamping, and walls shall remain exposed until dry. Any visible voids shall be patched with light straw clay prior to plastering.

**1307.3.6.4 Cold joints.** Whenever a wall is not continuously built, the top of the wall shall be thoroughly coated with clay slip prior to the application of a new layer of light straw clay in order to prevent cold joints.

### **1307.3.7 Openings in Walls.**

**1307.3.7.1 Doors and windows.** Rough bucks and/or frames for door and window shall be fastened securely to structural members. Windows and doors shall be flashed in accordance with ORSC R703.8.

**1307.3.7.2 Window sills.** An ORSC approved moisture barrier shall be installed at window sills in light straw clay walls prior to installation of windows.

### **1307.3.8 Wall Finishes.**

**1307.3.8.1 General.** The interior and exterior surfaces of light straw clay walls shall be protected from mechanical damage, flames, animals and prolonged exposure to water or snow by a weather-resistant finish in accordance with this section.

**1307.3.8.2 Moisture content of light straw clay prior to application of finish.** Light straw clay walls shall be dry to a maximum moisture content of 20% at a depth of 4 inches, as measured from each side of the wall, prior to the application of finish on either side of the wall. Moisture content is a self-certified measurement and shall be measured with an approved moisture meter or by other approved means.

**1307.3.8.3 Plaster finish.** Acceptable plaster finishes include clay based and lime based plasters. These may be applied directly onto the interior and exterior surface of the light straw clay walls without reinforcement, except at the juncture of dissimilar substrate greater than 2 inches. Light straw clay walls with a plaster or stucco finish of minimum 7/8-inch thickness on both sides shall be deemed to be fire resistive; may be used between a dwelling and attached garage as required in ORSC Section R309.2.

**1307.3.8.4 Bridging of dissimilar substrates.** Bridging shall be installed at the juncture of dissimilar substrates greater than 2 inches prior to the application of plaster. Acceptable bridging materials include: expanded metal lath, fiberglass mesh, reed matting, or burlap. Bridging shall extend a minimum of 4 inches on either side of the juncture.

**1307.3.8.5 Exterior siding.** Exterior wood, metal or composite material siding shall be spaced a minimum of  $\frac{3}{4}$  inch from the light straw clay to allow for moisture diffusion. The siding shall be fastened to wood furring strips in accordance with manufacturer's recommendations. Furring strips shall be securely fastened to the vertical wall reinforcing or structural framing at a maximum spacing of 32 inches. An air barrier shall be applied prior to application of siding, consisting of clay plaster or lime plaster or other ORSC approved air barrier. Insect screens shall be installed at top and bottom of spacing.

### **1307.3.9 Electrical.**

**1307.3.9.1 Electrical wiring.** All wiring within or on light straw clay walls shall meet the electrical provisions within this code. Wiring shall be run in metallic or non-metallic conduit systems.

**1307.3.9.2 Attachment.** All cable, conduit systems, and junction boxes shall be securely attached to wall framing per provisions of the OESC. Additional framing members shall be installed as necessary to meet OESC requirements.

### **1307.3.10 Plumbing.**

Water or DWV pipes within light straw clay walls shall be encased in a continuous pipe sleeve to prevent leakage within the wall.

#### **1307.3.10 Mechanical.**

Gas pipes within light straw clay walls shall be encased in a continuous pipe sleeve to prevent leakage within the wall.

### **1307.3.11 Fire Resistance.**

1307.3.11.1 Light straw clay walls when covered with plaster shall be deemed to be fire resistive.

1307.3.11.2 Light straw clay with a minimum thickness of 7/8 inch (22.4 mm) on both sides may be used between a dwelling and an attached garage as required in ORSC R309.2.

### **1307.3.12 Thermal Insulation.**

**1307.3.12.1 R-Value.** Light straw clay, when installed as according to this appendix, shall be deemed to have an R-value of 1.6 per inch.

**1307.3.12.2 U-Value.** Light straw clay wall assemblies, when installed as according to this appendix at 12-inch thickness, shall be deemed to thermally perform to a default U-value of  $U=0.060$ .

## **1307.4. Plumbing.**

### **1307.4.1. Composting Toilets Scope:**

The provisions of this section shall control the design, construction, maintenance, and operation of composting toilets within existing residential buildings and new residential construction. This guide is not intended as a complete set of directions for construction of Composting Toilet Systems.

#### **1307.4.1.2. Intent:**

The intent of these requirements is to safeguard public health and waterways through defining dry equivalents to on-site tertiary water treatment (per ICC 710.3). This guide can be used by

code officials, architects and other interested parties to evaluate the design and construction of Composting Toilet Systems. It is not restricted to a specific method of construction, nor does it provide the principles to be followed for the safe construction of Composting Toilet Systems.

Construction of Site-Built Composting Toilet Systems is complex, and in order to ensure their safety and performance, construction shall follow established, tested, and well-documented designs or be done by or under the supervision of a skilled and experienced composting toilet system builder.

#### **1307.4.2. Design Guidelines:**

##### **1307.4.2.1 Design Approval:**

**1307.4.2.1.1** Manufactured Composting Toilet Systems approved under NSF Standard 41, CSA, or other ANSI-approved certification body are approved.

**1307.4.2.1.2** Site-Built Composting Toilet Systems designed in accordance with the following specifications may be installed provisionally, pending laboratory verification. (**1307.4.4.2**) Site-Built means a composting toilet that is fabricated at the site of use. Manufactured toilets that have not been submitted to an ANSI-approved certification body will be treated as Site-Built Composting Toilet Systems.

##### **1307.4.2.2 Design requirements:**

**1307.4.2.2.1** All components shall have footings adequately designed to support the weight of users and the Composting Toilet System.

**1307.4.2.2.2** All components and fasteners must be corrosion resistant.

##### **1307.4.2.2.3 Commode:**

**603.2.2.3.1** Commode shall be designed to support users and provide a solid connection to the floor.

##### **1307.4.2.2.4 Collection Method:**

**1307.4.2.2.4.1** The Collection Method shall connect Commode directly to Composting Chamber or present watertight barriers to user contact with human wastes during normal operation or in event of failure.

**1307.4.2.2.4.2** The Collection Method shall be vented to prevent the infiltration of odors or exhaust gasses into the building during normal operation and in the event of power failure.

##### **1307.4.2.3 Composting chamber:**

**1307.4.2.3.1** Composting chamber shall be sited such that:

1. The infiltration of rainwater and ground water is prevented;
2. It is watertight, preventing the escape of liquids through other than standard openings; and
3. Adequate access for regular service and removal of Humus is provided.

**1307.4.2.3.2** Biological decomposition shall be maintained at or above 42°F (6°C).

**1307.4.2.3.3.** Chamber shall be vented such that the termination of the vent is insulated to prevent condensation and maintain directional airflow. Vents shall be a minimum of two feet above the highest elevation of any portion of the building within ten feet of the vent.

**1307.4.2.3.4** If Composting Toilet System has Liquid Diversion, liquid must drain to a sewer system, approved treatment system, or collection container. Collection container must be emptied back into the composting chamber, emptied to approved treatment system, or removed by a licensed professional as per management plan. **(1307.4.2.5)**

**1307.4.2.4 Pest Control.** All inlets and vents, must be screened or sealed against the infiltration of pests into the Composting Chamber. (per ICC708.8)

**1307.4.2.5 Management Plan:**

**1307.4.2.5.1** Management plan must present clear instructions for maintenance and be transferred upon transfer of property or tenancy.

**1307.4.2.5.2** Management plan must include:

1. Schedule for addition of necessary Compost Additives;
2. Source or provider of necessary Compost Additives. Source may be On-Site;
3. Schedule of any regular maintenance tasks and instructions for performing said tasks;
4. Expected input of and capacity for, human wastes, toilet paper, and other organic matter to Composting Toilet System;

5. Expected schedule for removing humus from Composting Chamber;
6. Plan for on-site disposal of Humus (1307.4.4.4) or removal by a licensed professional;
7. If Site Built Composting Toilet System is installed, plan for testing of humus by a certified laboratory; and
8. If Composting Toilet System contains Liquid Diversion, a plan for managing liquid. (1307.4.2.3.3).

### **1307.4.3. Installation:**

**1307.4.3.1** Prior to the installation of a Composting Toilet System, a permit must be obtained from a Building Official for:

1. A Composting Toilet System has been approved by Code Official or listed with NSF International to Standard 41 (May 1983 revised), CSA, or other ANSI approved certification body; or
2. A Site-Built Composting Toilet System meets Design Guidelines of Section 1307.4.

**1307.4.3.2** Installation shall not be put into use until inspected and approved by Building Official.

**1307.4.3.3** Site-Built Composting Toilet System shall be operated provisionally, pending laboratory testing. (1307.4.4.2)

### **1307.4.4 Operation:**

**1307.4.4.1** Site-Built Composting Toilet System will be available for inspection by authority having jurisdiction at the discretion of the authority having jurisdiction at any point in time. At the owner's expense, the authority having jurisdiction may request results of all laboratory testing, and new tests following repairs to alleviate dangerous or insanitary condition. (1307.4.4.5)

#### **1307.4.4.2 Testing:**

**1307.4.4.2.1** Site-Built Composting Toilet System's owner or owner's agent shall submit a sample of the Humus from the first treatment period to a certified laboratory before removal of Humus from the Composting Chamber.

#### **1307.4.4.2.2** The sample:

- 1 Shall not have a moisture content exceeding 75% by weight,

2 Shall not exceed 200 fecal coliforms/gram (Per NSF 41 7.1.4, Quality Criteria For Water, EPA, 1986).

**1307.4.4.2.3** Owner must retain a record of fecal coliform tests.

**1307.4.4.3** Upon transfer of property or tenancy, all test records must be transferred, and humus must be re-tested and a record retained. A copy of the re-test results and all records required to be transferred shall be submitted to the authority having jurisdiction.

**1307.4.4.4** Humus from composting chamber may be used around ornamental shrubs, flowers, trees, or fruit trees and shall be buried under at least six inches of soil cover. Depositing humus from any composting toilet system around any edible vegetable or vegetation shall be prohibited.

**1307.4.4.5** Composting toilet system shall be operated in a safe and sanitary condition in accordance with the management plan. Operation of composting toilet system may be suspended to alleviate a nuisance or dangerous or insanitary condition, until which time the owner or owner's agent shall conduct sufficient repairs or alterations to composting toilet system.

## **1307.5 Mechanical**

**RESERVED**

## **1307.6 Electrical**

**RESERVED**

## **APPENDIX A MATERIAL RESOURCE CONSERVATION AND EFFICIENCY**

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

### **SECTION E101 GENERAL**

**A101.1 Scope.** The provisions of this chapter shall govern matters related to *building* and *building site* material conservation and resource efficiency.

**A101.2 Intent.** The intent of this chapter is to limit landfill disposal of waste and debris generated by construction, land clearing, and demolition activities. This chapter shall regulate the minimum diversion rates and Construction and Waste Management Plan requirements. For the purposes of this chapter, it is intended that diversion will follow the waste management hierarchy established in ORS 459.015(2) as follows:

1. First, to reduce the amount of solid waste generated;
2. Second, to reuse material for the purpose for which it was originally intended;
3. Third, to recycle material that cannot be reused;
4. Fourth, to compost material that cannot be reused or recycled; and
5. Fifth, to recover energy from solid waste that cannot be reused, recycled or composted.

### **SECTION A102 MATERIAL AND WASTE MANAGEMENT**

**A102.1 Construction material and waste management plan.** Not less than 50 percent, or more as determined by the jurisdiction, of non-hazardous construction waste shall be diverted from landfills. 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, glass and concrete, shall be indicated.
2. Total waste materials and 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 total materials and materials to be diverted shall be specified and shall be calculated by weight or volume, but not both.
4. Receipts or other documentation related to diversion shall be maintained through the course of construction. Evidence of diversion, may be requested by the *code official*.

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 A102.2.

**A102.2 Building site waste management plan.** A *building site* waste management plan shall be developed and implemented to recycle or salvage not less than 50 percent, or more as determined by the jurisdiction, 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. Total waste materials and materials to be diverted from disposal by efficient usage, recycling or reuse on the *building site* shall be specified.
2. Where contaminated soils are removed, the methods of removal and location where the soils are to be treated and disposed.
3. The amount of total materials and materials to be diverted shall be specified and shall be calculated by weight or volume, but not both.
4. Receipts or other documentation related to diversion shall be maintained through the course of construction. Evidence of diversion, may be requested by the *code official*.

Construction materials and waste and *hardscape* materials removed during site preparation shall be managed in accordance with Section A102.1.

**A102.3 Demolition or deconstruction.** Where buildings, structures or portions thereof are deconstructed or demolished, not less than 50 percent, or more as determined by the jurisdiction, of non-hazardous materials shall be diverted from landfills and incineration. A demolition or *deconstruction* waste management plan shall be developed and shall include provisions that address all of the following:

1. Documentation of the total materials in buildings, structures and portions thereof to be deconstructed or demolished and materials to be diverted shall be required.
2. The amount of total materials and materials to be diverted shall be specified and shall be calculated by weight or volume, but not both.
3. Receipts or other documentation related to diversion shall be maintained through the course of construction. Evidence of diversion, may be requested by the *code official*.

## APPENDIX B SITE LIGHTING

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

**B 101.1 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 B 101.1  
UPLIGHT RATINGS<sup>a,b</sup>**

	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.

**B 102 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 B102(1)  
Maximum Glare Ratings for Building Mounted Luminaires Located  
Two Mounting Heights or Less from Lighting Boundary<sup>a, b, c</sup>**

	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 B102(2)  
Maximum allowable Backlight and Glare Ratings<sup>a,b,c</sup>**

	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
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-	B0	B0	B1	B2

half mounting height from <i>lighting boundary</i>	G1	G2	G3	G4
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- a. Backlight and glare ratings are defined by IESNA TM-15-07 Addendum A.
- b. Luminaries 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.
- c. The rating shall be determined by the actual photometric geometry in the specified mounting orientation.