

AN AMERICAN NATIONAL STANDARD
IAPMO/ANSI USEHC 1 – 2015

2015 UNIFORM SOLAR ENERGY AND HYDRONICS CODE®



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2015
**UNIFORM
SOLAR
ENERGY AND
HYDRONICS
CODE**[®]

AN AMERICAN NATIONAL STANDARD
IAPMO/ANSI USEHC 1 – 2015



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Important Notices and Disclaimers

The 2015 edition of the *Uniform Solar Energy and Hydronics Code* is developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on solar energy and hydronic issues. While the International Association of Plumbing and Mechanical Officials (IAPMO) administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in its codes and standards.

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In order to determine whether an IAPMO code has been corrected by Errata, please visit the IAPMO Group codes information pages on IAPMO's website (www.iapmo.org). The codes information pages provides a list of IAPMO codes with up-to-date specific information including any Errata.

To access the code information pages for a specific code, go to <http://codes.iapmo.org> to select from the list of IAPMO codes. For Errata, select the archived revision information.

Origin and Development

The industry has long recognized the advantages of a statewide adopted solar energy and hydronics code. The first edition of the *Uniform Solar Energy and Hydronics Code*[®] (USEHC[®]) was adopted by IAPMO in 1976. The widespread use of this code over the past three decades by jurisdictions throughout the United States and internationally is testament to its merit.

Publishing the 2009 *Uniform Solar Energy Code* (USEC), is a significant milestone because it is the first time in the history of the United States, a solar energy code was developed through a true consensus process. Beginning with the development of the 2015 edition, the *Uniform Solar Energy Code* (USEC) will expand to include sustainable energy sources and hydronic provisions, and will serve to coalesce and integrate the hydronics industry. The 2015 edition represents the most current approaches in the solar energy and hydronics field, and is the third edition developed under the ANSI consensus process. Contributions to the content of this code consists of diverse interests as consumers, enforcing authorities, installers/maintainers, labor, manufacturers, research/standards/testing laboratories, special experts, and users.

The *Uniform Solar Energy and Hydronics Code* (USEHC) provides consumers with complete requirements for the installation and maintenance of solar thermal energy, hydronics, geothermal energy, and solar photovoltaic (PV) systems, while, at the same time, allowing latitude for innovation and new technologies. The public at large is invited and encouraged to take part in IAPMO's open consensus code development process. This code is updated every three years. The *Uniform Solar Energy and Hydronics Code* is dedicated to all those who in working to achieve "the ultimate solar energy and hydronics code," have unselfishly devoted their time, effort, and personal funds to create and maintain this, the finest solar energy and hydronics code in existence today.

The *Uniform Solar Energy and Hydronics Code* updates every three years in revision cycles that takes two years to complete.

Each revision cycle advances according to a published schedule that includes final dates for all major events and contains three basic steps as follows:

1. Public and Committee Proposal Stage;
2. Comment Stage;
3. Executive Appeals and Issuance of Code.

IAPMO develops "full consensus" codes built on a foundation of maximum participation and agreement by a broad range of interests. This philosophy has led to producing technically sound codes that promote health and safety, yet do not stifle design or development.

It is important to stress that, the process remains committed to the principles of consensus code development where consensus Technical Committees and Correlating Committees revise codes. The public and membership is offered multiple opportunities to debate, provide input and raise concerns through Amending Motions at Technical Committee meetings. Anyone may submit an appeal related to the issuance of a document through the Executive Committee.

The 2015 *Uniform Solar Energy and Hydronics Code* is supported by the Mechanical Contractors Association of America (MCAA), the Plumbing-Heating-Cooling Contractors National Association (PHCC-NA), the United Association (UA), and the World Plumbing Council (WPC). The presence of these logos, while reflecting support, does not imply any ownership of the copyright to the USEHC, which is held exclusively by IAPMO. Further, the logos of these associations indicate the support of IAPMO's open consensus process being used to develop IAPMO's codes and standards.

The addresses of the organizations are as follows:

MCAA – 1385 Piccard Drive • Rockville, MD 20850 • (301) 869-5800

PHCC-NA – PO Box 6808 • Falls Church, VA 22046 • (800) 533-7694

UA – Three Park Place • Annapolis, MD 21401 • (410) 269-2000

WPC – World Plumbing Council Secretariat, 353 Shepperton Road • East Victoria Park 6101
• Western Australia • +61 (439) 943-098

Adoption

The *Uniform Solar Energy and Hydronics Code* is available for adoption and use by jurisdictions in the United States and Internationally. Its use within a governmental jurisdiction is accomplished through adoption by reference in accordance with applicable jurisdictional laws. At adoption, jurisdictions should insert the applicable information in bracketed words in the sample ordinance. The sample legislation for adoption of the *Uniform Solar Energy and Hydronics Code* on page ix provides key components, regulations and resolutions.

Revision Markings

Solid vertical lines in the margins indicate a technical change from the requirements of the 2012 edition. An arrow (←) in the margin indicates where an entire section, paragraph, exception or table has been deleted, or an item in a list of items or a table has been deleted.

A double right angle (◄) in the margin indicates that the text or a table has been relocated within the code. The table found on page xi points out the relocations in the 2015 edition of the *Uniform Solar Energy and Hydronics Code*.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another document. This reprinted material is not the complete and official position of the source document on the referenced subject that is represented by the standard in its entirety.

Text that is extracted pursuant to IAPMO's Extract Guidelines, but outside of the regular revision process is denoted with the use of the source document in the margin. This text is not fully processed by IAPMO in accordance with ANSI's public announcement consensus requirements for an American National Standard (ANS) nor approved by ANSI's Board of Standards Review. The next revision cycle processes such text in accordance with those requirements.

FORMAT OF THE UNIFORM SOLAR ENERGY AND HYDRONICS CODE

The format of the *Uniform Solar Energy and Hydronics Code* (USEHC) arranges each chapter in accordance with a specific subject matter. However, Chapter 3 is dedicated to general requirements that are applicable to every chapter. The subject matters are divided as follows:

CHAPTERS	SUBJECTS
1	Administration
2	Definitions
3	General Regulations
4	Hydronics
5	Solar Thermal Systems
6	Thermal Storage
7	Geothermal Energy Systems
8	Duct Systems
9	Solar Photovoltaic Systems
10	Referenced Standards
Appendix A	Engineered Solar Energy Systems
Appendix B	Solar Photovoltaic System Installation Guidelines
Appendix C	Supplemental Checklist for Solar Photovoltaic Systems

FORMAT OF THE UNIFORM SOLAR ENERGY AND HYDRONICS CODE

The following is a summary of the scope and intent of the provisions addressed within the chapters and appendices of the *Uniform Solar Energy and Hydronics Code*:

Chapter 1 Administration.

Chapter 1 regulates the application, enforcement, and administration of subsequent requirements of the code. As well as establishing the scope of the code, this chapter is concerned with enforcing the requirements contained in the body of the code. A solar energy and hydronics code, as with any other code, is intended to be adopted as a legally enforceable document to safeguard health, safety, property and public welfare. The code cannot be effective without satisfactory provisions for its administration and enforcement. The Authority Having Jurisdiction is to review the proposed and completed work and to decide whether a system conforms to the code requirements. As a public servant, the Authority Having Jurisdiction enforces the code in an unbiased, proper manner. The design professional is responsible for the design of a safe system. The contractor is responsible for installing the system in accordance with the plans.

Chapter 2 Definitions.

To maintain consistency and encourage the use of common terminology, Chapter 2 establishes definitions to provide clarity of terms and promote the use of a common language throughout the code. Understanding definitions within the context of their application enables greater collaboration, efficiency, standardization and interpretation in applying and enforcing terms used throughout the code. Codes are technical documents, and every term can impact the meaning of the code text. Terms not defined have a normally accepted meaning.

Chapter 3 General Regulations.

Chapter 3 regulates the general requirements, not specific to other chapters, for installing solar energy, hydronics or geothermal systems. Many regulations are not specific solar energy, hydronics or geothermal requirements, but relate to the overall system. This chapter contains safety requirements for appliance location and installation, appliance and system access, condensate disposal, and clearances to combustibles. Listing or labeling method of approval, based on applicable nationally recognized standards, for the safe and proper installation of solar energy, hydronics or geothermal systems is essential to ensure protection of public health, safety, and welfare. The safety requirements provide protection for piping, material, and structures, with provisions for installation practices, removing stress and strain of the pipe, sleeving, and hanger support. The building's structural stability is protected by the regulations for cutting and notching of structural members.

Chapter 4 Hydronics.

Chapter 4 regulates hydronic systems that are part of heating, cooling, ventilation, and conditioning systems. Such piping systems include steam, hot water, chilled water, steam condensate, and the ground source heat pump systems. The ground source heat pumps provisions in this chapter apply to the hydronics portions of the system. It is worth noting Chapter 7 address added provisions for ground source heat pumps.

Materials for piping and tubing must meet the working temperature and pressure of the system. In addition, materials must be compatible with the transfer medium to prevent deformation, bursting, or any chemical action between the material and the transfer medium. The allowable joining methods for piping or tubing are provided for application and enforcement purposes.

Chapter 5 Solar Thermal Systems.

Chapter 5 regulates the design, installation, and construction requirements of solar thermal systems. This chapter provides the minimum safety requirements for all types of solar thermal systems, such as draindown, drainback, thermosiphon, open-loop and closed-loop systems.

Materials for piping and tubing must meet the working temperature and pressure of the system. In addition, materials must be compatible with the transfer medium to prevent deformation, bursting, or any chemical action between the material and the transfer medium. The allowable joining methods for piping or tubing are provided in Chapter 4 for application and enforcement purposes.

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Chapter 6 Thermal Storage.

Chapter 6 regulates the design, installation, construction and location of thermal storage. Pressure-type storage tanks store large amounts of energy and, when the pressure exceeds 15 psi, the tank must comply with ASME Boiler Pressure Vessel Code (BPVC) Section VIII. The stored energy must be contained to prevent disastrous failures. Installing a safety relief valve and expansion tank prevents pressures in the tank from exceeding the design threshold.

Chapter 7 Geothermal Energy Systems.

Chapter 7 regulates the design, installation, construction and location of geothermal energy systems. In order to properly design a geothermal system, it is important to know the seasonal variation in the soil temperature, as well as the soil's inherent capability to store and transmit heat, namely its heat capacity and thermal conductivity.

Materials for piping and tubing must meet the working temperature and pressure of the system. In addition, materials must be compatible with the transfer medium to prevent deformation, bursting, or any chemical action between the material and the transfer medium. The allowable joining methods for piping or tubing are provided for application and enforcement purposes.

Chapter 8 Duct Systems.

Chapter 8 regulates requirements for ducts and plenums that are portions of a heating, cooling, absorption or evaporative cooling systems. This chapter contains material and installation requirements for metal, gypsum, factory-made, flexible, and plastic ducts. It also contains fire protection requirements, smoke dampers, and automatic shutoff for the building's air distribution system.

Chapter 9 Solar Photovoltaic Systems.

Chapter 9 regulates the installation of solar photovoltaic (PV) systems, including array circuit(s), inverter(s), and controller(s) for such systems. Solar PV systems covered by this chapter are permitted to be interactive with other electrical power production sources or standalone, with or without electrical energy storage such as batteries.

Chapter 10 Referenced Standards.

Chapter 10 provides a comprehensive list of referenced standards. Referenced standards set forth specific details of accepted practices, materials specifications, or test methods in many specialized applications. Standards provide an efficient method of conveying complex information and specifications on the performance requirements for materials, products, systems, application, and installation. The manner and purpose for a standard's use and, in turn, code compliance, must be definitive in all references to the standard. If the standard is intended to be a requirement for judging code compliance, the code must state its intent for use. The standard should adequately address a defined need and at the same time specify the minimum performance requirements, technical characteristics and methods of testing, and required test results.

The referenced standards table is organized in a manner that makes it easy to find specific standards in alphabetical order, and by acronym of the publishing agency of the standard. The table lists the title of the standard, the edition, any addenda, and the section or sections of the code that reference the standard. Contact information for each publishing agency is provided at the end of the chapter.

Appendix A Engineered Solar Energy Systems.

Appendix A provides requirements for the design, installation, and inspection of an engineered solar energy system, alternate materials and equipment not specifically covered in other parts of the code.

Appendix B Solar Photovoltaic System Installation Guidelines.

Appendix B provides installation guidelines for solar photovoltaic (PV) systems. The installation guidelines provided in this appendix are not applicable to PV installations for non-habitable structures such as parking shade structures, solar trellises, etc.

Appendix C Supplemental Checklist for Solar Photovoltaic Systems.

Appendix C provides a supplemental checklist for solar photovoltaic (PV) installation that should be provided with the plan details.

SAMPLE LEGISLATION FOR ADOPTION OF THE UNIFORM SOLAR ENERGY AND HYDRONICS CODE

The Uniform Codes are designed to be adopted by jurisdictions through an ordinance. Jurisdictions wishing to adopt the 2015 *Uniform Solar Energy and Hydronics Code* as an enforceable regulation governing solar energy, hydronics and geothermal systems should ensure the legal basis under which adoption and implementation are included in the ordinance.

The following sample ordinance is a guide for drafting an ordinance for adoption that addresses key components regulations and resolutions.

ORDINANCE NO.

An ordinance of the [JURISDICTION] adopting the 2015 edition of the *Uniform Solar Energy and Hydronics Code*, regulating the design, construction, quality of materials, erection, installation, alteration, repair, location, relocation, replacement, addition to, use or maintenance of solar energy, hydronics and geothermal systems in the [JURISDICTION]; providing for the issuance of permits and collection of fees therefor; repealing Ordinance No. of the [JURISDICTION] and all other ordinances and parts of the ordinances in conflict therewith.

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

Section 1 Codes Adopted by Reference. That certain documents, three (3) copies of which are on file in the office of the [JURISDICTION'S KEEPER OF RECORDS] and the [JURISDICTION], being marked and designated as the 2015 *Uniform Solar Energy and Hydronics Code*, including Appendix Chapters [FILL IN THE APPENDIX CHAPTERS BEING ADOPTED], as published by the International Association of Plumbing and Mechanical Officials, be and is hereby adopted as the Code of the [JURISDICTION], in the State of [STATE NAME] regulating and controlling the design, construction, quality of materials, erection, installation, alteration, repair, location, relocation, replacement, addition to, use or maintenance of solar energy, hydronics and geothermal systems as herein provided; providing for the issuance of permits and collection of fees therefor; and each and all of the regulations, provisions, penalties, conditions and terms of such 2015 *Uniform Solar Energy and Hydronics Code* on file in the office of the [JURISDICTION] are hereby referred to, adopted, and made a part hereof, as if fully set out in this ordinance.

Section 2 Modifications. The following sections are hereby revised:

Section 101.1. Insert: [NAME OF JURISDICTION]

Section 104.5. Insert: [APPROPRIATE FEE SCHEDULE]

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

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

Section 5 Legal Notice. That the [JURISDICTION'S KEEPER OF RECORDS] is hereby ordered and directed to cause this ordinance to be published. (An additional provision may be required to direct the number of times the ordinance is to be published and to specify that it is to be in a newspaper in general circulation. Posting may also be required.)

Section 6 Violations and Penalties. [INCORPORATE PENALTIES FOR VIOLATIONS]

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

COMMITTEE ON UNIFORM SOLAR ENERGY AND HYDRONICS CODE

The list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred.

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Anthony Amable, City and County of San Francisco [E]

Robert Bean, Indoor Climate Consultants Inc. [SE]

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Jeffrey Fecteau, Underwriters Laboratories (UL) [R/S/T]

Rex Gillespie, Caleffi North America, Inc. [M]

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Nonvoting

Hugo Aguilar, IAPMO Staff Liaison

COMMITTEE MEMBERSHIP CLASSIFICATION ABBREVIATIONS

These classifications apply to Technical Committee members and represent their principal interest in the activity of a committee.

- M** *Manufacturer*: A representative of a maker or marketer of a product, assembly or system, or portion thereof, that is affected by the standard.
- U** *User*: A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.
- I/M** *Installer/Maintainer*: A representative of an entity that is in the business of installing or maintaining a product, assembly or system affected by the standard.
- L** *Labor*: A labor representative or employee concerned with safety in the workplace.
- R/S/T** *Research/Standards/Testing Laboratory*: A representative of an independent research organization; an organization that develops codes, standards and other similar documents; or an independent testing laboratory.
- E** *Enforcing Authority*: A representative or an agency or an organization that promulgates and/or enforces standards.
- C** *Consumer*: A person who is, or represents, the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in the *User* classification.
- SE** *Special Expert*: A person not representing any of the previous classifications, but who has special expertise in the scope of the standard or portion thereof.

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CHAPTER 1

ADMINISTRATION

101.0 General.

101.1 Title. This document shall be known as the “Uniform Solar Energy and Hydronics Code,” may be cited as such, and will be referred to herein as “this code.”

101.2 Scope. The provisions of this code shall apply to the erection, installation, alteration, addition, repair, relocation, replacement, addition to, use or maintenance of solar energy, water heating, appliances intended for space heating or cooling, swimming pool heating, process heating, geothermal and hydronic systems, snow and ice melt systems and use of any solar energy systems or swimming pool, spa or hot tub systems within this jurisdiction.

101.3 Purpose. This code is an ordinance providing minimum requirements and standards for the protection of the public health, safety, and welfare.

101.4 Unconstitutional. Where a section, subsection, sentence, clause, or phrase of this code is, for a reason, held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this code. The legislative body hereby declares that it would have passed this code, and each section, subsection, sentence, clause, or phrase thereof, irrespective of the fact that one or more sections, subsections, sentences, clauses, and phrases are declared unconstitutional.

101.5 Validity. Where a provision of this code, or the application thereof to a person or circumstance, is held invalid, the remainder of the code, or the application of such provision to other persons or circumstances, shall not be affected thereby.

102.0 Applicability.

102.1 Conflicts Between Codes. Where the requirements within the jurisdiction of this code conflict with the requirements of the plumbing or mechanical code, this code shall prevail. In instances where this code, applicable standards, or the manufacturer’s installation instructions conflict, the more stringent provisions shall prevail. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall prevail.

102.2 Existing Installation. Systems lawfully in existence at the time of the adoption of this code shall be permitted to have their use, maintenance, or repair continued where the use, maintenance, or repair is in accordance with the original design and location and no hazard to life, health, or property has been created by such system.

102.3 Maintenance. Systems, materials, and appurtenances, both existing and new, of a premise under the Authority Having Jurisdiction shall be maintained in operating condition. Devices or safeguards required by this code shall be maintained in accordance with the code edition under which installed.

The owner or the owner’s designated agent shall be responsible for maintenance of the system. To determine compliance with this subsection, the Authority Having Jurisdiction shall be permitted to cause a system to be inspected.

102.4 Additions, Alterations, Renovations, or Repairs. Additions, alterations, renovations or repairs shall conform to that required for a new system without requiring the existing system to be in accordance with the requirements of this code. Additions, alterations, renovations or repairs shall not cause an existing system to become unsafe, insanitary, or overloaded.

Additions, alterations, renovations or repairs to existing system installations shall comply with the provisions for new construction, unless such deviations are found to be necessary and are first approved by the Authority Having Jurisdiction.

102.5 Health and Safety. Where compliance with the provisions of this code fails to eliminate or alleviate a nuisance, or other dangerous or insanitary condition that involves health or safety hazards, the owner or the owner’s agent shall install such additional facilities or shall make such repairs or alterations as ordered by the Authority Having Jurisdiction.

102.6 Changes in Building Occupancy. Systems that are a part of a building or structure undergoing a change in use or occupancy, as defined in the building code, shall be in accordance with the requirements of this code that are applicable to the new use or occupancy.

102.7 Moved Structures. Parts of the system of a building or part thereof that is moved from one foundation to another, or from one location to another, shall be in accordance with the provisions of this code for new installations and completely tested as prescribed elsewhere in this section for new work, except that walls or floors need not be removed during such test where equivalent means of inspection acceptable to the Authority Having Jurisdiction are provided.

102.8 Appendices. The provisions in the appendices are intended to supplement the requirements of this code and shall not be considered part of this code unless formally adopted as such.

103.0 Duties and Powers of the Authority Having Jurisdiction.

103.1 General. The Authority Having Jurisdiction shall be the Authority duly appointed to enforce this code. For such purposes, the Authority Having Jurisdiction shall have the powers of a law enforcement officer. The Authority Having Jurisdiction shall have the power to render interpretations of this code and to adopt and enforce rules and regulations sup-