

2012 UNIFORM SOLAR ENERGY CODE®



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2012 Uniform Solar Energy Code®



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Code changes from the 2009 edition are marked in the margins as follows:

- ➔ An arrow in the margin indicates where an entire section, exception, paragraph, or table has been deleted or an item in a list of items or a table has been deleted.
- | A solid vertical line in the margin indicates a technical change from the requirements of 2009 edition.
- » A double right angle in the margin indicates that text has been relocated within the code.

Information on referenced publications can be found in Chapter 12.

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First Printing, May 2012

ISSN 1081-3772
Published by the International Association of Plumbing and Mechanical Officials
4755 East Philadelphia Street, Ontario, California 91761-2816 – USA
Main Phone: (909) 472-4100 • Main Fax: (909) 472-4150

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2012 USEC Foreword

The advantages of a uniform solar energy code adopted by various jurisdictions have long been recognized by industry and government officials. The 2012 edition was developed through a true consensus process. Contributions to the content of the code were made from all sectors of the building environment, enforcing authority, installer/maintainer, labor, manufacturer, research/standard/testing laboratories, users and special experts.

The USEC is designed as a scientifically sound model code that supports renewable-energy sources through passive and active solar energy as potential alternatives to fossil fuels through performance standards, while, at the same time, allowing latitude for innovation and new technologies. Solar power generation has emerged as one of the most rapidly growing renewable sources for thermal energy, photovoltaic power and concentrating power. The public at large is encouraged and invited to participate in IAPMO's open consensus code development process. This code is updated every three years. A code development timeline and other relevant information are available at IAPMO's website at www.iapmo.org.

The *Uniform Solar Energy Code* is dedicated to all those who, in working to achieve "the ultimate solar code; have unselfishly devoted their time, effort, and personal funds to create and maintain this, the finest solar code in existence today.

The *2012 Uniform Solar Energy Code* is supported by the American Society of Sanitary Engineering (ASSE), the Mechanical Contractors Association (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 USEC, 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.

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These lists represent 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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- (e) the signature of the submitter; and
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CHAPTER 1

ADMINISTRATION

101.0 General.

101.1 Title. This document shall be known as the “Uniform Solar Energy 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, repair, relocation, replacement, addition to, use, or maintenance of solar energy systems, including but not limited to equipment and appliances intended to utilize solar energy for space heating or cooling; water heating; swimming pool heating or process heating; and solar photovoltaic systems.
- » **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 the 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.** Solar energy 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.** Solar energy systems, materials, and appurtenances, both existing and new, and parts thereof 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 solar energy systems. To determine compliance with this subsection, the Authority

Having Jurisdiction shall be permitted to cause a solar energy system to be reinspected.

102.4 Additions, Alterations, or Repairs. Additions, alterations, renovations or repairs to a solar energy system shall conform to that required for a new system without requiring the existing solar energy 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 solar energy systems 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 solar energy facilities or shall make such repairs or alterations as ordered by the Authority Having Jurisdiction.

102.6 Changes in Building Occupancy. Solar energy 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 solar energy systems of a building or part thereof that is moved from one foundation to another, or from one location to another, shall be completely tested as prescribed elsewhere in this section for new work, except that walls or floors need not be removed during such test where other 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 supplemental to this code as deemed necessary in order to clarify the application of the provisions of this code. Such interpretations, rules, and regulations shall be in accordance with the intent and purpose of this code.

In accordance with the prescribed procedures and with the approval of the appointing authority, the Authority Having

ing Jurisdiction shall be permitted to appoint such number of technical officers, inspectors, and other employees as shall be authorized from time to time. The Authority Having Jurisdiction shall be permitted to deputize such inspectors or employees as necessary to carry out the functions of the code enforcement agency.

» **103.2 Liability.** The Authority Having Jurisdiction charged with the enforcement of this code, acting in good faith and without malice in the discharge of the Authority Having Jurisdiction's duties, shall not thereby be rendered personally liable for a damage that accrues to persons or property as a result of an act or by reason of an act or omission in the discharge of duties. A suit brought against the Authority Having Jurisdiction or employee because of such act or omission performed in the enforcement of a provision of this code shall be defended by legal counsel provided by this jurisdiction until final termination of the proceedings.

» **103.3 Applications and Permits.** The Authority Having Jurisdiction shall be permitted to require the submission of plans, specifications, drawings, and such other information as required by the Authority Having Jurisdiction, prior to the commencement of, and at a time during the progress of, work regulated by this code.

The issuance of a permit upon plans and specifications shall not prevent the Authority Having Jurisdiction from thereafter requiring the correction of errors in said plans and specifications or from preventing construction operations being carried on thereunder where in violation of this code or of other pertinent ordinance or from revoking a certificate of approval where issued in error.

» **103.4 Right of Entry.** Where it is necessary to make an inspection to enforce the provisions of this code, or where the Authority Having Jurisdiction has reasonable cause to believe that there exists in a building or upon a premises a condition or violation of this code that makes the building or premises unsafe, insanitary, dangerous, or hazardous, the Authority Having Jurisdiction shall be permitted to enter the building or premises at reasonable times to inspect or to perform the duties imposed upon the Authority Having Jurisdiction by this code, provided that where such building or premises is occupied, the Authority Having Jurisdiction shall present credentials to the occupant and request entry. Where such building or premises is unoccupied, the Authority Having Jurisdiction shall first make a reasonable effort to locate the owner or other person having charge or control of the building or premises and request entry. Where entry is refused, the Authority Having Jurisdiction has recourse to every remedy provided by law to secure entry.

Where the Authority Having Jurisdiction shall have first obtained an inspection warrant or other remedy provided by law to secure entry, no owner, occupant, or person having charge, care, or control of a building or premises shall fail or neglect, after a request is made as herein provided, to promptly permit entry herein by the Authority Having Jurisdiction for the purpose of inspection and examination pursuant to this code.

104.0 Permits. «

104.1 Permits Required. It shall be unlawful for a person, firm, or corporation to make an installation, alteration, repair, replacement, or remodel a solar energy system regulated by this code except as permitted in Section 104.2, or cause the same to be done without first obtaining a separate permit for each separate building, structure, or interconnected set of systems.

104.2 Exempt Work. A permit shall not be required for the following:

- (1) The repairing of leaks in pipes, valves, or components, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes, or components.
- (2) Replacement of a component part that does not alter its original approval and is in accordance with other applicable requirements of this code.

Exemption from the permit requirements of this code shall be deemed not to grant authorization for work to be done in violation of the provisions of the code or other laws or ordinances of this jurisdiction.

104.3 Application for Permit. To obtain a permit, the applicant shall first file an application therefore in writing on a form furnished by the Authority Having Jurisdiction for that purpose. Such application shall:

- (1) Identify and describe the work to be covered by the permit for which application is made.
- (2) Describe the land upon which the proposed work is to be done by legal description, street address, or similar description that will readily identify and definitely locate the proposed building or work.
- (3) Indicate the use or occupancy for which the proposed work is intended.
- (4) Be accompanied by plans, diagrams, computations, and other data as required in Section 104.3.1.
- (5) Be signed by the permittee or the permittee's authorized agent. The Authority Having Jurisdiction shall be permitted to require evidence to indicate such authority.
- (6) Give such other data and information as required by the Authority Having Jurisdiction.

104.3.1 Plans and Specifications. Plans, engineering calculations, diagrams, and other data shall be submitted in one or more sets with each application for a permit. The Authority Having Jurisdiction shall be permitted to require plans, computations, and specifications to be prepared by, and the solar energy system designed by, an engineer, an architect, or both who shall be licensed by the state to practice as such.

Exception: The Authority Having Jurisdiction shall be permitted to waive the submission of plans, calculations, or other data where the Authority Having Jurisdiction finds that the nature of the work applied for is such that reviewing of plans is not necessary to obtain compliance within the code.

- » **104.3.2 Plan Review Fees.** Where a plan or other data is required to be submitted by Section 104.3.1, a plan review fee shall be paid at the time of submitting plans and specifications for review.

The plan review fees for solar energy system work shall be determined and adopted by this jurisdiction. The plan review fees specified in this subsection are separate fees from the permit fees specified in this section and are in addition to the permit fees.

Where plans are incomplete or changed so as to require additional review, a fee shall be charged at the rate shown in Table 104.5.

- » **104.3.3 Information on Plans and Specifications.** Plans and specifications shall be drawn to scale upon substantial paper or cloth and shall indicate the location, nature, and extent of the work proposed and show in detail that it is in accordance with the provisions of this code and relevant laws, ordinances, rules, and regulations.

The Authority Having Jurisdiction shall have the option to accept plans and specifications electronically, in lieu of on cloth or paper, in whatever format it shall require.

- » **104.3.4 Time Limitation of Application.** Applications for which no permit is issued within 180 days following the date of application shall expire by limitation, plans and other data submitted for review thereafter, shall be returned to the applicant or destroyed by the Authority Having Jurisdiction. The Authority Having Jurisdiction shall be permitted to exceed the time for action by the applicant for a period not to exceed 180 days upon request by the applicant showing that circumstances beyond the control of the applicant have prevented action from being taken. No application shall be extended more than once. In order to renew action on an application after expiration, the applicant shall resubmit plans and pay a new plan review fee.

- » **104.4 Permit Issuance.** The application plans, and specifications and other data filed by an applicant for a permit shall be reviewed by the Authority Having Jurisdiction. Such plans shall be permitted to be reviewed by other departments of this jurisdiction to verify compliance with applicable laws under their jurisdiction. Where the Authority Having Jurisdiction finds that the work described in an application for permit and the plans, specifications, and other data filed therewith are in accordance with the requirements of the code and other pertinent laws and ordinances, and that the fees specified in Section 104.5 have been paid, the Authority Having Jurisdiction shall issue a permit therefore to the applicant.

104.4.1 Approved Plans or Construction Documents. Where the Authority Having Jurisdiction issues the permit where plans are required, the Authority Having Jurisdiction shall endorse in writing or stamp the plans and specifications “APPROVED.” Such approved plans and specifications shall not be changed, modified,

or altered without authorization from the Authority Having Jurisdiction, and the work shall be completed in accordance with approved plans.

The Authority Having Jurisdiction shall be permitted to issue a permit for the construction of a part of a solar energy system before the entire plans and specifications for the whole system have been submitted or approved, provided adequate information and detailed statements have been filed in accordance with the pertinent requirements of this code. The holder of such permit shall be permitted to proceed at the holder’s risk without assurance that the permit for the entire building, structure, or solar energy system will be granted.

104.4.2 Validity of Permit. The issuance of a permit or approval of plans and specifications shall not be construed to be a permit for, or an approval of, a violation of the provisions of this code or other ordinance of the jurisdiction. No permit presuming to give authority to violate or cancel the provisions of this code shall be valid.

The issuance of a permit based upon plans, specifications, or other data shall not prevent the Authority Having Jurisdiction from thereafter requiring the correction of errors in said plans, specifications, and other data or from preventing building operations being carried on thereunder where in violation of this code or of other ordinances of this jurisdiction.

104.4.3 Expiration. A permit issued by the Authority Having Jurisdiction under the provisions of this code shall expire by limitation and become null and void where the work authorized by such permit is not commenced within 180 days from the date of such permit, or where the work authorized by such permit is suspended or abandoned at a time after the work is commenced for a period of 180 days. Before such work is recommenced, a new permit shall first be obtained to do so, and the fee therefore shall be one-half the amount required for a new permit for such work, provided no changes have been made or will be made in the original plans and specifications for such work, and provided further that such suspensions or abandonment have not exceeded 1 year.

104.4.4 Extensions. A permittee holding an unexpired permit shall be permitted to apply for an extension of the time within which work shall be permitted to commence under that permit where the permittee is unable to commence work within the time required by this section. The Authority Having Jurisdiction shall be permitted to extend the time for action by the permittee for a period not exceeding 180 days upon written request by the permittee showing that circumstances beyond the control of the permittee have prevented action from being taken. No permit shall be extended more than once. In order to renew action on a permit after expiration, the permittee shall pay a new full permit fee.

104.4.5 Suspension and Revocation. The Authority Having Jurisdiction shall be permitted to, in writing, suspend or revoke a permit issued under the provisions of this code where the permit is issued in error or on the basis of incorrect information supplied or in violation of other ordinance or regulation of the jurisdiction.

- » **104.4.6 Retention of Plans.** One set of approved plans, specifications, and computations shall be retained by the Authority Having Jurisdiction until final approval of the work covered therein.

One set of approved plans, specifications, computations, and manufacturer's installation instructions shall be kept on the site of the building or work at times during which the work authorized thereby is in progress.

- » **104.5 Fees.** Fees shall be assessed in accordance with the provisions of this section and as set forth in the fee schedule Table 104.5. The fees are to be determined and adopted by this jurisdiction.

- » **104.5.1 Work Commencing Before Permit Issuance.** Where work for which a permit is required by this code has been commenced without first obtaining said permit, a special investigation shall be made before a permit is issued for such work.

104.5.2 Fees. An investigation fee, in addition to the permit fee, shall be collected whether or not a permit is then or subsequently issued. The investigation fee shall be equal to the amount of the permit fee that is required by this code, if a permit were to be issued. The payment of such investigation fee shall not exempt a person from compliance with other provisions of this code, nor from a penalty prescribed by law.

104.5.3 Fee Refunds. The Authority Having Jurisdiction shall be permitted to authorize the refunding of fees as follows:

- (1) The amount paid hereunder that was erroneously paid or collected.
- (2) Refunding of not more than a percentage, as determined by this jurisdiction where no work has been done under a permit issued in accordance with this code.

The Authority Having Jurisdiction shall not authorize the refunding of a fee paid except upon written application filed by the original permittee not to exceed 180 days after the date of fee payment.

» 105.0 Inspections and Testing.

- » **105.1 General.** Solar energy systems for which a permit is required by this code shall be inspected by the Authority Having Jurisdiction. No solar energy system or portion thereof shall be covered, concealed, or put into use until it first has been tested, inspected, and approved as prescribed in this code. Neither the Authority Having Jurisdiction nor the jurisdiction shall be liable for expense entailed in the

removal or replacement of material required to permit inspection. Solar energy systems regulated by this code shall not be connected to the water, the energy fuel supply, or the sewer system until authorized by the Authority Having Jurisdiction.

105.2 Required Inspection. New solar energy system work and such portions of existing systems as affected by new work, or changes, shall be inspected by the Authority Having Jurisdiction to ensure compliance with the requirements of this code and to ensure that the installation and construction of the solar energy system is in accordance with approved plans. The Authority Having Jurisdiction shall make the following inspections and other such inspections as necessary. The permittee or the permittee's authorized agent shall be responsible for the scheduling of such inspections as follows:

- (1) Underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and before backfill is put in place.
- (2) Rough-in inspection shall be made prior to the installation of wall or ceiling membranes.
- (3) Final inspection shall be made upon completion of the installation.

105.2.1 Uncovering. Where a solar energy system, or part thereof, which is installed, altered, or repaired, is covered or concealed before being inspected, tested, and approved as prescribed in this code, it shall be uncovered for inspection after notice to uncover the work has been issued to the responsible person by the Authority Having Jurisdiction. The requirements of this section shall not be considered to prohibit the operation of solar energy system equipment installed to replace existing equipment serving an occupied portion of the building in the event a request for inspection of such equipment has been filed with the Authority Having Jurisdiction not more than 72 hours after such replacement work is completed, and before a portion of such solar energy system is concealed by a permanent portion of the building.

105.2.2 Other Inspections. In addition to the inspections required by this code, the Authority Having Jurisdiction shall be permitted to require other inspections to ascertain compliance with the provisions of this code and other laws that are enforced by the Authority Having Jurisdiction.

105.2.3 Inspection Requests. It shall be the duty of the person doing the work authorized by a permit to notify the Authority Having Jurisdiction that such work is ready for inspection. The Authority Having Jurisdiction shall be permitted to require that every request for inspection be filed not less than 1 working day before such inspection is desired. Such request shall be permitted to be made in writing or by telephone, at the option of the Authority Having Jurisdiction. It shall be the duty of the person requesting inspections required by this code to provide access to and means for proper inspection of such work.

105.2.4 Advance Notice. It shall be the duty of the person doing the work authorized by the permit to notify the Authority Having Jurisdiction, orally or in writing that said work is ready for inspection. Such notification shall be given not less than 24 hours before the work is to be inspected.

105.2.5 Responsibility. It shall be the duty of the holder of a permit to make sure that the work will stand the test prescribed before giving the notification. The equipment, material, and labor necessary for inspection or tests shall be furnished by the person to whom the permit is issued or by whom inspection is requested.

» **105.2.6 Reinspections.** A reinspection fee shall be permitted to be assessed for each inspection or reinspection where such portion of work for which inspection is called is not complete or where required corrections have not been made.

This provision is not to be interpreted as requiring reinspection fees the first time a job is rejected for failure to be in accordance with the requirements of this code, but as controlling the practice of calling for inspections before the job is ready for inspection or reinspection.

Reinspection fees shall be permitted to be assessed where the approved plans are not readily available to the inspector, for failure to provide access on the date for which the inspection is requested, or for deviating from plans requiring the approval of the Authority Having Jurisdiction.

To obtain reinspection, the applicant shall file an application therefore in writing upon a form furnished for that purpose and pay the reinspection fee in accordance with Table 104.5. In instances where reinspection fees have been assessed, no additional inspection of the work will be performed until the required fees have been paid.

» **105.3 Testing of Systems.** Solar energy systems shall be tested and approved as required by this code or the Authority Having Jurisdiction. Tests shall be conducted in the presence of the Authority Having Jurisdiction or the Authority Having Jurisdiction's duly appointed representative. No test or inspection shall be required where a solar energy system or part thereof, is set up for exhibition purposes and has no connection with a water or drainage system. In cases where it would be impractical to provide the required water or air tests, or for minor installations and repairs, the Authority Having Jurisdiction shall be permitted to make such inspection as deemed advisable in order to be assured that the work has been performed in accordance with the intent of this code. Joints and connections in the solar energy system shall be gastight and watertight for the pressures required by test.

» **105.3.1 Defective Systems.** An air test shall be used in testing the sanitary condition of the drainage or a solar energy system of a building premises where there is reason to believe that it has become defective. In buildings or premises condemned by the Authority Having Jurisdiction because of an insanitary condition of

the solar energy system or part thereof, the alterations in such system shall be in accordance with the requirements of this code.

105.3.2 Retesting. Where the Authority Having Jurisdiction finds that the work will not pass the test, necessary corrections shall be made, and the work shall be resubmitted for test or inspection.

105.3.3 Approval. Where prescribed tests and inspections indicate that the work is in accordance with this code, a certificate of approval shall be issued by the Authority Having Jurisdiction to the permittee on demand.

105.4 Connection to Service Utilities. No person shall make connections from a source of energy or fuel to a solar energy system or equipment regulated by this code and for which a permit is required until approved by the Authority Having Jurisdiction. No person shall make connection from a water-supply line nor shall connect to a sewer system regulated by this code and for which a permit is required until approved by the Authority Having Jurisdiction. The Authority Having Jurisdiction shall be permitted to authorize temporary connection of the solar energy system equipment to the source of energy or fuel for the purpose of testing the equipment.

106.0 Violations and Penalties.

106.1 General. It shall be unlawful for a person, firm, or corporation to erect, construct, enlarge, alter, repair, move, improve, remove, convert, demolish, equip, use, or maintain a solar energy system or permit the same to be done in violation of this code.

106.2 Notice of Correction or Violation. Notices of correction or violation shall be written by the Authority Having Jurisdiction and shall be permitted to be posted at the site of the work or mailed or delivered to the permittee or his authorized representative.

Refusal, failure, or neglect to comply with such notice or order within 10 days of receipt thereof, shall be considered a violation of this code and shall be subject to the penalties set forth by the governing laws of the jurisdiction.

106.3 Penalties. A person, firm, or corporation violating a provision of this code shall be deemed guilty of a misdemeanor and upon conviction thereof, shall be punishable by a fine, imprisonment, or both set forth by the governing laws of the jurisdiction. Each separate day or portion thereof, during which a violation of this code occurs or continues, shall be deemed to constitute a separate offense.

106.4 Stop Orders. Where work is being done contrary to the provisions of this code, the Authority Having Jurisdiction shall be permitted to order the work stopped by notice in writing served on persons engaged in the doing or causing such work to be done, and such persons shall forthwith stop work until authorized by the Authority Having Jurisdiction to proceed with the work.

106.5 Authority to Disconnect Utilities in Emergencies. The Authority Having Jurisdiction shall have the authority to disconnect a solar energy system to a building, structure, or equipment regulated by this code in case of emergency where necessary to eliminate an immediate hazard to life or property.

106.6 Authority to Condemn. Where the Authority Having Jurisdiction ascertains that a solar energy system or portion thereof, regulated by this code, has become hazardous to life, health, or property, or has become insanitary, the Authority Having Jurisdiction shall order in writing that such solar energy system either be removed or placed in a safe or sanitary condition. The order shall fix a reasonable time limit for compliance. No person shall use or maintain a defective solar energy system after receiving such notice.

Where such solar energy system is to be disconnected, written notice shall be given. In cases of immediate danger to life or property, such disconnection shall be permitted to be made immediately without such notice.

107.0 Board of Appeals.

107.1 General. In order to hear and decide appeals of orders, decisions, or determinations made by the Authority Having Jurisdiction relative to the application and interpretations of this code, there shall be and is hereby created a Board of Appeals consisting of members who are qualified by experience and training to pass upon matters pertaining to solar energy system design, construction, and maintenance and the public health aspects of such systems and who are not employees of the jurisdiction. The Authority Having Jurisdiction shall be an ex-officio member and shall act as secretary to said board but shall have no vote upon a matter before the board. The Board of Appeals shall be appointed by the governing body and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render decisions and findings in writing to the appellant with a duplicate copy to the Authority Having Jurisdiction.

107.2 Limitations of Authority. The Board of Appeals shall have no authority relative to interpretation of the administrative provisions of this code, nor shall the board be empowered to waive requirements of this code.

TABLE 104.5
SOLAR ENERGY SYSTEM PERMIT FEES²

Permit Issuance

- | | | |
|---|---|-------|
| 1. For issuing each permit..... | 1 | _____ |
| 2. For issuing each supplemental permit | 1 | _____ |

Unit Fee Schedule (in addition to items 1 and item 2 above)

- | | | |
|---|---|-------|
| 1. For Collectors (including related piping and regulating devices): | | |
| Up to 1000 square feet..... | 1 | _____ |
| Between 1001 and 2000 square feet | 1 | _____ |
| More than 2000 square feet, \$5.00 plus \$1.00 per | | |
| 1000 square feet or fraction thereof over 2000 square feet..... | 1 | _____ |
| 2. For Storage Tanks (including related piping and regulating devices): | | |
| Up to 750 gallons..... | 1 | _____ |
| Between 751 gallons and 2000 gallons | 1 | _____ |
| Exceeding 2000 gallons, \$3.00 plus \$1.00 per | | |
| 1000 or fraction thereof exceeding 2000 gallons | 1 | _____ |
| 3. For Rock Storage: | | |
| Up to 1500 cubic feet..... | 1 | _____ |
| Between 1501 and 3000 cubic feet | 1 | _____ |
| More than 3000 cubic feet, \$3.00 plus \$1.00 per | | |
| 1000 cubic feet or fraction thereof over 3000 cubic feet..... | 1 | _____ |
| 4. For each appliance or piece of equipment regulated by this code for which no fee is listed | 1 | _____ |

Other Inspections and Fees

- | | | |
|--|---|-------|
| 1. Inspections outside of normal business hours | 1 | _____ |
| 2. Reinspection Fee | 1 | _____ |
| 3. Inspections for which no fee is specifically indicated | 1 | _____ |
| 4. Additional plan review required by changes, additions, or | | |
| revisions to approved plans (minimum charge - ½ hour)..... | 1 | _____ |
| 5. Plan Check Fee: | | |
| Where specific plans are required, a plan check fee shall be charged | | |
| equal to one-half the total permit fee, excluding the permit issuance fee..... | 1 | _____ |

For SI units: 1 square foot = 0.0929 m², 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m³

Notes:

¹ Jurisdiction will indicate its fees here.

² These fees do not include permit fees for parts of the solar energy system that are subject to the requirements of other applicable codes.

CHAPTER 2

DEFINITIONS

201.0 General.

201.1 Applicability. For the purpose of this code, the following terms have the meaning indicated in this chapter.

No attempt is made to define ordinary words, which are used in accordance with their established dictionary meanings, except where a word has been used loosely and it is necessary to define its meaning as used in this code to avoid misunderstanding.

202.0 Definition of Terms.

» **202.1 General.** The definitions of terms are arranged alphabetically according to the first word of the term.

202.2 Terms Defined in Other Documents. Where terms are not defined in this chapter and defined in the building code, mechanical code, plumbing code, electrical code, and fire code; such terms shall have meanings as defined in those codes.

203.0

– A –

Absorber. That part of the solar collector that receives the incident radiation energy.

Absorptance. The collecting of heat, measured as percent of total radiation available.

→ **Accessible.** Having access to but which first may require the removal of an access panel, door, or similar obstruction.

Accessible, Readily. Having a direct access without the necessity of removing panel, door, or similar obstruction.

Air Mass. The ratio of the mass of atmosphere, in the actual earth-sun path, to the mass that would exist if the sun were directly overhead at sea level.

Air Break, Drainage. The drain from an appliance or appurtenance that discharges indirectly into another receptor at a point below the flood level rim and above the trap seal.

Air Gap, Drainage. The unobstructed vertical distance through the free atmosphere between the lowest openings from a pipe, appliance, or appurtenance conveying waste to the flood-level rim of the receptor.

Air Gap, Water Distribution. The unobstructed vertical distance through the free atmosphere between the lowest opening from a pipe or faucet conveying potable water to the flood-level rim of a tank, vat, or receptor.

→ **Alternating-Current (ac) Module (Alternating-Current Photovoltaic Module).** A complete, environmentally protected unit consisting of solar cells, optics, inverter, and other components, exclusive of tracker, designed to generate ac power where exposed to sunlight. [NFPA 70:690.2]

Ambient Temperature. Surrounding temperature.

Angle of Incidence. The angle between the direct solar irradiation and the normal to the aperture plane.

Appliance. A device or apparatus that is designed to utilize energy.

Approved. Acceptable to the Authority Having Jurisdiction.

Approved Testing Agency. An organization primarily established for purposes of testing to approved standards and approved by the Authority Having Jurisdiction.

Appurtenance, Plumbing. A manufactured device, a prefabricated assembly, or an on-the-job assembly of component parts that is an adjunct to the basic piping system. An appurtenance demands no additional water supply, nor does it add a discharge load to the drainage system. It performs some useful function in the operation, maintenance, servicing, economy, or safety of the system. <<

Appurtenance, Solar. A manufactured device, a prefabricated assembly, or an on-the-job assembly of component parts that is an adjunct to a solar energy system.

Area, Absorber. The total projected heat transfer area from which the absorbed solar irradiation heats the transfer media.

Area, Aperture. The maximum projected area of a solar collector through which the unconcentrated solar radiant energy is admitted.

Area, Gross Collector. The maximum projected area of the complete collector module, including integral mounting means.

Array. A mechanically integrated assembly of modules or panels with a support structure and foundation, tracker, and other components, as required, to form a direct-current power-producing unit. [NFPA 70:690.2]

Authority Having Jurisdiction. The organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, installations, or procedures. The Authority Having Jurisdiction shall be a federal, state, local, or other regional department or an individual such as a plumbing official, mechanical official, labor department official, health department official, building official, or others having statutory authority. In the absence of a statutory authority, the Authority Having Jurisdiction may be some other responsible party. This definition shall include the Authority Having Jurisdiction's duly authorized representative.

Auxiliary Energy System. Equipment using non-solar energy sources to supplement or backup the output provided by a solar energy system.

204.0

– B –

Backflow. The flow of water or other liquids, mixtures, or substances into the distributing pipes of a potable supply of water from sources other than its intended source. See Backsiphonage, backpressure backflow.

DEFINITIONS

Backflow Connection. An arrangement whereby backflow can occur.

Backflow Preventer. A backflow prevention device, an assembly, or other method to prevent backflow into the potable water system.

Backpressure Backflow. Backflow due to an increased pressure above the supply pressure, which may be due to pumps, boilers, gravity, or other sources of pressure.

Backsiphonage. The flowing back of used, contaminated, or polluted water from a plumbing fixture or vessel into a water supply pipe due to a pressure less than atmospheric in such pipe. See Backflow.

Balancing Valves. A valve that regulates the flow rate of liquid, to achieve uniform distribution, throughout multiple collectors.

Bipolar Photovoltaic Array. A photovoltaic array that has two outputs, each having opposite polarity to a common reference point or center tap. [NFPA 70:690.2]

Blocking Diode. A diode used to block reverse flow of current into a photovoltaic source circuit. [NFPA 70:690.2]

Building. A structure built, erected, and framed of component structural parts designed for the housing, shelter, enclosure, or support of persons, animals, or property of any kind.

Building Code. The building code that is adopted by the jurisdiction.

Building Drain. That part of the lowest piping of a drainage system that receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer beginning 2 feet (610 mm) outside the building wall.

Building Integrated Photovoltaics. Photovoltaic cells, devices, modules, or modular materials that are integrated into the outer surface or structure of a building and serve as the outer protective surface of that building. [NFPA 70:690.2]

205.0

– C –

Calcium Hardness. A measure of dissolved calcium compounds and mineral content of water. It is measured as calcium carbonate (CaCO_3).

Certified Backflow Assembly Tester. A person who has shown competence to test and maintain backflow assemblies to the satisfaction of the Authority Having Jurisdiction.

Charge Controller. Equipment that controls dc voltage or dc current, or both, used to charge a battery. [NFPA 70:690.2]

Circulating Air. Air being conveyed from or to a collector through openings, ducts, plenums, or concealed spaces to a heat exchanger or storage media.

Closed Loop System. A system where the fluid is enclosed in a piping system that is not vented to the atmosphere.

Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

Collector. See Solar Collector.

Collector, Concentrating. A solar collector that uses reflectors, lenses, or other optical elements to concentrate the radiant energy passing through the aperture onto an absorber of which the surface area is smaller than the aperture area.

Collector System. That section of the solar system that includes the collector and piping or ducts from the collector to the storage system.

Collector Tilt. The angle above horizontal at which a solar heat collector is positioned.

Combustible Liquid. A liquid having a flash point at or above 100°F (38°C). Combustible liquids shall be divided into the following classifications:

- (1) Class II liquids having a flash point above 100°F (38°C) and below 140°F (60°C).
- (2) Class IIIA liquids having a flash point at or above 140°F (60°C) and below 200°F (93°C).
- (3) Class IIIB liquids having a flash point at or above 200°F (93°C).

The classifications of combustible liquids do not include compressed gases or cryogenic fluids.

Concentration Ratio. The ratio of the aperture area to the absorber area (in concentrating solar collectors).

Concentrator. Reflector of lens designed to focus solar energy into a reduced area.

Contamination. An impairment of the quality of the potable water that creates an actual hazard to the public health through poisoning or through the spread of disease by sewage, industrial fluids, or waste. Also defined as High Hazard.

Cover, Collector (Glazing). The material covering the aperture to provide thermal and environmental protection.

Critical Level. The critical level (C-L or C/L) marking on a backflow prevention device or vacuum breaker is a point conforming to approved standards and established by the testing laboratory (usually stamped on the device by the manufacturer) that determines the minimum elevation above the flood-level rim of the fixture or receptor served at which the device may be installed. Where a backflow prevention device does not bear a critical level marking, the bottom of the vacuum breaker, combination valve, or the bottom of such approved device shall constitute the critical level.

Cross-Connection. A connection or arrangement, physical or otherwise, between a potable water supply system and a tank, receptor, equipment, or device through which it may be possible for nonpotable, used, unclean, polluted and contaminated water, or other substances to enter into a part of such potable water system under any condition.

206.0

– D –

Department Having Jurisdiction. The Authority Having Jurisdiction, including other law enforcement agencies affected by a provision of this code, whether such agency is specifically named or not.

Design Flood Elevation. The elevation of the “design flood,” including wave height, relative to the datum specified on the community’s legally designated flood hazard map. In areas designated as Zone AO, the design flood elevation shall be the elevation of the highest existing grade of the building’s perimeter plus the depth number in feet (m) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610 mm).

Design Pressure. The maximum allowable pressure for which a specific part of a system is designed.

Design Temperature. The maximum allowable continuous or intermittent temperature for which a specific part of a solar energy system is designed to operate safely and reliably.

Developed Length. The length along the center line of a pipe and fittings.

Diameter. Unless specifically stated, “diameter” is the nominal diameter as designated commercially.

Distribution System. That section of the solar system from the storage system to the point of use.

Diversion Charge Controller. Equipment that regulates the charging process of a battery by diverting power from energy storage to direct-current or alternating-current loads or to an interconnected utility service. [NFPA 70:690.2]

Drain. A pipe that carries waste or waterborne wastes in a building drainage system.

Drainage System. Includes the piping within a premise that conveys liquid waste to a legal point of disposal.

Drainback System. A closed loop system, which allows gravity draining of the heat transfer fluid into, lower portions or the solar loop under prescribed circumstances.

Draindown. An active solar energy system in which the fluid in the solar collector is drained from the solar energy system under prescribed circumstances.

207.0

– E –

Electrical (Auxiliary) Heating. Electrical heating element immersed into the storage.

Electrical Production and Distribution Network. A power production, distribution, and utilization system, such as a utility system and connected loads, that is external to and not controlled by the photovoltaic power system. [NFPA 70:690.2]

Emittance. The amount of heat radiated back from the solar collector, measured as percent of energy absorbed by the collector.

Enclosure. A room or box used to store solar components.

Energy Collector Fluid. That fluid used to transfer energy from the collector to the storage system or point of use.

Energy Storage Fluid (or Media). That fluid (or media) used in the storage container for storing collected energy.

Energy Transfer Fluid. That fluid used within a closed system either from the collector to the storage system or from the storage system to the point of use.

Equipment. A general term including materials, fittings, devices and apparatus used as part of or in connection with installations regulated by this code.

Essentially Nontoxic Transfer Fluid. Fluid generally recognized as safe by the Food and Drug Administration (FDA) as food grade.

Existing Work. A solar system or part thereof that has been installed prior to the effective date of this code.

External Auxiliary Heating. Auxiliary heating device located outside the storage. The heat is transferred to the storage by direct or indirect charging via a charge loop.

208.0

– F –

Flammable Liquid. Any liquid that has a flash point below 100°F (38°C), and has a vapor pressure not exceeding 40 psi (276 kPa) at 100°F (38°C). Flammable liquids shall be known as Class I liquids and shall be divided into the following classifications:

- (1) Class IA liquids having a flash point below 73°F (23°C) and a boiling point below 100°F (38°C).
- (2) Class IB liquids having a flash point below 73°F (23°C) and a boiling point at or above 100°F (38°C).
- (3) Class IC liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C).

Flash Point. The minimum temperature corrected to a pressure of 14.7 psi (101 kPa) at which a test flame causes the vapors of a portion of the sample to ignite under the conditions specified by the test procedures and apparatus. The flash point of a liquid shall be determined in accordance with ASTM D 56, ASTM D 93, or ASTM D 3278.

Flat Plate Collector. A panel (nonconcentrating type) of suitable material that converts solar energy into usable energy and the absorbing surface is essentially planar.

Flood Hazard Area. The greater of the following two areas:

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

Flood Hazard Area Subject to High Velocity Wave Action. Area within the flood hazard area which is subject to high velocity wave action, and shown on a Flood Insurance Rate Map or other flood hazard map as Zone V, VO, VE or V1-30.

Flood-Level Rim. The top edge of a receptor from which water overflows.

DEFINITIONS

209.0 – G –

Grade. The slope or fall of a line of pipe in reference to a horizontal plane. In drainage, it is usually expressed as the fall in a fraction of an inch (mm) or percentage slope per foot (m) length of pipe.

210.0 – H –

Hangers. See Supports.

Hazardous Material. A substance or mixture of substances that is toxic, corrosive, flammable, an irritant, a sensitizer, and that presents a potential threat to the health of humans or animals.

Heat Exchanger. A device that transfers heat from one medium to another.

Heat Transfer Medium. The medium used to transfer energy from the solar collectors to the thermal storage or load.

Heliostat. A reflecting surface mounted on an axis to direct the sun's rays to a fixed point.

High Hazard. See Contamination.

Horizontal Pipe. A pipe or fitting that is installed in a horizontal position or which makes an angle of less than 45 degrees (0.79 rad) with the horizontal.

Hybrid System. A system comprised of multiple power sources. These power sources may include photovoltaic, wind, micro-hydro generators, engine-driven generators, and others, but do not include electrical production and distribution network systems. Energy storage systems, such as batteries, do not constitute a power source for the purpose of this definition. [NFPA 70:690.2]

211.0 – I –

Ignition Source. Appliances or equipment due to their intended use and operation, are capable of providing sufficient temperature and energy to raise its ignition temperature and capable of igniting flammable vapors or fumes. Sources may include appliance or equipment burners, burner igniters or electric switching devices.

Immersed Heat Exchanger. Heat exchanger, which is completely surrounded with the fluid in the storage tank.

Indirect Waste Pipe. A waste pipe that does not connect directly with the drainage system, but that discharges into the drainage system through an air break or air gap into a trap, fixture, receptor or interceptor.

Insanitary. A condition that is contrary to sanitary principles or is injurious to health.

Conditions to which “insanitary” shall apply include the following:

- (1) A trap that does not maintain a proper trap seal.
- (2) An opening in a drainage system, except where lawful, that is not provided with an approved liquid-sealed trap.

- (3) A plumbing fixture or other waste-discharging receptor or device that is not supplied with water sufficient to flush and maintain the fixture or receptor in a clean condition.
- (4) A defective fixture, trap, pipe, or fitting.
- (5) A trap, except where in this code exempted, directly connected to a drainage system, the seal of which is not protected against siphonage and backpressure by a vent pipe.
- (6) A connection, cross-connection, construction, or condition, temporary or permanent, that would permit or make possible by any means whatsoever for an unapproved foreign matter to enter a water distribution system used for domestic purposes.
- (7) The foregoing enumeration of conditions to which the term “insanitary” shall apply, shall not preclude the application of that term to conditions that are, in fact, insanitary.

Insolation. The rate of solar energy received on a unit surface in a unit time.

Instantaneous Efficiency. The amount of energy removed by the transfer fluid per gross collector area. During the specified time period, divided by the total solar radiation incident on the collector per unit area during the same test period, under steady state or quasi-steady state.

Interactive System. A solar photovoltaic system that operates in parallel with and may deliver power to an electrical production and distribution network. For the purpose of this definition, an energy storage subsystem of a solar photovoltaic system, such as a battery, is not another electrical production source. [NFPA 70:690.2]

Inverter. Equipment that is used to change voltage level or waveform, or both, of electrical energy. Commonly, an inverter [also known as a power conditioning unit (PCU) or power conversion system (PCS)] is a device that changes dc input to an ac output. Inverters may also function as battery chargers that use alternating current from another source and convert it into direct current for charging batteries. [NFPA 70:690.2]

Inverter Input Circuit. Conductors between the inverter and the battery in stand-alone systems or the conductors between the inverter and the photovoltaic output circuits for electrical production and distribution network. [NFPA 70:690.2]

Inverter Output Circuit. Conductors between the inverter and an ac panelboard for stand-alone systems or the conductors between the inverter and the service equipment or another electric power production source, such as a utility, for electrical production and distribution network. [NFPA 70:690.2]

Irradiation, Instantaneous. The quantity of solar radiation incident on a unit surface area in unit time, measured in British thermal unit per square foot hour [Btu/(ft²•h)] (kW/m²).

Irradiation, Integrated Average. The solar radiation incident on a unit surface area during a specified time period divided by the duration of that time period.

212.0 – J –

Joint, Brazed. A joint obtained by joining of metal parts with alloys that melt at temperatures exceeding 840°F (449°C), but less than the melting temperature of the parts to be joined.

Joint, Soldered. A joint obtained by the joining of metal parts with metallic mixtures or alloys that melt at a temperature up to and including 840°F (449°C).

Joint, Welded. A gastight joint obtained by the joining of metal parts in the plastic molten state.

213.0 – K –

No definitions.

214.0 – L –

Labeled. Equipment or materials bearing a label of a listing agency (accredited conformity assessment body). See Listed (Third-Party Certified).

Langelier Saturation Index. A formula used to measure water balance or mineral saturation control of pool, spa, or hot tub water. Total alkalinity, calcium hardness, pH, water temperature, and total dissolved solids are measured, given a factor, and calculated to determine whether water has a tendency to be corrosive or scale forming.

Langley (calth/cm²). A unit of measurement of insolation, equal to 4.184 E+04 joules per square meter (J/m²).

Listed (Third party certified). Equipment or materials included in a list published by a listing agency (accredited conformity assessment body) that maintains periodic inspection on current production of listed equipment or material and whose listing states either that the equipment or material complies with approved standards or has been tested and found suitable for use in a specified manner.

Listing Agency. An agency accredited by an independent and authoritative conformity assessment body to operate a material and product listing and labeling (certification) system and that is accepted by the Authority Having Jurisdiction, which is in the business of listing or labeling. The system includes initial and ongoing product testing, a periodic inspection on current production of listed (certified) products, and makes available a published report of such listing in which specific information is included that the material or product is in accordance with applicable standards and found safe for use in a specific manner.

Load. The heat output of the storage during discharge. The load is defined as the product of the mass, specific thermal capacity and temperature increase of the water as it passes the solar hot water system.

Lot. A single or individual parcel or area of land legally recorded or validated by other means acceptable to the Authority Having Jurisdiction on which is situated a building or which is the site of work regulated by this code, together with the yards, courts, and unoccupied spaces

legally required for the building or works, and that is owned by or is in the lawful possession of the owner of the building or works.

Low Hazard. See Pollution.

215.0 – M –

Main. The principal artery of a system of continuous piping to which branches may be connected.

May. A permissive term.

Mechanical Code. The mechanical code that is adopted by the jurisdiction. Where a mechanical code is not adopted or where the content of the mechanical code adopted by the jurisdictions is not applicable, then mechanical code shall mean the Uniform Mechanical Code (UMC) promulgated by the International Association of Plumbing and Mechanical Officials (IAPMO).

Module. A complete, environmentally protected unit consisting of solar cells, optics, and other components, exclusive of tracker, designed to generate dc power where exposed to sunlight. [NFPA 70:690.2]

Monopole Subarray. A PV subarray that has two conductors in the output circuit, one positive and one negative. Two monopole PV subarrays are used to form a bipolar PV array. [NFPA 70:690.2]

216.0 – N –

Nuisance. Includes, but is not limited to:

- (1) A public nuisance known at common law or in equity jurisprudence.
- (2) Where a work regulated by this code is dangerous to human life or detrimental to health and property.
- (3) Inadequate or unsafe water supply or sewage disposal system.

217.0 – O –

Offset. A combination of elbows or bends in a line of piping that brings one section of the pipe out of line but into a line parallel with the other section.

Open Loop System. A system where the fluid is enclosed in a piping system that is vented to the atmosphere.

Out-Gassing. As applied to thermal energy, the thermal process by which materials expel gas.

218.0 – P –

Passive Solar Systems. As used in these requirements, are solar systems that utilize elements of a building, without augmentation by mechanical components such as blowers or pumps, to provide for the collections, storage, or distribution of solar energy for heating, cooling, or both.

Person. A natural person, his heirs, executor, administrators, or assigns and shall also include a firm, corporation, municipal or quasi-municipal corporation, or governmental agency. Singular includes plural, male and female.

DEFINITIONS

pH. The log of the reciprocal of the hydrogen ion concentration of a solution, and a measure of the acidity or alkalinity of the water. It is determined by the concentration of hydrogen ions in a specific volume of water.

Photolysis. A chemical decomposition caused by radiation.

Photosynthesis. The building up of chemical compounds with the help of radiation.

Photovoltaic. Relating to electricity produced by the action of solar radiation on a solar cell.

Photovoltaic Output Circuit. Circuit conductors between the photovoltaic source circuit(s) and the inverter or dc utilization equipment. [NFPA 70:690.2]

Photovoltaic Panel. A collection of modules mechanically fastened together, wired, and designed to provide a field-installable unit. [NFPA 70:690.2]

Photovoltaic Power Source. An array or aggregate of arrays that generates dc power at system voltage and current. [NFPA 70:690.2]

Photovoltaic Source Circuit. Circuits between modules and from modules to the common connection point(s) of the dc system. [NFPA 70:690.2]

Photovoltaic System Voltage. The direct current (dc) voltage of any photovoltaic source or photovoltaic output circuit. For multiwire installations, the photovoltaic system voltage is the highest voltage between any two dc conductors. [NFPA 70:690.2]

Pipe. A cylindrical conduit or conductor conforming to the particular dimensions commonly known as “pipe size.”

Plastic CC1. Plastic materials that have a burning extent of 1 inch (25.4 mm) or less where tested in nominal 0.060 inch (1.524 mm) thickness by ASTM D 635 or in the thickness intended for use.

Plastic CC2. Plastic materials that have a burning rate of 2½ inches per minute (in/min) (0.001 m/s) or less where tested in nominal 0.060 inch (1.524 mm) thickness by ASTM D 635 or in the thickness intended for use.

Plenum. An air compartment or chamber to which one or more ducts are connected and that forms part of either the conditioned air supply, circulating air, or exhaust air system, other than the occupied space being conditioned.

Plumbing Code. The plumbing code that is adopted by the jurisdiction. Where a plumbing code is not adopted or where the content of the plumbing code adopted by the jurisdiction is not applicable, then plumbing code shall mean the Uniform Plumbing Code (UPC) promulgated by the International Association of Plumbing and Mechanical Officials (IAPMO).

Plumbing Official. See Authority Having Jurisdiction.

Pollution. An impairment of the quality of the potable water to a degree that does not create a hazard to the public health but which does adversely and unreasonably affect the aesthetic qualities of such potable water for domestic use. Also defined as Low Hazard.

Potable Water. Water that is satisfactory for drinking, culinary, and domestic purposes and that meets the requirements of the Health Authority Having Jurisdiction.

Pressure. The normal force exerted by a homogeneous liquid or gas, per unit of area, on the wall of the container.

Residual Pressure. The pressure available at the fixture or water outlet after allowance is made for pressure drop due to friction loss, head, meter, and other losses in the system during maximum demand periods.

Static Pressure. The pressure existing without any flow.

Pressure-Limiting Device. A pressure-responsive mechanism designed to automatically stop the operation of the pressure-imposing element at a predetermined pressure.

Pressure-Relief Device. A pressure-actuated valve, rupture member, or fusible plug designed to automatically relieve excessive pressure.

Pump (Circulating). A device that circulates liquids or gases within a closed circuit for an intended purpose.

Pyranometer. A device used to measure the total solar radiation incident upon a surface per unit time per unit area.

Pyrheliometer. A device used to measure the direct radiation on a surface normal to the sun’s rays.

219.0

– Q –

Quasi-Steady State. The state of the solar collector test where the flow rate and temperature of the fluid entering the collector are constant but the exit fluid temperature changes gradually due to the normal change in irradiation that occurs with time for clear sky conditions.

Quick-Acting Valve. A valve that closes quickly or abruptly where manually released or electrically actuated.

220.0

– R –

Radiant Heater. A heater designed to transfer heat primarily by direct radiation.

Relief Valve, Vacuum. A device which automatically opens or closes for relieving a vacuum with the system, depending on whether the vacuum is above or below a predetermined value.

Rock Storage. A bin, basement, or other container filled with rock to act as an energy reservoir for a solar system.

Roughing-In. The installation of the parts of the solar system that are capable of being completed prior to the installation of fixtures. This includes drainage, water supply, gas piping, vent piping, and the necessary fixture supports.

221.0

– S –

Selective Surface. A special coating applied to solar collectors, having high absorption and low emission factors.

Shall. Indicates a mandatory requirement.

Size. See Diameter.

Solar Cell. The basic photovoltaic device that generates electricity where exposed to light. [NFPA 70:690.2]

Solar Collector. A device used to absorb energy from the sun.

Solar Constant. The average amount of solar radiation reaching the earth's atmosphere per unit time [about 2 lang-leys per minute [1395 J/(m²•s)].

Solar Energy System. A configuration of equipment and components to collect, convey, store, and convert the sun's energy for a purpose.

Solar Energy System Components. Any appliance, assembly, device, equipment, or piping used in the conversion of solar energy into thermal energy for service water heating, pool water heating, space heating and cooling, and electrical service.

Solar Photovoltaic System. The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to a utilization load. [NFPA 70:690.2]

Solar Thermal System. A complete assembly of subsystems which convert solar energy into thermal energy and utilize this energy for service water heating, pool water heating, space heating and cooling purposes.

Stand-Alone System. A solar photovoltaic system that supplies power independently of an electrical production and distribution network. [NFPA 70:690.2]

Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix, footnote, or fine print note and are not to be considered a part of the requirements of a standard.

Standard Air. Air weighing 0.075 of a pound per cubic foot (lb/ft³) (1.201 kg/m³) and is equivalent in density to dry air at a temperature of 70°F (21°C) and standard barometric pressure of 29.92 of a inch Hg. (101.32 kPa).

Storage Temperature. Temperature of the storage medium.

Stored Energy. Accumulated energy that is available for use.

Stratified. State where thermal stratification is inside the storage.

Subarray. An electrical subset of a PV array. [NFPA 70:690.2]

Supports. Supports, hangers, and anchors are devices for properly supporting and securing pipe, fixtures, and equipment.

Swimming Pool Code. For the purpose of this code, any reference to the swimming pool code shall mean the Uniform Swimming Pool, Spa, and Hot Tub Code (USP-SHTC) as promulgated by the International Association of Plumbing and Mechanical Officials (IAPMO) or local ordinance.

222.0 – T –

Thermal Stratification. State where the local storage temperature is a function of the vertical storage height, with the temperature decreasing from top to bottom.

Thermosiphon. The natural circulation of fluids due to temperature differential.

Tilt Angle. The angle above horizontal of a plane surface.

Time Constant. The time required for the fluid leaving a solar collector to attain 63.2 percent of its steady state value following a step change in insolation or inlet fluid temperature.

Total Alkalinity. The sum of all alkaline minerals in the water that is primarily in bicarbonate form, but also as sodium, calcium, magnesium, potassium carbonates, and hydroxides. It is a measure of the water's ability to resist changes in pH.

Total Dissolved Solids (TDS). A measure (by electrical conductivity) of the amount of soluble matter that is present in the water.

Total Incident Irradiation. The total solar radiant energy incident upon a unit surface area during a specified time period, expressed in British thermal unit per square foot (Btu/ft²) (J/m²).

Transfer System. The intermediate piping, ducts, or both between the various components of the solar system.

Transfer Time. Time period during which energy is transferred through the connections for charge (x=C) or discharge (x=D). The transfer time is calculated over one of more test sequences, excluding time periods used for conditioning at the beginning of the test sequences.

Trickling Collector. A solar collector in which fluids free flow over the collector surface.

223.0 – U –

Unsanitary. See Insanitary.

224.0 – V –

Vacuum. A pressure less than that exerted by the atmosphere.

Vacuum Breaker. See Backflow Preventer.

Venetian Blind Collector. A solar collector in which movable vanes are employed to absorb or reject energy.

225.0 – W –

Water-Distribution Pipe. In a building or premises, a pipe that conveys potable water from the building supply pipe to the plumbing fixtures and other water outlets.

Water Supply System. The building supply pipe, the water-distribution pipes, and the necessary connecting pipes, fittings, control valves, backflow prevention devices, and all appurtenances carrying or supplying potable water in or adjacent to the building or premises.

DEFINITIONS

226.0 – X –

No definitions.

227.0 – Y –

No definitions.

228.0 – Z –

No definitions.

CHAPTER 3

GENERAL REGULATIONS

301.0 General.

301.1 Applicability. This chapter shall govern the general requirements for the installation, design, construction, and repair of a solar energy system.

» 302.0 Materials – Standards and Alternates.

302.1 Minimum Standards. Pipe, pipe fittings, traps, equipment, material, and devices used in a solar energy system shall be listed or labeled (third party certified) by a listing agency (accredited conformity assessment body) and shall comply with approved applicable recognized standards referenced in this code, and shall be free from defects.

Unless otherwise provided for in this code, materials, equipment, or devices used or entering into the construction of solar energy systems, or parts thereof, shall be submitted to the Authority Having Jurisdiction for approval.

302.1.1 Marking. Each length of pipe, pipe fitting, appliance, equipment, assembly, and device used in a solar energy system shall have cast, stamped, or indelibly marked on it the manufacturer's mark or name, which shall readily identify the manufacturer to the end user of the product. Where required by the approved standard that applies, the product shall be marked with the weight and the quality of the product. Materials and devices used or entering into the construction of solar energy systems, or parts thereof, shall be marked and identified in a manner satisfactory to the Authority Having Jurisdiction. Such marking shall be done by the manufacturer. Field markings shall not be permitted.

302.1.2 Standards. Standards listed or referred to in this chapter or other chapters cover materials that conform to the requirements of this code, where used in accordance with the limitations imposed in this or other chapters thereof and their listing. Where a standard covers materials of various grades, weights, quality, or configurations, the portion of the listed standard that is applicable shall be used. Design and materials for special conditions or materials not provided for herein shall be permitted to be used by special permission of the Authority Having Jurisdiction after the Authority Having Jurisdiction has been satisfied as to their adequacy. A list of accepted solar energy system materials standards is included in Table 1201.1.

302.1.3 Existing Buildings. In existing buildings or premises in which solar energy system installations are to be altered, repaired, or renovated, the Authority Having Jurisdiction has discretionary powers to permit deviation from the provisions of this code, provided that such proposal to deviate is first submitted for proper determination in order that health and safety requirements, as they pertain to solar energy systems, shall be observed.

302.2 Alternate Materials and Methods of Construction Equivalency. Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire-resistance, effectiveness, durability, and safety over those prescribed by this code. Technical documentation shall be submitted to the Authority Having Jurisdiction to demonstrate equivalency. The Authority Having Jurisdiction shall have the authority to approve or disapprove the system, method, or device for the intended purpose.

However, the exercise of this discretionary approval by the Authority Having Jurisdiction shall have no effect beyond the jurisdictional boundaries of said Authority Having Jurisdiction. An alternate material or method of construction so approved shall not be considered as in accordance with the requirements, intent, or both of this code for a purpose other than that granted by the Authority Having Jurisdiction where the submitted data does not prove equivalency.

302.2.1 Testing. The Authority Having Jurisdiction shall have the authority to require tests, as proof of equivalency.

302.2.1.1 Tests. Tests shall be made in accordance with approved or applicable standards, by an approved testing agency at the expense of the applicant. In the absence of such standards, the Authority Having Jurisdiction shall have the authority to specify the test procedure.

302.2.1.2 Request by Authority Having Jurisdiction. The Authority Having Jurisdiction shall have the authority to require tests to be made or repeated where there is reason to believe that a material or device no longer is in accordance with the requirements on which its approval was based.

302.3 Flood Hazard Areas. Solar energy systems and components shall be located above the elevation in accordance with the building code for utilities and attendant equipment. Where mounted on or located in a building, solar energy systems and components shall be located not less than the design flood elevation or the elevation of the lowest floor, whichever is higher.

Exceptions:

- (1) Solar energy systems that are designed and installed to prevent water from entering or accumulating within their components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to such elevation in accordance with the flood-resistant construction requirements of the building code.
- (2) Tanks and dry storage containment structures that are designed, constructed, installed, and anchored to resist all flood-related and other loads during the design flood, or lesser floods.

302.3.1 Flood Hazard Areas Subject to High Velocity Wave Action. In flood hazard areas subject to high velocity wave action, solar energy systems and components shall comply with Section 302.3 and shall not be mounted on or penetrate through walls that are intended to breakaway under flood loads in accordance with the building code.

302.3.2 Flood Resistant Materials. Solar energy system components installed in flood hazard areas and below the design flood elevation shall be made of flood damage-resistant materials.

» 303.0 Structural Design Loads.

303.1 General. Solar energy system components, including building components and attachments, shall be designed and constructed to withstand the following loads in accordance with the building code:

- (1) Dead loads.
- (2) Live loads.
- (3) Snow loads.
- (4) Wind loads.
- (5) Seismic loads.
- (6) Flood loads.
- (7) Expansion and contraction loads resulting from temperature changes.

» 304.0 Workmanship.

304.1 Engineering Practices. Design, construction, and workmanship shall comply with accepted engineering practices and shall be of such character as to secure the results sought to be obtained by this code.

304.2 Concealing Imperfections. It is unlawful to conceal cracks, holes, or other imperfections in materials by welding, brazing, or soldering or by using therein or thereon a paint, wax, tar, solvent cement, or other leak-sealing or repair agent.

304.3 Burred Ends. Burred ends of pipe and tubing shall be reamed to the full bore of the pipe or tube, and chips shall be removed.

304.4 Installation Practices. Solar energy systems shall be installed in a manner that is in accordance with this code, applicable standards, and the manufacturer's installation instructions.

304.4.1 On-Site. The installer shall leave the manufacturer's installation and operating instructions with the system owner.

» 305.0 Installation.

305.1 Dissimilar Metals. Except for necessary valves, where intermembering or mixing of dissimilar metals occur, the point of connection shall be confined to exposed or accessible locations.

The Authority Having Jurisdiction shall be permitted to require the use of an approved dielectric insulator on the solar thermal piping connections of open loop systems.

305.2 Direction of Flow. Valves, pipes, and fittings shall be installed in correct relationship to the direction of flow.

305.3 Changes in Direction. Changes in direction shall be made by the approved use of fittings, except that changes in direction in copper tubing shall be permitted to be made with bends provided that such bends are made with bending equipment that does not deform or create a loss in the cross-sectional area of the tubing.

305.4 Improper Location. Solar thermal piping or equipment shall not be located as to interfere with the normal use thereof or with the normal operation and use of windows, doors, or other required facilities.

305.5 Attic Installations. An attic space in which solar energy system components are installed shall be accessible through an opening and passageway not less than as large as the largest component of the appliance, and not less than 22 inches by 30 inches (559 mm by 762 mm). [NFPA 54:9.5.1]

305.5.1 Length of Passageway. Where the height of the passageway is less than 6 feet (1829 mm), the distance from the passageway access to the components shall not exceed 20 feet (6096 mm) measured along the centerline of the passageway. [NFPA 54:9.5.1.1]

305.5.2 Width of Passageway. The passageway shall be unobstructed and shall have solid flooring not less than 24 inches (610 mm) wide from the entrance opening to the components. [NFPA 54:9.5.1.2]

305.5.3 Work Platform. A level working platform not less than 30 inches by 30 inches (762 mm by 762 mm) shall be provided in front of the service side of the components. [NFPA 54:9.5.2]

305.5.4 Lighting and Convenience Outlet. A permanent 120-volt receptacle outlet and a luminaire shall be installed near the appliance. The switch controlling the luminaire shall be located at the entrance to the passageway. [NFPA 54:9.5.3]

306.0 Protection of Structures.

306.1 Structural Integrity. A structural member weakened or impaired by cutting, notching, or otherwise shall be reinforced, repaired, or replaced so as to be left in a safe structural condition in accordance with the requirements of the building code.

306.2 Waterproofing of Openings. Joints at the roof around pipes, ducts, or other appurtenances shall be made watertight by the use of lead, copper, galvanized iron, or other approved flashings or flashing material. Exterior wall openings shall be made watertight.

306.3 Rodentproofing. In or on buildings where openings have been made in walls, floors, or ceilings for the passage of pipes and components, such openings shall be closed and protected by the installation of approved metal collars securely fastened to the adjoining structure.

306.4 Protection Against Decay. Wood used in the construction of collector or system mounting, and exposed to outdoor conditions shall be pressure-treated with preservative or shall be a naturally durable, decay resistant species of lumber.

» 307.0 Hangers and Supports.

307.1 Components of Solar Energy System. Components of a solar energy system shall be supported in accordance with this code, the manufacturer's installation instructions, and in accordance with the Authority Having Jurisdiction.

» **307.2 Material.** Hangers and anchors shall be of sufficient strength to support the weight of the pipe and its contents. Piping shall be isolated from incompatible materials. Pipe hangers and supports shall be of sufficient strength to withstand all static and dynamic loading conditions in accordance with its intended use. Pipe hangers and supports with direct contact with piping shall be of approved materials that are compatible with the piping and will not cause galvanization.

» **307.3 Suspended Piping.** Suspended piping shall be supported at intervals not to exceed those shown in Table 307.3.

307.4 Alignment. Piping shall be supported in such a manner as to maintain its alignment and prevent sagging.

307.5 Underground Installation. Piping in the ground shall be laid on a firm bed for its entire length; where other support is otherwise provided, it shall be approved in accordance with Section 302.0.

» **307.6 Hanger Rod Sizes.** Hanger rod sizes shall not be smaller than those shown in Table 307.6.

TABLE 307.6
HANGER ROD SIZES

PIPE AND TUBE SIZE (inches)	ROD SIZE (inches)
1/2 – 4	3/8
5 – 8	1/2
10 – 12	5/8

For SI units: 1 inch = 25.4 mm

» 308.0 Trenching, Excavation, and Backfill.

308.1 Trenches. Trenches deeper than the footing of a building or structure and paralleling the same shall be not less than 45 degrees (0.79 rad) therefrom, or as approved in accordance with Section 302.0.

308.2 Tunneling and Driving. Tunneling and driving shall be permitted to be done in yards, courts, or driveways of a building site. Where sufficient depth is available to permit, tunnels shall be permitted to be used between open-cut trenches. Tunnels shall have a clear height of 2 feet (610 mm) above the pipe and shall be limited in length to one-half the depth of the trench, with a maximum length of 8 feet (2438 mm). Where pipes are driven, the drive pipe shall be not less than one size larger than the pipe to be laid.

308.3 Open Trenches. Excavations required to be made for the installation of a solar energy system, or a part thereof, within the walls of a building, shall be open trench work and shall be kept open until the piping has been inspected, tested, and accepted.

308.4 Excavations. Excavations shall be completely back-filled as soon after inspection as practicable. Precaution shall be taken to ensure compactness of backfill around piping without damage to such piping. Trenches shall be backfilled in thin layers to 12 inches (305 mm) above the top of the piping with clean earth, which shall not contain stones, boulders, cinderfill, frozen earth, construction debris, or other materials that will damage or break the piping or cause corrosive action. Mechanical devices such as bulldozers, graders, etc., shall be permitted to then be used to complete backfill to grade. Fill shall be properly compacted. Precautions shall be taken to ensure permanent stability for pipe laid in filled or made ground.

308.5 Water Pipes. Water pipes shall not be run or laid in the same trench as building sewer or drainage piping constructed of clay or materials that are not approved for use within a building unless both of the following conditions are met:

- (1) The bottom of the water pipe, at all points, shall be not less than 12 inches (305 mm) above the top of the sewer or drain line.
- (2) The water pipe shall be placed on a solid shelf excavated at one side of the common trench with a clear horizontal distance of not less than 12 inches (305 mm) from the sewer or drain line.

Water pipes crossing sewer or drainage piping constructed of clay or materials that are not approved for use within a building shall be laid not less than 12 inches (305 mm) above the sewer or drainpipe.

309.0 Testing.

309.1 Piping. The piping of the solar thermal system shall be tested with water, air, heat transfer liquid, or as recommended by the manufacturer's instructions, except that plastic pipe shall not be tested with air. The Authority Having Jurisdiction shall be permitted to require the removal of plugs, etc., to ascertain where the pressure has reached all parts of the system.

309.2 System Requirements. Upon completion, the system, including piping, collectors, heat exchangers, and other related equipment, shall be tested and proved airtight.

309.2.1 Open Loop Systems. Open loop systems directly connected to the potable water system shall be tested under a water pressure not less than the maximum working pressure under which it is to be used. The water used for tests shall be obtained from a potable source of supply. A 50 pound-force per square inch (psi) (345 kPa) air pressure test shall be permitted to be substituted for the water test.

309.2.2 Other Open Loop Systems. Systems operating at atmospheric pressure shall be tested under actual operating conditions.

309.2.3 Closed Loop Systems. Closed loop or other type pressure systems shall be tested at one-and-one-half times maximum designed operating pressure.

Systems shall withstand the test without leaking for a period of not less than 15 minutes.

**TABLE 307.3
HANGERS AND SUPPORTS**

MATERIALS	TYPES OF JOINTS	HORIZONTAL	VERTICAL
Cast	Lead and Oakum	5 feet, except 10 feet where 10 foot lengths are installed ^{1, 2, 3}	Base and each floor, not to exceed 15 feet
	Compression Gasket	Every other joint, unless over 4 feet then support each joint ^{1, 2, 3}	Base and each floor, not to exceed 15 feet
Cast Iron Hubless	Shielded Coupling	Every other joint, unless over 4 feet then support each joint ^{1, 2, 3, 4}	Base and each floor, not to exceed 15 feet
Copper Tube and Pipe	Soldered or Brazed	1½ inches and smaller, 6 feet; 2 inches and larger, 10 feet	Each floor, not to exceed 10 feet ⁵
Steel and Brass Pipe for Water	Threaded or Welded	¾ inch and smaller, 10 feet; 1 inch and larger, 12 feet	Every other floor, not to exceed 25 feet ⁵
Schedule 40 PVC	Solvent Cemented	Allow for expansion every 30 feet ³	Base and each floor; provide mid-story guides; Provide for expansion every 30 feet.
CPVC	Solvent Cemented	1 inch and smaller, 3 feet; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
Copper	Mechanical	In accordance with standards acceptable to the Authority Having Jurisdiction	
Steel & Brass	Mechanical	In accordance with standards acceptable to the Authority Having Jurisdiction	
PEX	Cold Expansion Insert and Compression	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
PEX-AL-PEX	Metal Insert and Metal Compression	½ inch } ¾ inch } All sizes 98 inches 1 inch }	Base and each floor; provide mid-story guides
PE-AL-PE	Metal Insert and Metal Compression	½ inch } ¾ inch } All sizes 98 inches 1 inch }	Base and each floor; provide mid-story guides
Polypropylene (PP)	Fusion weld (socket, butt, saddle, electrofusion) threaded (metal threads only) or mechanical	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm

Notes:

¹ Support adjacent to joint, not to exceed 18 inches (457 mm).

² Brace not to exceed 40 foot (12 192 mm) intervals to prevent horizontal movement.

³ Support at each horizontal branch connection.

⁴ Hangers shall not be placed on the coupling.

⁵ Vertical water lines shall be permitted to be supported in accordance with recognized engineering principles with regard to expansion and contraction, where first approved by the Authority Having Jurisdiction.

309.3 Storage Tanks. Storage tanks shall be tested in accordance with Section 309.3.1 and Section 309.3.2.

309.3.1 Pressure Type. Storage tanks shall be tested in accordance with Section 309.2.3.

309.3.2 Non-Pressure Type. Storage tanks shall be tested by filling it with water for a period of 24 hours prior to inspection and shall withstand the test without leaking. No tank or portion thereof shall be covered or concealed prior to approval.

310.0 Electrical.

310.1 Wiring. Electrical connections, wiring, and devices shall be installed in accordance with NFPA 70. Electrical

equipment, appliances, and devices installed in areas that contain flammable vapors or dusts shall be of a type approved for such environment.

310.2 Controls. Required electrical, mechanical, safety, and operating controls shall be listed or labeled by a listing agency. Electrical controls shall be of such design and construction as to be suitable for installation in the environment in which they are located.

311.0 Disposal of Liquid Waste.

311.1 General. It shall be unlawful for a person to cause, suffer, or permit the disposal of liquid wastes, heat transfer medium, or other solar thermal liquids, in a place or manner, except through and by means of an approved drainage

system installed and maintained in accordance with the provisions of this code. Waste from a solar thermal system that is deleterious to surface or subsurface waters shall not be discharged into the ground or into a waterway.

311.2 Connections to Drainage System Required.

Receptors, drains, appurtenances, and appliances, used to receive or discharge liquid wastes, shall be connected to the drainage system of the building or premises in accordance with the requirements of this code.

312.0 Location.

312.1 System. Except as otherwise provided in this code, no solar energy system, or parts thereof shall be located in a lot other than the lot that is the site of the building, structure, or premises served by such facilities.

312.2 Ownership. No subdivision, sale, or transfer of ownership of existing property shall be made in such manner that the area, clearance, and access requirements of this code are decreased.

»»

313.0 Abandonment.

313.1 General. An abandoned solar thermal system or part thereof shall be disconnected from remaining systems, drained, plugged, and capped in an approved manner.

313.2 Storage Tank. An underground water storage tank that has been abandoned or discontinued otherwise from use in a solar thermal system shall be completely drained and filled with earth, sand, gravel, concrete, or other approved material or removed in a manner satisfactory to the Authority Having Jurisdiction.

»»

314.0 Safety Requirements.

314.1 Welding. Welding shall be done by approved welders in accordance with nationally recognized standards. Such welding shall be subject to the approval of the Authority Having Jurisdiction.

»» **314.2 Spark or Flame.** Solar energy system equipment that generates a glow, spark, or flame capable of igniting flammable vapors shall be permitted to be installed in a residential garage provided the pilots and burners, heating elements, motors, controllers, or switches are not less than 18 inches (457 mm) above the floor level unless listed as flammable vapor ignition resistant.

314.3 Hazardous Heat-Transfer Mediums. Hazardous heat-transfer mediums shall comply with Section 314.3.1 and Section 314.3.2.

»» **314.3.1 Approval.** Heat-transfer mediums that are hazardous shall not be used in solar thermal systems, except with prior approval of the Authority Having Jurisdiction.

314.3.2 Flash Points. The flash point of a heat-transfer medium shall be:

- (1) Not less than 50°F (10°C) above the design maximum nonoperating temperature and as high as the maximum stagnation temperature of the medium in the system.

- (2) Not less than 50°F (10°C) above the design maximum operating temperature and exceeding the maximum stagnation temperature minus 200°F (93°C) of the medium in the system.

314.4 Discharge. The collector, collector manifold, and manifold relief valve shall not discharge directly or indirectly into the building or toward an open flame or other source of ignition.

315.0 Safety Devices.

315.1 Pressure Relief Valves. Solar energy system components containing pressurized fluids shall be protected against pressures exceeding design limitations with a pressure relief valve. Each section of the system in which excessive pressures are capable of developing shall have a relief device located so that a section cannot be isolated from a relief device. Valves shall not be located on either side of a relief valve connection. The relief valve discharge pipe shall be of approved material that is rated for the temperature of the system. The discharge pipe shall be the same diameter as the relief valve outlet, discharge by gravity through an air gap into the drainage system or outside of the building with the end of the pipe not exceeding 2 feet (610 mm) nor less than 6 inches (152 mm) above the ground and pointing downward.

315.2 Vacuum Relief Valves. The solar energy system components that are subjected to a vacuum while in operation or during shutdown shall be protected with vacuum relief valves. Where the piping configuration, equipment location, and valve outlets are located below the storage tank elevation the system shall be equipped with a vacuum relief valve at the highest point.

315.3 Space Heating. Where a combination potable water heating and space heating system requires water for space heating at temperatures higher than 140°F (60°C), a thermostatic mixing valve that is in accordance with ASSE 1017 shall be provided to limit the water supplied to the potable hot water distribution system to a temperature of 140°F (60°C) or less.

316.0 Protection of System Components.

316.1 Materials. Solar thermal system components in contact with heat-transfer mediums shall be approved for such use. Solar thermal system components, installed outdoors, shall be resistant to UV radiation.

316.2 Corrosion. Solar thermal systems and components subject to corrosion shall be protected in an approved manner. Metal parts exposed to atmospheric conditions shall be of corrosion-resistant material.

316.3 Mechanical Damage. Portions of a solar energy system installed where subjected to mechanical damage shall be guarded against such damage by being installed behind approved barriers or, where located within a garage, be elevated or located out of the normal path of a vehicle.