



Uniform Solar, Hydronics and Geothermal Code[®]

2020 TECHNICAL COMMITTEE
MEETING MONOGRAPH

TELECONFERENCE | MAY 19, 2020

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**2020 Uniform Solar, Hydronics & Geothermal Code
Technical Committee Teleconference Meeting
May 19, 2020**

AGENDA

- I. Call to Order
- II. Chairman Comments
- III. Announcements
- IV. Self-Introductions
- V. Review and Approval of Agenda
- VI. Approval of Minutes from Previous Meeting
(June 19, 2019 – Ontario, CA)
- VII. Discussion on Public Comments to the Uniform Solar, Hydronics &
Geothermal Code
- VIII. Other Business
- IX. Future Meetings
- X. Adjournment



TENTATIVE ORDER OF DISCUSSION

2020 PROPOSED PUBLIC COMMENTS TO THE UNIFORM SOLAR, HYDRONICS & GEOTHERMAL CODE

The following is the tentative order of discussion on which the public comments will be discussed at the Technical Committee Meeting. Proposed public comments that are grouped together are those that are both indented and separated by lines. Indented public comments are those being discussed out of numerical order.

Item # 001.01	Item # 069
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Uniform Solar, Hydronics & Geothermal Code Public Comments



CODES ADMINISTRATION

Proposals

Item #: 001.01

USHGC 2021 Section: 205.0

SUBMITTER: USHGC Technical Committee Proposal

RECOMMENDATION:

Add new text

205.0 - C -

Certified. A formally stated recognition and approval of an acceptable level of competency, acceptable to the Authority Having Jurisdiction. [NFPA 96:3.3.10]

SUBSTANTIATION:

The additional definition for "certified" is necessary as it is repeatedly mentioned throughout current and proposed code language. Utilizing an NFPA extract would be ideal, and the same definition gathered from NFPA 96 is also used within the mechanical code. For these reasons, the additional language is necessary and further enhances the USHGC.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

205.0 - C -

Certified Person. A formally stated recognition and approval of an acceptable level of competency, acceptable to the Authority Having Jurisdiction. [NFPA 96:3.3.10] A person trained and certified by the equipment manufacturer, or by a recognized organization through a formal certification program for the system to be serviced or cleaned; that is acceptable to the Authority Having Jurisdiction.

COMMITTEE STATEMENT:

The term "Certified" is being amended to "Certified Person" as the intent of the submitter was to provide terminology for a certified person and not a certified manufactured part or piece of equipment.

Additionally, the terminology provided has been replaced to further support the submitter's intent. The new definition was gathered from the Uniform Mechanical Code.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC Section #: 205.

Item #: 001.01

SUBMITTER: Monte Myers
Self

Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal **as modified** by this public comment.

205.0 - C -

Certified Person. A person trained and certified by the equipment manufacturer, or by a recognized organization through a formal certification program, for design, installation, and maintenance of a specified system or piece of equipment ~~the system to be serviced or cleaned~~; that is acceptable to the Authority Having Jurisdiction.

SUBSTANTIATION:

The term “certified person” does not only apply to those certified for service and cleaning. A person may be certified for design, installation and/or maintenance of a specified system. For example, the International Ground Source Heat Pump Association (IGSHPA) offers certifications for installation and design of geothermal systems.

Additionally, maintenance covers service and cleaning and is more appropriate for this definition. The revision to this definition is to remove the exclusion of designers and installers who are certified for such tasks. For these reasons, the provided modification is necessary.

PUBLIC COMMENT 2

Code Year: 2021 USHGC Section #: 205.0

Item #: 001.01

SUBMITTER: Jazmin Curiel
Self

Comment #: 2

RECOMMENDATION:
Add new text

Request to accept the code change proposal **as modified** by this public comment.

205.0 - C -

Certified. A formally stated recognition and approval by a recognized organization which validates and verifies that standard requirements set forth are met.

SUBSTANTIATION:

A definition for “certified” should be included as it is used throughout the code and currently does not have provided terminology. Since a definition for “certified person” was accepted during the proposal stage, also including terminology for “certified” will provide clarity for the end user as to the differences in the terms.

While a definition for “certified” is listed within the Uniform Mechanical Code (UMC), the term refers to competency, and this implies that a product or piece of equipment can be competent. Competent, by definition, is “having the necessary ability, knowledge, or skill to do something successfully” or being “a person who is efficient and capable.” For this reason, the definition provided in the UMC is not appropriate for the intent with which it has in the USHGC. It is recommended that the definition within the UMC be updated as well during the following code cycle.



CODES ADMINISTRATION

Proposals

Item #: 002

USHGC 2021 Section: 208.0

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION:
Add new text

208.0 - F -

Field Evaluation Body (FEB). An organization or part of an organization that performs field evaluations of electrical or other equipment. [NFPA 70:100]

Field Labeled (as applied to evaluated products). Equipment or materials to which has been attached a label, symbol, or other identifying mark of an FEB indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [NFPA 70:100]

SUBSTANTIATION:

The term "field labeled" is used several times within Chapter 8. This term is currently not defined and without a definition may be misunderstood to imply permission to affix a listed label in the field. Since the sections containing the term "field labeled" are all extracted material from NFPA 70, and this term is defined in NFPA 70, the definition of "field labeled" needs to be extracted and placed within the USHGC to ensure proper use of this term. Additionally, the term "field evaluation body (FEB)" also needs to be extracted and placed within the USHGC as the acronym, FEB, is used within the definition of "field labeled" and may not be understood by the users of this code.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC **Section #:** 204.0, 205.0, 206.0

Item #: 002

SUBMITTER: James Majerowicz
Plumbers' Joint Apprenticeship Committee L.U. 130, U.A.

Comment #: 1

RECOMMENDATION:
Add new text

Request to accept the code change proposal **as modified** by this public comment.

204.0 - B -

Branch Circuit. The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s). [NFPA 70:100]

205.0 - C -

Circuit Breaker. A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating. [NFPA 70:100]

206.0 - D -

Disconnecting Means. A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply. [NFPA 70:100]

SUBSTANTIATION:

The above terms are used throughout Chapter 8 (Solar Photovoltaic Systems) and require terminology for clarification when interpreting listed provisions. Additionally, these are commonly used terms for systems utilizing electrical components and should therefore be included in Chapter 2 (Definitions). The definitions included are from NFPA 70 as is most language within Chapter 8. Adding definitions which are extracts from this standard will ensure that the terminology matches the intent of the language provided in Chapter 8.



CODES ADMINISTRATION

Proposals

Item #: 003

USHGC 2021 Section: 302.1.2

SUBMITTER: David Mann
Self

RECOMMENDATION:
Revise text

302.0 Standards and Alternates.

302.1 Minimum Standards. (remaining text unchanged)

302.1.2 Standards. Standards listed or referred to in this chapter or other chapters cover materials that will 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 standards that appear in specific sections of this code are referenced in Table 901.1. Standards referenced in Table 901.1 shall be applied as indicated in the applicable referenced section. A list of additional approved standards, publications, practices and guides that are not referenced in specific sections of this code appear in Table 901.2. ~~The documents indicated in Table 901.2 shall be permitted in accordance with Section 302.2.~~

SUBSTANTIATION:

Section 302.1.2 is being revised to allow the end user to use an applicable approved standard in Table 901.2 without the additional step of an alternate method and material. All standards in Table 901.2 have been vetted and have a place in the code. To prevent confusion in the field and to prevent contradictions within the USHGC, Section 302.1.2 must be revised as the standards in Table 901.2 can be used, where applicable, without additional approval in accordance with Section 302.2.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:

The proposed change is being rejected as it negates the current provisions for alternate methods and materials. The Technical Committee agrees that the Authority Having Jurisdiction should determine when and where the standards in Table 901.2 are applicable.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1**Code Year:** 2021 USHGC **Section #:** 302.1.2**Item #:** 003**SUBMITTER:** Adam Segura
Self**Comment #:** 1**RECOMMENDATION:**

Revise text

Request to accept the code change proposal **as submitted** by this public comment.

SUBSTANTIATION:

The revisions to Section 302.1.2 are being resubmitted to correlate with the language approved in Item #048 of the 2019 UMC ROC. The approval of such change allows for the use of an applicable approved standard in Table 901.2 (Standards, Publications, Practices, and Guides) without the additional requirement of compliance with Section 302.2 (Alternative Materials and Methods of Constructions Equivalency). This is necessary since the documents listed in Table 901.2 have already been reviewed by the Technical Committee and deemed appropriate for use based on the listed application within the table.



CODES ADMINISTRATION

Proposals

Item #: 005

USHGC 2021 Section: 308.1.1

SUBMITTER: Christopher Jensen
UL LLC

RECOMMENDATION:
Revise text

308.0 Condensate Wastes and Control.

308.1 Condensate Disposal. (remaining text unchanged)

308.1.1 Condensate Pumps. Where approved by the Authority Having Jurisdiction, condensate pumps shall be installed in accordance with the manufacturer's installation instructions. Pump discharge shall rise vertically to a point where it is possible to connect to a gravity condensate drain and discharged to an approved disposal point. Each condensing unit shall be provided with a separate sump and interlocked with the equipment to prevent the equipment from operating during a failure. Separate pumps shall be permitted to connect to a single gravity indirect waste where equipped with check valves and approved by the Authority Having Jurisdiction. Motor operated condensate pumps rated 600 volts or less shall be listed and labeled in accordance with UL 778.

Note: UL 778 meets the requirements for a mandatory reference standard in accordance with Section 15.0 of IAPMO's Regulations Governing Consensus Development of the Uniform Solar, Hydronics & Geothermal and Swimming Pool, Spa & Hot Tub Codes.

SUBSTANTIATION:

Section 308.1.1 is being revised to include provisions for motor operated condensate pumps by requiring such pumps to be listed and labeled in accordance with UL 778.

The addition of UL 778 is necessary as it covers component specifications, electrical and fire enclosures, internal wiring, parts in contact with potable water, mechanical assemblies, protection against corrosion, supply connections, performance, ratings, and markings for motor operated condensate pumps rated 600 volts or less.

Including UL 778 within this code provides consistency and clarity for AHJ's, manufacturers, and testing labs as to an appropriate product standard. Adding UL 778 to Section 308.1.1 is consistent with a similar reference in Section 310.1 for circulators and pumps.

Additionally, UL has 21 manufacturers that currently have condensate pumps listed to UL 778.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC Section #: 308.1.1, Table 901.1

Item #: 005

SUBMITTER: Jazmin Curiel
Self

Comment #: 1

RECOMMENDATION:

Revise text

Request to accept the code change proposal **as modified** by this public comment.

308.0 Condensate Wastes and Control.

308.1 Condensate Disposal. (remaining text unchanged)

308.1.1 Condensate Pumps. Where approved by the Authority Having Jurisdiction, condensate pumps shall be installed in accordance with the manufacturer's installation instructions. Pump discharge shall rise vertically to a point where it is possible to connect to a gravity condensate drain and discharged to an approved disposal point. Each condensing unit shall be provided with a separate sump and interlocked with the equipment to prevent the equipment from operating during a failure. Separate pumps shall be permitted to connect to a single gravity indirect waste where equipped with check valves and approved by the Authority Having Jurisdiction. Motor operated condensate pumps rated 600 volts or less shall be listed and labeled in accordance with [CSA C22.2 No. 108 or](#) UL 778.

**TABLE 901.1
REFERENCED STANDARDS**

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
CSA C22.2 No. 108 – 2014(R2019)	Liquid Pumps	Pumps	308.1.1

(portions of table not shown remain unchanged)

Note: CSA C22.2 No. 108 meets the requirements for a mandatory reference standard in accordance with Section 15.0 of IAPMO's Regulations Governing Consensus Development of the Uniform Solar, Hydronics & Geothermal and Swimming Pool, Spa & Hot Tub Codes.

SUBSTANTIATION:

Section 308.1.1 is being modified to include CSA C22.2 No. 108 as the standard applies to liquid pumps. Various manufacturers are currently making condensate pumps which are being listed to this standard. The standard covers construction, markings, testing, bonding, and enclosures for liquid pumps including condensate pumps. Including this additional listing further enhances the code.

PUBLIC COMMENT 2

Code Year: 2021 USHGC Section #: 308.0, 308.1, 308.2, 308.7

Item #: 005

SUBMITTER: Adam Segura
Self

Comment #: 2

RECOMMENDATION:

Revise text

Request to accept the code change proposal **as modified** by this public comment.

308.0 Condensate Wastes and Control.

308.1 Condensate Disposal. Condensate from air washers, air-cooling coils, condensing appliances, and the overflow from evaporative coolers and similar water supplied equipment or similar air-conditioning equipment shall be collected and discharged to an approved plumbing fixture or disposal area. Where discharged into the drainage system, equipment shall drain ~~by means of using~~ an indirect waste pipe. The waste pipe shall have a slope of not less than 1/8 inch per foot (10.4 mm/m)

or 1 percent slope and shall be of approved corrosion- resistant material not smaller than the outlet size in accordance with Section 308.3 or Section 308.4 for air-cooling coils or condensing appliances, respectively. Condensate or wastewater shall not drain over a public way.

308.2 Condensate Control. Where an equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, other than damage to replaceable lay-in ceiling tiles, a drain line shall be provided and shall be drained in accordance with Section 308.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

- (1) (remaining text unchanged)
- (2) An additional watertight pan of corrosion-resistant material, with a separate drain line, installed beneath the cooling coil, unit, or ~~the~~ appliance to catch the overflow condensate due to a clogged primary condensate drain.
- (3) An additional drain line at a level that is higher ~~that than~~ the primary drain line connection of the drain pan.
- (4) (remaining text unchanged)

308.7 Plastic Fittings. Female plastic ~~threaded-screwed~~ fittings shall be used with ~~male~~ plastic ~~male~~-fittings and plastic ~~male~~-threads.

SUBSTANTIATION:

The above sections pertaining to condensate waste control are being revised to correlate with the 2021 Uniform Plumbing Code. This is necessary to ensure that fluidity between the two codes is met.



CODES ADMINISTRATION

Proposals

Item #: 007

USHGC 2021 Section: 401.3 - 401.5

SUBMITTER: Lance MacNevin
Plastic Pipe Institute

RECOMMENDATION:
Revise text

401.0 General.

401.3 Water Hammer Protection. The flow of the hydronic piping system shall be ~~controlled~~designed to prevent water hammer.

401.4 Terminal Units. Terminal units, valves, and flow control devices shall be installed in accordance with the manufacturer's installation instructions.

~~410.4~~**401.5 Return-Water Low-Temperature Protection.** (remaining text unchanged)

(renumber remaining sections)

SUBSTANTIATION:

Section 401.3 is being revised to clarify that the piping system installed must be designed to prevent water hammer from occurring. Controlling the flow of the hydronic piping is not the only method of preventing water hammer. Adjusting the length of the piping as well as installing water hammer arrestors and check valves are piping design methods that effectively prevent such occurrences. For these reasons, the provisional language has been amended.

A terminal unit is a component of the hydronic system that receives heat and provides it to a room or space. Hydronic systems are composed of an energy source (boiler, water heater, or chiller), in combination with pumps and piping that connect the energy source to terminal heat-transfer units. There are multiple types of terminal units that can be selected from in relation to the application and budget of the installer/user. For this reason, the terminal units must be installed in compliance with the manufacturer's installation instructions, and all connecting valves and flow control devices must be compatible with the terminal units.

Section 410.4 has been relocated to Section 401.5 as this language is better suited under "General" provisions rather than provisions for "System Controls".

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC Section #: Table 901.2

Item #: 007

SUBMITTER: Jeff Matson
Chair, USHGC Hydronics Task Group

Comment #: 1

RECOMMENDATION:

Add new text

Request to accept the code change proposal **as modified** by this public comment.

TABLE 901.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

DOCUMENT NUMBER	DOCUMENT TITLE	APPLICATION
IAPMO IGC 332 – 2017a	Hydronic Radiators	Hydronic Systems

(portions of table not shown remain unchanged)

SUBSTANTIATION:

Section 401.4 pertains to terminal units for hydronic systems which include heating/cooling coils, central reheat coils, radiators, convectors, unit heaters, fan-coil units and radiant heating/cooling panels. Since hydronic radiators are a type of terminal unit, it is necessary that applicable industry standards are included within the USHGC pertaining to these types of terminal units.

IAPMO IGC 332 is being added to Table 901.2 since the standard covers hydronic radiators intended for use in residential and commercial applications. This standard is necessary as it specifies requirements for materials, physical characteristics, performance testing, and markings for such radiators. Hydronic radiators covered by this standard include, but are not limited to, manifold, finned tube, floor mounted, wall mounted, bench, panel and towel warming. Such inclusion further enhances the code and provides the end user with an applicable standard for hydronic radiators.

PUBLIC COMMENT 2

Code Year: 2021 USHGC Section #: 225.0

Item #: 007

SUBMITTER: Edmond Murray
Aztec Solar

Comment #: 2

RECOMMENDATION:

Add new text

Request to accept the code change proposal **as modified** by this public comment.

225.0 - W -

Water Hammer. A hydraulic shock that occurs within a pressurized piping system when the fluid flow within the system is suddenly stopped and the fluid momentum is broken.

SUBSTANTIATION:

The provided definition is necessary since there are listed provisions within Chapter 4 (Hydronics) and Chapter 7 (Geothermal Energy Systems) for prevention of water hammer. This definition appropriately states what a water hammer is, what systems it applies to, and how it is formed within these systems. For these reasons, the above terminology is necessary and further enhances the code.



CODES ADMINISTRATION

Proposals

Item #: 008

USHGC 2021 Section: 402.2, Table 901.1

SUBMITTER: Lance MacNevin
Plastic Pipe Institute

RECOMMENDATION:
Add new text

402.0 Protection of Potable Water Supply.

402.2 Chemical Injection. Where systems include an additive, chemical injection or provisions for such injection, the potable water supply shall be protected by a reduced-pressure principle backflow prevention assembly listed or labeled in accordance with ASSE 1013. Such additive or chemical shall be compatible with system components.

(renumber remaining sections)

**TABLE 901.1
REFERENCED STANDARDS**

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
<u>ASSE 1013-2011</u>	<u>Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers</u>	<u>Backflow Prevention</u>	<u>402.2</u>

(portions of table not shown remain unchanged)

Note: ASSE 1013 meets the requirements for a mandatory reference standard in accordance with Section 15.0 of IAPMO's Regulations Governing Consensus Development of the Uniform Solar, Hydronics & Geothermal and Swimming Pool, Spa & Hot Tub Codes.

SUBSTANTIATION:

The addition of Section 402.2 is needed for further provisions on protecting the potable water supply from additives and chemical injections. Backflow prevention assemblies are necessary as they prevent contaminants from being drawn up into the potable water system when there is a higher pressure on the contaminant side in relation to the potable water supply side.

ASSE 1013 is provided as it lists performance requirements for reduced pressure principle backflow preventers. The standard also provides material requirements, compliance and hydrostatic backpressure testing procedures, and installation guidelines. The standard requires that such assemblies be equipped with two independent acting check valves separated by an intermediate chamber that is hydraulically operated to vent to the atmosphere. Such requirements ensure that the pressure on the contaminant side does not exceed that of the potable water side. For these reasons, the addition of standard ASSE 1013 is appropriate and aids in protecting the potable water supply.

Additionally, chemical compatibility is a necessary requirement to prevent damage to system components and piping.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

402.0 Protection of Potable Water Supply.

402.2 Chemical Injection. Where systems include an additive, chemical injection or provisions for such injection, the potable water supply shall be protected by an air gap, or a reduced-pressure principle backflow prevention assembly listed ~~or and~~ labeled in accordance with ASSE 1013. Such additive or chemical shall be compatible with system components.

(renumber remaining sections)

**TABLE 901.1
REFERENCED STANDARDS**

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
ASSE 1013-2011	Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers	Backflow Prevention	402.2

(portions of table not shown remain unchanged)

COMMITTEE STATEMENT:

The phrase "listed or labeled" allows for the choice between the two, where manufactured equipment actually must be "listed and labeled." From a technical perspective, listing and labeling are meant to be used in conjunction.

Additional language is required to clarify that systems utilizing an air gap device do not also require a backflow prevention assembly.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC **Section #:** 402.2, Table 901.1

Item #: 008

SUBMITTER: Jeff Matson
Chair, USHGC Hydronics Task Group

Comment #: 1

RECOMMENDATION:

Revise text

Request to accept the code change proposal **as modified** by this public comment.

402.0 Protection of Potable Water Supply.

402.2 Chemical Injection. ~~Additives or chemicals shall be compatible with system components.~~ Where systems include an additive, chemical injection or provisions for such injection, the potable water supply shall be protected by an air gap in accordance with ASME A112.1.2, an air gap fitting in accordance with ASME A112.1.3, or a reduced-pressure principle backflow prevention assembly listed and labeled in accordance with ASSE 1013. ~~Such additive or chemical shall be compatible with system components.~~

**TABLE 901.1
REFERENCED STANDARDS**

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
<u>ASME A112.1.2 – 2012(R2017)</u>	<u>Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water-Connected Receptors)</u>	<u>Backflow Protection</u>	<u>402.2</u>
<u>ASME A112.1.3 – 2000(R2015)</u>	<u>Air Gap Fittings for Use with Plumbing Fixtures, Appliances, and Appurtenances</u>	<u>Backflow Protection</u>	<u>402.2</u>

(portions of table not shown remain unchanged)

Note: ASME A112.1.2 and ASME A112.1.3 meet the requirements for mandatory reference standards in accordance with Section 15.0 of IAPMO’s Regulations Governing Consensus Development of the Uniform Solar, Hydronics & Geothermal and Swimming Pool, Spa & Hot Tub Codes.

SUBSTANTIATION:

The above proposed standards are included to provide specifications for air gaps. The option for an air gap was added during the proposal stage, and this modification will ensure that the end user is required to comply with industry standards.

ASME A112.1.2 identifies methods of providing protection against backsiphonage through means of an air gap and establishes physical requirements and methods of testing air gaps for plumbing fixtures and water receptors.

ASME A112.1.3 provides physical requirements and methods of testing for air gap fittings for protection against back siphonage and back pressure backflow.

Furthermore, the last sentence of Section 402.2 has been relocated to the beginning of the section as this is more appropriate for the provision.



CODES ADMINISTRATION

Proposals

Item #: 009

USHGC 2021 Section: 205.0, 403.1

SUBMITTER: Mark Eatherton
Advanced Hydronics

RECOMMENDATION:
Revise text

403.0 Capacity of Heat Source.

403.1 Heat Source. The heat source shall be sized to the design load or the connected load, whichever is more.

205.0 – C –

Connected Load. The total amount of heat required by all heat-consuming end-uses served by a single heat source in a system.

SUBSTANTIATION:

Section 403.1 is being modified to include considerations for any connected loads when sizing a heat source to be incorporated into a hydronic system. In addition to the design space heating load, other loads such as domestic hot water, may also be present within a system. Properly sizing the heat source ensures that the system works efficiently. An undersized heat source will constantly run and cause increased wear on the unit, and an over-sized heat source unit will cycle on and off too often.

Such language is necessary as it provides clarification for proper sizing of heat sources needed for system efficiency.

A definition for the term “connected load” has been added for further clarification on the proposed language added to Section 403.1. Such addition is necessary to ensure that the sizing requirements of Section 403.1 can be properly met.

The “connected load” in this case refers to the combined heat requirements of all heat consuming components connected to a single heat source.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:

It is not always required that the heat source be sized to the connected load. Hybrid hydronic systems rarely go to the full load of the system.

Additionally, radiant heating systems may have a very high potential output, and sizing the heat source based on this would not be appropriate. For these reasons the item is being rejected.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC **Section #:** 206.0

Item #: 009

SUBMITTER: Edmond Murray
Aztec Solar

Comment #: 1

RECOMMENDATION:

Add new text

Request to **replace** the code change proposal by this public comment.

206.0 - D -

Design Load. The maximum load that a component, system or structure is anticipated to undergo during extreme operating conditions.

SUBSTANTIATION:

The term “design load” is used within Chapters 3, 4 and 7 of the USHGC and should be accompanied by a definition which appropriately represents the term. In Chapter 3, the term is used when referring to structural loads, and in Chapters 4 and 7, the term is used when referring to a system’s design load. Both structural and system design loads are covered by this definition and provide clarification for the end user.



Proposals

Item #: 010

USHGC 2021 Section: 403.2, Table 403.2

SUBMITTER: Lance MacNevin
Plastic Pipe Institute

RECOMMENDATION:
Revise text

403.0 Capacity of Heat Source.

403.2 Dual Purpose Water Heater. Water heaters utilized for combined space-and water-heating applications shall be listed ~~and/or~~ labeled in accordance with the standards referenced in Table 403.2, and shall be installed in accordance with the manufacturer's installation instructions. The total heating capacity of a dual purpose water heater shall be based on the sum of the potable hot water requirements and the space heating design requirements corrected for hot water first-hour draw recovery.

**TABLE 403.2
WATER HEATERS**

TYPE	STANDARDS
Gas- ~~Fired~~ , 75 000 Btu/h ~~r~~ or less, ~~Storage~~	CSA Z21.10.1
Gas- ~~Fired~~ , ~~a~~ Above 75 000 Btu/h ~~r~~ , ~~Storage~~ , ~~Circulating and Instantaneous~~	CSA Z21.10.3
Electric, ~~s~~ Space ~~h~~ Heating	UL 834
Solid ~~f~~ Fuel- ~~Fired~~ , ~~hydronic~~	UL 2523

For SI units: 1000 British thermal units per hour = 0.293kW

SUBSTANTIATION:

Section 403.2 is being revised to show "listed or labeled" to provide clarification that water heaters do not need to be both listed and labeled. Both listing and labeling are completed by nationally recognized laboratories that make periodic inspections, determine compliance with nationally recognized standards, and test equipment for specified use. The requirement for both would be redundant and unnecessary.

Table 403.2 is also being updated to incorporate correct titles and descriptions of the types of water heaters covered by the provided correlating standards.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

403.0 Capacity of Heat Source.

403.2 Dual Purpose Water Heater. Water heaters utilized for combined space-and water-heating applications shall be listed ~~and/or~~ labeled in accordance with the standards referenced in Table 403.2, and shall be installed in accordance with the manufacturer's installation instructions. The total heating capacity of a dual purpose water heater shall be based on the sum of the potable hot water requirements and the space heating design requirements corrected for hot water first-hour draw recovery.

**TABLE 403.2
WATER HEATERS**

TYPE	STANDARDS
Gas-Fired, 75 000 Btu/h or less, Storage	CSA Z21.10.1
Gas-Fired, Above 75 000 Btu/h, Storage, Circulating and Instantaneous	CSA Z21.10.3
Electric, Space Heating	UL 834
Solid Fuel-Fired	UL 2523

For SI units: 1000 British thermal units per hour = 0.293kW

COMMITTEE STATEMENT:

The phrase "listed or labeled" allows for the choice between the two, where manufactured equipment actually must be "listed and labeled." From a technical perspective, listing and labeling are meant to be used in conjunction. For this reason, the original language in Section 403.2 is being kept.

The revisions and updates made to Table 403.2 are being accepted as submitted.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: **AFFIRMATIVE:** 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC **Section #:** 206.0, 403.2

Item #: 010

SUBMITTER: Edmond Murray
Aztec Solar

Comment #: 1

RECOMMENDATION:

Revise text

Request to accept the code change proposal **as modified** by this public comment.

206.0 - D -

Dual Purpose Water Heater. An appliance utilized as a heat source for both space heating and domestic hot water applications.

403.0 Capacity of Heat Source.

403.2 Dual Purpose Water Heaters. (remaining text unchanged)

SUBSTANTIATION:

A definition for "dual purpose water heater" has been added to help the end user know what this type of water heater is and how it is used.

Dual purpose water heaters are appliances which are used to heat water for sinks, showers, and washing machines as well as in space heating applications such as hydronic radiant heating panels. They have a "dual" purpose to provide heat for two different types of hot water applications, domestic and space heating.

This new terminology also helps the end user apply the appropriate provisions listed within the code without confusion.



CODES ADMINISTRATION

Proposals

Item #: 014

USHGC 2021 Section: 405.2.1

SUBMITTER: Mark Eatherton
Advanced Hydronics

RECOMMENDATION:
Add new text

405.0 Installation, Testing, and Inspection.

405.2 Pressure Testing. (remaining text unchanged)

405.2.1 Piping Used for Combustion Venting. Where polymer-based drain, waste and vent pipe is used to vent a combustion heat source, the completed assembly shall be pressure-tested at not less than 5 psi (34 kPa).

SUBSTANTIATION:

The addition of Section 405.2.1 is to include piping utilized for combustion venting. In order to prevent leakage of exhaust gasses into occupied spaces, the polymer-based DWV exhaust piping assembly must be pressure tested. The addition of this pressure test is for safety of the end user.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:

The proposed language is being rejected as the inclusion of the term "combustion" in the title is incorrect. Additionally, no method of testing was provided for the assembly.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC **Section #:** 405.2.1 – 405.2.1.4

Item #: 014

SUBMITTER: Monte Myers
Self

Comment #: 1

RECOMMENDATION:
Add new text

Request to **replace** the code change proposal by this public comment.

405.0 Installation, Testing, and Inspection.

405.2 Pressure Testing. (remaining text unchanged)

405.2.1 Test Gauges. Tests in accordance with this code, which are performed utilizing dial gauges, shall be limited to gauges having pressure graduations or incrementations in accordance with Section 405.2.1.1 through Section 405.2.1.4.

405.2.1.1 Pressure Tests (10 psi or Less). Required pressure tests of 10 pounds-force per square inch (psi) (69 kPa) or

less shall be performed with gauges of 0.10 psi (0.69 kPa) incrementation or less.

405.2.1.2 Pressure Tests (Greater Than 10 psi to 100 psi). Required pressure tests exceeding 10 psi (69 kPa) but less than or equal to 100 psi (689 kPa) shall be performed with gauges of 1 psi (7 kPa) incrementation or less.

405.2.1.3 Pressure Tests (Exceeding 100 psi). Required pressure tests exceeding 100 psi (689 kPa) shall be performed with gauges incremented for 2 percent or less of the required test pressure.

405.2.1.4 Pressure Range. Test gauges shall have a pressure range not exceeding twice the test pressure applied.

SUBSTANTIATION:

Section 405.2.1 through Section 405.2.1.4 have been added to address gauges used in pressure testing to be completed on hydronic system components and piping. Currently, both the 2021 UMC and UPC use such provisions to ensure that readings are taken on devices that are incremented appropriately and provide precise readings. Such inclusion is necessary, further enhances the code, and correlates with the provisions of the other uniform codes.



CODES ADMINISTRATION

Proposals

Item #: 015

USHGC 2021 Section: 405.4

SUBMITTER: Mark Eatherton
Advanced Hydronics

RECOMMENDATION:
Revise text

405.0 Installation, Testing, and Inspection.

405.4 Oxygen Diffusion Corrosion. PEX and PE-RT tubing in closed hydronic systems shall contain an oxygen barrier.

~~Exception: Closed hydronic systems without ferrous components in contact with the hydronic fluid.~~

SUBSTANTIATION:

Some closed hydronic systems can have ferrous components; so PEX or PE-RT in these systems must have an oxygen barrier. Therefore, the exception should be removed.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:

The substantiation lacks sufficient technical justification as some hydronic systems may be installed without ferrous components.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC **Section #:** 217.0

Item #: 015

SUBMITTER: Edmond Murray
Aztec Solar

Comment #: 1

RECOMMENDATION:
Add new text

Request to replace the code change proposal by this public comment.

217.0 - O -

Oxygen Permeation. The ability of oxygen molecules to pass through a material. Also known as oxygen diffusion.

SUBSTANTIATION:

Section 409.4 (Oxygen Diffusion Corrosion) refers to oxygen permeation along with a specified allowable rate. Since this term is not commonly understood or known, a definition is being added for clarification. The provided definition appropriately represents what the term means and describes what the provision applies to in Section 409.4.



CODES ADMINISTRATION

Proposals

Item #: 016

USHGC 2021 Section: 406.0 - 406.2

SUBMITTER: Lance MacNevin
Plastic Pipe Institute

RECOMMENDATION:
Add new text

406.0 Pressure and Safety Devices.

406.1 General. Each closed hydronic system shall be protected against pressures exceeding design limitations with not less than one pressure relief valve. Each closed section of the system containing a heat source shall have a relief valve located so that the heat source is not capable of being isolated from a relief device. Pressure relief valves shall be installed in accordance with their listing and the manufacturer's installation instructions.

406.2 Discharge Piping. The discharge piping serving a temperature relief valve, pressure relief valve, or combination of both shall be in accordance with Section 311.3.

(renumber remaining sections)

SUBSTANTIATION:

Any heated closed system is capable of developing pressures that exceed its design working pressure. Closed liquid-filled systems can develop high hydrostatic pressures with even slight temperature increases. A hydronic system is more likely to be subjected to extreme temperatures and pressures that could cause associated hazards. Pressure and temperature relief valves are necessary to prevent injury that could result from the failure of pressurized vessels and piping.

Typical hydronic systems involve large complex piping circuits with valve arrangements that greatly increase the likelihood of portions of the piping system being isolated from the over-pressure or over-temperature safety devices. Any portion of a system isolated from the relief valve or valves is unprotected from the danger of excessive pressures and temperatures. To ensure complete protection to all portions of a system, multiple relief valves at different locations in the system are necessary.

A safety or relief valve discharge pipe is needed to direct the discharge to a location where it cannot cause injury or property damage. The material from which the discharge pipe is constructed must be able to withstand such pressures and temperatures, as well as be able to resist the forces developed during discharge that would tend to dislocate the discharge pipe. Section 311.3 (Discharge Piping) addresses discharge piping materials as well as further provisions on discharge piping and should be referenced within Section 406.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC Section #: 311.3, Table 901.1

Item #: 016

SUBMITTER: Jeff Matson
Chair, USHGC Hydronics Task Group

Comment #: 1

RECOMMENDATION:

Revise text

Request to accept the code change proposal **as modified** by this public comment.

311.0 Safety Devices.

311.3 Discharge Piping. The discharge piping serving a temperature relief valve, pressure relief valve, or combination of both shall have no valves, obstructions, or means of isolation and be provided with the following:

- (1) ~~Equal to Not less than~~ the size of the valve outlet and shall discharge full size to the flood level of the area receiving the discharge and pointing down.
- (2) Materials shall be rated at not less than the operating temperature of the system and approved for such use or shall comply with ASME A112.4.1.
- (3) Discharge pipe shall discharge independently 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) and not less than 6 inches (152 mm) above the ground and pointing downwards.
- (4) Discharge in such a manner that does not cause personal injury or structural damage.
- (5) No part of such discharge pipe shall be trapped or subject to freezing.
- (6) The terminal end of the pipe shall not be threaded.
- (7) Discharge from a relief valve into a water heater pan shall be prohibited.
- (8) The discharge termination point shall be readily observable.

**TABLE 901.1
REFERENCED STANDARDS**

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
<u>ASME A112.4.1 – 2009(R2019)</u>	<u>Water Heater Relief Valve Drain Tubes</u>	<u>Discharge Piping</u>	<u>311.3(2)</u>

(portions of table not shown remain unchanged)

Note: ASME A112.4.1 meets the requirements for a mandatory reference standard in accordance with Section 15.0 of IAPMO's Regulations Governing Consensus Development of the Uniform Solar, Hydronics & Geothermal and Swimming Pool, Spa & Hot Tub Codes.

SUBSTANTIATION:

The proposed modifications to Section 311.3 are necessary for compliance with the plumbing code. The revision to option (1) is needed as there are cases where PEX and PE-RT tubing require insert fittings to reduce inner diameters. Requiring the piping to be greater than the valve outlet prevents the PEX tubing inner diameter from being smaller than the valve outlet.

ASME A112.4.1 is being included as it is applicable to discharge piping provisions and provides performance requirements and test methods applicable to water heater relief valve drain (or runoff) tubes for use with relief valves having a steam rating of 105,000 Btu/hr or less.

Furthermore, item (8) makes it clear that the termination point of the drainage line must be visible in order to detect leaks or failed valves.



CODES ADMINISTRATION

Proposals

Item #: 018

USHGC 2021 Section: 406.2, 406.3

SUBMITTER: Lance MacNevin
Plastic Pipe Institute

RECOMMENDATION:
Revise text

406.0 Heating Appliances and Equipment.

406.2 Boilers. Boilers and their controls ~~s~~ systems shall comply with the mechanical code.

406.3 Dual-Purpose Water Heaters. Water heaters used for combined space- and water-heating applications shall be in accordance with the standards referenced in Table 403.2, and shall be installed in accordance with the manufacturer's installation instructions. Water used as the heat transfer fluid in the hydronic heating system shall be isolated from the potable water supply and distribution in accordance with Section 313.0, Section 314.0, and Section ~~402.2~~402.0.

(Section 402.0 along with pertaining subsections are shown for information only)

402.0 Protection of Potable Water Supply.

402.1 Prohibited Sources. Hydronic systems or parts thereof, shall be constructed in such a manner that polluted, contaminated water, or substances shall not enter a portion of the potable water system either during normal use or where the system is subject to pressure that exceeds the operating pressure in the potable water system. Piping, components, and devices in contact with the potable water shall be approved for such use and where an additive is used it shall not affect the performance of the system.

402.2 Protection of Potable Water. The potable water system shall be protected from backflow in accordance with the Uniform Plumbing Code.

402.3 Compatibility. Fluids used in hydronic systems shall be compatible with all components that will contact the fluid. Where a heat exchanger is installed with a dual purpose water heater, such application shall comply with the requirements for a single wall heat exchanger in Section 313.1.

SUBSTANTIATION:

Currently the mechanical code lists provisions and standards for "boilers and their control systems." In order to correlate with such language, Section 406.2 is being revised to show "control systems" rather than "controls" as this may be confusing for the end user. Since Section 406.2 requires compliance with the mechanical code, language between the codes should be consistent to ensure that all listed provisions are clear.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC Section #: 407.3

Item #: 018

SUBMITTER: Andrew Todd
V&T Carbonic Inc.

Comment #: 1

RECOMMENDATION:

Revise text

Request to accept the code change proposal **as modified** by this public comment.

407.0 Heating Appliances and Equipment.

407.3 Dual-Purpose Water Heaters. Water heaters used for combined space- and water-heating applications shall be in accordance with the standards referenced in Table 403.2, and shall be installed in accordance with the manufacturer's installation instructions. Water used as the heat transfer fluid in the hydronic heating system shall be isolated from the potable water supply and distribution in accordance with Section 313.0, Section 314.0, and Section 402.0. Dual purpose water heaters shall not be installed exclusively for space heating applications. Water heaters intended only for domestic hot water applications shall not be installed with hydronic distribution systems.

SUBSTANTIATION:

Section 407.3 is being modified to include further provisions for dual purpose water heaters and dual purpose systems. Dual purpose water heaters must be installed for their intended purpose since they are designed to generate a certain volume of hot water based on design capacity and correlating specified applications. Where water heaters are meant for use in only domestic hot water applications, they should not be connected to a dual purpose system since they are not rated for that type of system. All requirements are in accordance with the most recently published industry standards.



CODES ADMINISTRATION

Proposals

Item #: 019

USHGC 2021 Section: 406.5, Table 901.1

SUBMITTER: Lance MacNevin
Plastic Pipe Institute

RECOMMENDATION:
Add new text

406.0 Heating Appliances and Equipment.

406.5 Heat Pumps. Water source heat pumps shall comply with AHRI/ASHRAE/ISO 13256-1 for water-to-air heat pumps and AHRI/ASHRAE/ISO 13256-2 for water-to-water heat pumps. Air source heat pumps shall comply with AHRI 210/240. Heat pumps shall be fitted with a means to indicate that the compressor is locked out.

**TABLE 901.1
REFERENCED STANDARDS**

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
<u>AHRI 210/240-2017</u>	<u>Performance Rating of Unitary Air-conditioning & Air-source Heat Pump Equipment</u>	<u>Air-Source Heat Pumps</u>	<u>406.5</u>

(portions of table not shown remain unchanged)

Note: AHRI/ASHRAE/ISO 13256-1, AHRI/ASHRAE/ISO 13256-2, and AHRI 210/240 meet the requirements for mandatory referenced standards in accordance with Section 15.0 of IAPMO's Regulations Governing Consensus Development of the Uniform Solar, Hydronics & Geothermal and Swimming Pool, Spa & Hot Tub Codes.

SUBSTANTIATION:

Section 406.5 has been added to provide standards to address both water and air source heat pumps. Both standards provide detailed test methods, performance requirements and marking provisions for water-source heat pumps. AHRI/ASHRAE/ISO 13256-1 specifically addresses water-to-water and brine-to-water heat pumps while AHRI/ASHRAE/ISO 13256-2 addresses water-to-air and brine-to-air heat pumps. AHRI/ASHRAE/ISO 13256-1 and AHRI/ASHRAE/ISO 13256-2 have been used in the industry since 1998 and have been reaffirmed two times without substantive changes to the requirements. AHRI 210/240 covers air source heat pumps and their classifications, markings, as well as testing and rating requirements.

The inclusion of both water and air source heat pumps is applicable to Chapter 4 (Hydronics) as these heat pumps are used in hydronic space heating applications including radiant flooring and air heating.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

COMMITTEE STATEMENT:

The proposal is being accepted; however, the standards provided are only performance standards where health and safety are not addressed. Standards pertaining to health and safety must also be included. An applicable health and safety standard would be UL 60335-2-40 as mentioned by the Technical Committee.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC Section #: 407.5, Table 407.5

Item #: 019

SUBMITTER: Andrew Todd
V&T Carbonic Inc.

Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal **as modified** by this public comment.

407.0 Heating Appliances and Equipment.

407.5 Heat Pumps. ~~Heat pumps shall be in accordance with Table 407.5. Water source heat pumps shall comply with AHRI/ASHRAE/ISO 13256-1 for water-to-air heat pumps and AHRI/ASHRAE/ISO 13256-2 for water-to-water heat pumps. Air source heat pumps shall comply with AHRI 210/240.~~ Heat pumps shall be fitted with a means to indicate that the compressor is locked out.

TABLE 407.5
HEAT PUMPS

TYPE OF HEAT PUMP	STANDARDS
<u>Water-to-Air</u>	<u>AHRI/ASHRAE/ISO 13256-1</u>
<u>Water-to-Water</u>	<u>AHRI/ASHRAE/ISO 13256-2</u>
<u>Air Source</u>	<u>AHRI 210/240</u>

Note: AHRI/ASHRAE/ISO 13256-1, AHRI/ASHRAE/ISO 13256-2, and AHRI 210/240 meet the requirements for mandatory referenced standards in accordance with Section 15.0 of IAPMO's Regulations Governing Consensus Development of the Uniform Solar, Hydronics & Geothermal and Swimming Pool, Spa & Hot Tub Codes.

SUBSTANTIATION:

Section 407.5 is being converted into a table for ease of use. Throughout the code, tables are used to clearly identify and designate standards to particular materials, equipment and appliances. This information falls into these categories and should therefore be added in table format.

PUBLIC COMMENT 2

Code Year: 2021 USHGC Section #: 407.5

Item #: 019

SUBMITTER: Christopher Jensen
UL LLC

Comment #: 2

RECOMMENDATION:
Revise text

Request to accept the code change proposal **as modified** by this public comment.

407.0 Heating Appliances and Equipment.

407.5 Heat Pumps. ~~Heat pumps shall be listed and labeled in accordance with UL 1995 or UL 60335-2-40.~~ Water source heat pumps shall also comply with AHRI/ASHRAE/ISO 13256-1 for water-to-air heat pumps and AHRI/ASHRAE/ISO 13256-2 for water-to-water heat pumps. Air source heat pumps shall also comply with AHRI 210/240. Heat pumps shall be fitted with a means to indicate that the compressor is locked out.

**TABLE 901.1
REFERENCED STANDARDS**

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
UL 1995-2015	Heating and Cooling Equipment (with revisions through August 17, 2018).	Heat Pumps	407.5
UL 60335-2-40-2019/CSA C22.2 No. 60335-2-40-2019	Household And Similar Electrical Appliances-Safety-Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers	Heat Pumps	407.5

(portions of table not shown remain unchanged)

Note: UL 1995 and UL 60335-2-40 meet the requirements for mandatory reference standards in accordance with Section 15.0 of IAPMO's Regulations Governing Consensus Development of the Uniform Solar, Hydronics & Geothermal and Swimming Pool, Spa & Hot Tub Codes.

SUBSTANTIATION:

AHRI/ASHRAE/ISO 13256-1, AHRI/ASHRAE/ISO 13256-2, and AHRI 210/240 are performance standards; however, they do not fully address health and safety requirements for heat pumps. The ANSI consensus standards for safety of heat pumps are UL 1995 (Heating and Cooling Equipment) and UL 60335-2-40 (Household and Similar Electric Appliances-Safety-Part 2-40: Particular Requirements for Electric Heat Pumps, Air-Conditioners and Dehumidifiers). Including UL 1995 and UL 60335-2-40 in Section 407.5 will ensure that heat pumps are certified to the appropriate safety standards as requested by the Technical Committee and reflected in their Committee Statement on Item #019 of the 2019 USHGC ROP.



Proposals

Item #: 020

USHGC 2021 Section: 407.4

SUBMITTER: Mark Eatherton
Advanced Hydronics

RECOMMENDATION:
Delete text without substitution

407.0 Expansion Tanks.

~~**407.4 Open-Type Expansion Tanks.** Open-type expansion tanks shall be located not less than 3 feet (914 mm) above the highest point of the system. An overflow with a diameter of not less than one-half the size of the supply or not less than 1 inch (25 mm) in diameter shall be installed at the top of the tank. The overflow shall discharge through an air gap into the drainage system.~~

SUBSTANTIATION:

Open type expansion tanks are no longer installed in any new or retrofit applications. These types of tanks are not capable of reaching high operating temperatures like that of closed expansion tanks. Open tanks allow for air to migrate into the system resulting in corrosion of components. Additionally, open expansion tanks must be located above the highest heating element, in general on the top of buildings, where they may be exposed to freezing conditions.

For these reasons, open type expansion tanks and their listed provisions should be removed from the code.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

407.0 Expansion Tanks.

407.1 General. An expansion tank shall be installed in each closed hydronic system to control system pressure due to thermal expansion and contraction. Expansion tanks shall be of the closed ~~or open~~ type. Expansion tanks shall be rated for the pressure of the system.

COMMITTEE STATEMENT:

Open-type expansion tanks are being removed from Section 407.1 since the provisions for open-type expansion tanks are being removed in Section 407.4.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC Section #: 605.1, 605.2

Item #: 020

SUBMITTER: Edmond Murray
Aztec Solar

Comment #: 1

RECOMMENDATION:

Delete text without substitution

Request to accept the code change proposal **as modified** by this public comment.

605.0 Expansion Tanks.

605.1 Where Required. An expansion tank shall be installed in a water heating system as a means for controlling increased pressure caused by thermal expansion. Expansion tanks shall be of the closed ~~or open~~ type and securely fastened to the structure. Tanks shall be rated for the pressure of the system. Supports shall be capable of carrying twice the weight of the tank filled with water without placing strain on the connecting piping.

Water-heating systems incorporating hot water tanks or fluid relief columns shall be installed to prevent freezing under normal operating conditions.

~~**605.2 Systems with Open-Type Expansion Tanks.** Open type expansion tanks shall be located not less than 3 feet (914 mm) above the highest point of the system. Such tanks shall be sized based on the capacity of the system. An overflow with a diameter of not less than one-half the size of the water supply or not less than 1 inch (25 mm) in diameter shall be installed at the top of the tank. The overflow shall discharge through an air gap into the drainage system.~~

(renumber remaining sections)

SUBSTANTIATION:

Provisions pertaining to open-type expansion tanks in Chapter 4 (Hydronics) were removed during the proposal stage. The reasonings can be found in the substantiation of the original proposal (Item #020). Based on the concerns listed within the technical justification of this item, open-type expansion tank provisions should also be removed from Chapter 6 (Thermal Storage).

PUBLIC COMMENT 2

Code Year: 2021 USHGC Section #: 207.0

Item #: 020

SUBMITTER: Edmond Murray
Aztec Solar

Comment #: 2

RECOMMENDATION:

Add new text

Request to accept the code change proposal **as modified** by this public comment.

207.0 - E -

Expansion Tank. A vessel used to protect closed systems from excessive pressure.

SUBSTANTIATION:

The term "expansion tank" is used throughout the USHGC along with listed provisions for such tanks. These types of tanks provide protection because they accept the increase in thermal fluid volume as a result of thermal expansion. They also assist in system startup and operation by acting as a mechanism which accepts entrained air. The provided definition is necessary as it pertains to various systems listed within the USHGC and clarifies that these tanks are meant to protect such closed systems from excessive pressures.



CODES ADMINISTRATION

Proposals

Item #: 021

USHGC 2021 Section: 407.5

SUBMITTER: Lance MacNevin
Plastic Pipe Institute

RECOMMENDATION:
Add new text

407.0 Expansion Tanks.

407.5 Sizing. Expansion tanks shall be sized to accept the full expansion volume of the fluid in the system. The minimum capacity of a closed-type expansion tank shall be sized in accordance with Section 605.4.

SUBSTANTIATION:

The proposed language in Section 407.5 is necessary as it addresses sizing of expansion tanks to be installed in hydronic systems. Section 407.5 also includes a reference to Section 605.4 (Minimum Capacity of Closed-Type Tank) which provides an equation for determining the minimum volume required for closed-type expansion tanks.

Sizing of expansion tanks used in hydronic systems is necessary as the tanks are utilized to accept changes in the fluid volume and density in relation to temperature gradients, maintain positive gauge pressure, and prevent cavitation at control valves.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

407.0 Expansion Tanks.

407.5 Sizing. Expansion tanks shall be sized to accept the ~~full~~design expansion volume of the fluid in the system. The minimum capacity of a closed-type expansion tank shall be sized in accordance with Section 605.4.

COMMITTEE STATEMENT:

The proposed text is being modified as the sizing should be based on “design” parameters rather than the full expansion volume of the fluid within the system. There is no need to size the expansion tank beyond design parameters.

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC Section #: 605.4

Item #: 021

SUBMITTER: Edmond Murray
Aztec Solar

Comment #: 1

RECOMMENDATION:

Revise text

Request to accept the code change proposal **as modified** by this public comment.

605.0 Expansion Tanks.

605.4 Minimum Capacity of Closed-Type Tank. The minimum capacity for a gravity-type hot water system expansion tank shall be in accordance with Table 605.4(1). The minimum capacity for a forced-type hot water system expansion tank shall be in accordance with Table 605.4(2) or Equation 605.4(1). The minimum capacity for diaphragm tanks shall be in accordance with Table 605.4(2) or Equation 605.4(2).

$$V_{t(\text{forced type})} = \frac{(0.00041t - 0.0466)V_s}{\left(\frac{P_a - P_a}{P_f - P_o}\right)} \quad [\text{Equation 605.4(1)}]$$

$$V_{t(\text{diaphragm})} = \frac{(0.00041t - 0.0466)V_s}{\left(1 - \frac{P_f}{P_o}\right)} \quad [\text{Equation 605.4(2)}]$$

Where:

V_t = Minimum volume of expansion tank, gallons (L).

V_s = Volume of system, not including expansion tank, gallons (L).

t = Average operating temperature, °F (°C).

P_a = Atmospheric pressure, ~~feet H₂O absolute~~ pounds per square inch (kPa).

P_f = Fill pressure, ~~feet H₂O absolute~~ pounds per square inch (kPa).

P_o = Maximum operating pressure, ~~feet H₂O absolute~~ pounds per square inch (kPa).

$$\text{For SI units: } V_{t(\text{forced type})} = \frac{(0.000738t - 0.03348)V_s}{\left(\frac{P_a - P_a}{P_f - P_o}\right)}, V_{t(\text{diaphragm})} = \frac{(0.000738t - 0.03348)V_s}{\left(1 - \frac{P_f}{P_o}\right)}$$

[Table 605.4(2) is being shown for information purposes only]

TABLE 605.4(2)
EXPANSION TANK CAPACITIES FOR FORCED
WATER SYSTEMS¹

SYSTEM VOLUME ² (gallons)	TANK CAPACITY DIAPHRAGM TYPE (gallons)	TANK CAPACITY (gallons)
100	9	15
200	17	30
300	25	45
400	33	60
500	42	75
1000	83	150
2000	165	300

For SI units: 1 gallon = 3.785 L



Documents

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Notes:

¹ Based on an average operating water temperature of 195°F (91°C), a fill pressure of 12 psig (83 kPa), and an operating pressure of not more than 30 psig (207 kPa).

² Includes volume of water in boiler, radiation, and piping, not including expansion tank.

SUBSTANTIATION:

Diaphragm tanks are included in Table 605.4(2), but Equation 605.4(1) pertains to non-precharged tanks. Including the precharged tank equation is required to allow for more accurate tank sizing.

Sizing the tank is the primary thermal consideration when installing a tank into a system. For precharged tanks, including properly charged diaphragm and bladder tanks, the starting pressure when water first starts to enter the tank is equal to the initial precharge pressure. Hence, the equation reduces to Equation 605.4(2). If Equation 605.4(1) is used to calculate the volume of a diaphragm tank, the tank will be oversized for the system.

Furthermore, SI units for the equations have been added to meet IAPMO's Manual of Style.

A link for supporting documentation is as follows:

http://www.taylor-engineering.com/Websites/taylorengineering/articles/ASHRAE_Journal_-_The_Fundamentals_of_Expansion_Tanks.pdf



CODES ADMINISTRATION

Proposals

Item #: 025

USHGC 2021 Section: 408.4

SUBMITTER: Lance MacNevin
Plastic Pipe Institute

RECOMMENDATION:
Revise text

408.0 Materials.

405.4408.4 Oxygen Diffusion Corrosion. PEX and PE-RT tubing in closed hydronic systems shall contain an oxygen barrier with an oxygen permeation rate not to exceed 4.59 E-04 grains per square feet per day (0.32 mg/m²/day) at 104 °F (40 °C).

Exception: Closed hydronic systems without ferrous components in contact with the hydronic fluid.

SUBSTANTIATION:

PEX and PE-RT tubing used for hydronic applications requires an oxygen barrier to prevent diffusion of oxygen molecules into the water through the piping walls. An oxygen barrier also prevents corrosion of any cast iron components or parts such as circulator pumps, fill valves and boiler heating elements. The barrier allows for PEX and PE-RT use in hot water hydronic heating applications such as radiator heating, fan coils, and radiant floor heating. The revision of this section is necessary as it provides a maximum limit for oxygen permeation through the tubing.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC **Section #:** 409.4

Item #: 025

SUBMITTER: Andrew Todd
V&T Carbonic Inc.

Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal **as modified** by this public comment.

409.0 Materials.

409.4 Oxygen Diffusion Corrosion. Where closed hydronic systems are installed, a means of oxygen permeation prevention shall be provided in accordance with one of the following:

1. PEX and PE-RT tubing ~~in closed hydronic systems~~ shall contain an oxygen barrier with an oxygen permeation rate not to exceed 4.59 E-04 grains per square feet per day (0.32 mg/m²/day) at 104°F (40°C).



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2. Non-ferrous components shall be installed in any part of the system which comes in contact with the hydronic fluid.
3. Where a ferrous boiler system is installed in conjunction with a non-ferrous radiant panel heating system, a nonferrous heat exchanger shall be installed which isolates the boiler from the radiant panel system.

~~**Exception:** Closed hydronic systems without ferrous components in contact with the hydronic fluid.~~

SUBSTANTIATION:

Section 409.4 is being revised to include all options available for oxygen permeation prevention. The title remains the same since noncompliance with the provision will result in oxygen diffusion corrosion and is therefore appropriate. The options provided correlate with industry standards and are necessary since these options are valid methods for preventing corrosion of closed hydronic system components.

Options 2 and 3 are based on the fact that only ferrous metals are at risk. A system can be designed and installed without any corrodible ferrous metal components, or simply components coming in contact with the hydronic fluid can be non-ferrous. Furthermore, a heat exchanger can be used to separate the heat transfer fluid in non-barrier tubing from that in ferrous components such as cast iron boilers and in turn prevent corrosion.



CODES ADMINISTRATION

Proposals

Item #: 026

USHGC 2021 Section: 409.3

SUBMITTER: Lance MacNevin
Plastic Pipe Institute

RECOMMENDATION:
Revise text

409.0 Joints and Connections.

409.3 CPVC/AL/CPVC Plastic Pipe and Joints. Joints between chlorinated polyvinyl chloride/aluminum/ chlorinated polyvinyl chloride (CPVC/AL/CPVC) pipe ~~or~~and fittings shall be installed in accordance with one of the following methods:
(1) Mechanical joints shall include, but not be limited to, flanged, grooved and push-fit fittings.
(2) Solvent cement joints for CPVC/AL/CPVC pipe and fittings shall be clean from dirt and moisture. Solvent cements in accordance with ASTM F493, requiring the use of a primer shall be orange in color. The primer shall be colored and be in accordance with ASTM F656. Listed solvent cement in accordance with ASTM F493 that does not require the use of primers, yellow in color, shall be permitted for pipe and fittings manufactured in accordance with ASTM D2846, 1/2 inch (15 mm) through 2 inches (50 mm) in diameter, 1/2 inch (15 mm) through 3 inches (80 mm) in diameter. Apply primer where required inside the fitting and to the depth of the fitting on pipe. Apply liberal coat of cement to the outside surface of pipe to depth of fitting and inside of fitting. Place pipe inside fitting to forcefully bottom the pipe in the socket and hold together until joint is set.

SUBSTANTIATION:
Section 409.3 is being revised to clarify that joints refer to piping “and” fittings and not just one or the other. The current language is confusing and should be changed.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 16

VOTING RESULTS: AFFIRMATIVE: 16

Appended Comments

PUBLIC COMMENT 1

Code Year: 2021 USHGC **Section #:** 410.2 – 410.15.3, Table 901.1

Item #: 026

SUBMITTER: Andrew Todd
V&T Carbonic Inc.

Comment #: 1

RECOMMENDATION:
Revise text

Request to accept the code change proposal **as modified** by this public comment.

410.0 Joints and Connections.

~~410.4~~**410.2 Copper or Copper Alloy Pipe, and Tubing, and Joints.** Joints between Joining methods for copper or copper alloy pipe, ~~or~~ tubing, and fittings shall be installed in accordance with ~~one of the following methods, the manufacturer's~~

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installation instructions and shall comply with Section 410.2.1 through 410.2.5.

(1) **410.2.1 Brazed Joints.** Brazed joints between copper or copper alloy pipe or tubing and fittings shall be made with brazing alloys having a liquid temperature above 1000°F (538°C). The joint surfaces to be brazed shall be cleaned bright by either manual or mechanical means. Tubing shall be cut square and reamed to full inside diameter. Brazing flux shall be applied to the joint surfaces where required by manufacturer's recommendation. Brazing filler metal ~~in accordance with~~ shall conform to AWS A5.8 and shall be applied at the point where the pipe or tubing enters the socket of the fitting.

(2) **410.2.2 Flared Joints.** Flared joints for soft copper or copper alloy tubing shall be made with fittings that ~~are in accordance~~ comply with the applicable standards referenced in Table 409.1. Pipe or tubing shall be cut square using an appropriate tubing cutter. The tubing shall be reamed to full inside diameter, resized to round, and expanded with a proper flaring tool.

(3) **410.2.3 Mechanical Joints.** Mechanical joints shall include, but are not limited to, compression, flanged, grooved, pressed, and push fit fittings.

410.2.3.1 Mechanically Formed Tee Fittings. Mechanically formed tee fittings shall have extracted collars that shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the pipe or tube surface to form a collar having a height not less than three times the thickness of the branch tube wall. The branch pipe or tube shall be notched to conform to the inner curve of the run pipe or tube and shall have two dimple depth stops to ensure that penetration of the branch pipe or tube into the collar is of a depth for brazing and that the branch pipe or tube does not obstruct the flow in the main line pipe or tube. Dimple depth stops shall be in line with the run of the pipe or tube. The second dimple shall be 1/4 of an inch (6.4 mm) above the first and shall serve as a visual point of inspection. Fittings and joints shall be made by brazing. Soldered joints shall not be permitted.

(4) **410.2.3.2 Press-Connect Fittings.** ~~Pressed~~ Press-connect fittings for copper or copper alloy pipe or tubing shall have an elastomeric o-ring that forms the joint. The pipe or tubing shall be fully inserted into the fitting, and the pipe or tubing marked at the shoulder of the fitting. Pipe or tubing shall be cut square, chamfered, and reamed to full inside diameter. The fitting alignment shall be checked against the mark on the pipe or tubing to ensure the pipe or tubing is inserted into the fitting. The joint shall be pressed using the tool recommended by the manufacturer.

(5) **410.2.3.3 Push Fit Fittings.** Removable and nonremovable push fit fittings for copper or copper alloy tubing or pipe that employ quick assembly push fit connectors shall ~~be in accordance~~ comply with ASSE 1061. Push fit fittings for copper or copper alloy pipe or tubing shall have an approved elastomeric o-ring that forms the joint. Pipe or tubing shall be cut square, chamfered, and reamed to full inside diameter. The tubing shall be fully inserted into the fitting, and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to ensure the tubing is inserted into the fitting and gripping mechanism has engaged on the pipe.

(6) **410.2.4 Soldered Joints.** Soldered joints between copper or copper alloy pipe or tubing and fittings shall be made in accordance with ASTM B828 with the following sequence of joint preparation and operation as follows: measuring and cutting, reaming, cleaning, fluxing, assembly and support, heating, applying the solder, cooling and cleaning. Pipe or tubing shall be cut square and reamed to the full inside diameter including the removal of burrs on the outside of the pipe or tubing. Surfaces to be joined shall be cleaned bright by manual or mechanical means. Flux shall be applied to pipe or tubing and fittings and shall ~~be in accordance with~~ conform to ASTM B813, and shall become noncorrosive and nontoxic after soldering. Insert pipe or tubing into the base of the fitting and remove excess flux. Pipe or tubing and fitting shall be supported to ensure a uniform capillary space around the joint. Heat shall be applied using an air or fuel torch with the flame perpendicular to the pipe or tubing using acetylene or an LP gas. Preheating shall depend on the size of the joint. The flame shall be moved to the fitting cup and alternate between the pipe or tubing and fitting. Solder ~~in accordance with~~ conforming to ASTM B32 shall be applied to the joint surfaces until capillary action draws the molten solder into the cup. Solder and fluxes with a lead content that exceeds 0.2 percent shall be prohibited in piping systems conveying potable water. Joint surfaces shall not be disturbed until cool and any remaining flux residue shall be cleaned.

(7) **410.2.5 Threaded Joints.** Threaded joints for copper or copper alloy pipe shall be made with pipe threads ~~in accordance that~~ comply with ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads, and such material shall be of approved types, insoluble in water, and nontoxic.

410.2.410.3 Chlorinated Polyvinyl Chloride (CPVC) Pipe CPVC Plastic Pipe and Joints. ~~Joints between chlorinated polyvinyl chloride (CPVC) plastic pipe and fittings joining methods shall be installed in accordance with one of the following methods: the manufacturer's installation instructions and shall comply with Section 410.3.1 through Section 410.3.3.~~

(1) **410.3.1 Mechanical Joints.** Mechanical joints shall include, ~~but not be limited to,~~ compression, flanged, grooved, and push fit fittings.

410.3.1.1 Push Fit Fittings. Removable and nonremovable push fit fittings ~~with an elastomeric o-ring~~ that employ a quick assembly push fit connectors shall ~~be in accordance~~ comply with ASSE 1061.

(2) **410.3.2 Solvent Cement Joints.** Solvent cement joints for CPVC pipe and fittings shall be clean from dirt and moisture. Solvent cements ~~in accordance~~ shall comply with ASTM F493, requiring the use of a primer shall be orange in color. The primer shall be colored and ~~be in accordance~~ shall comply with ASTM F656. Listed solvent cement ~~in accordance that~~ complies with ASTM F493 and that does not require the use of primers, yellow or red in color, shall be permitted for pipe and fittings ~~manufactured in accordance that~~ comply with ASTM D2846, 1/2 of an inch (15 mm) through 2 inches (50 mm) in diameter or ASTM F442, 1/2 of an inch (15 mm) through 3 inches (80 mm) in diameter. Apply primer where required inside the

fitting and to the depth of the fitting on pipe. Apply liberal coat of cement to the outside surface of pipe to depth of fitting and inside of fitting. Place pipe inside fitting to forcefully bottom the pipe in the socket and hold together until joint is set.

(3) **410.3.3 Threaded Joints.** Threaded joints for CPVC pipe Threads shall be made with pipe threads in accordance with ASME B1.20.1. A minimum of Schedule 80 shall be permitted to be threaded and; however, the pressure rating shall be reduced by 50 percent. The use of molded fittings shall not result in a 50 percent reduction in the pressure rating of the pipe provided that the molded fittings shall be fabricated so that the wall thickness of the material is maintained at the threads. Thread sealant compound that is compatible with the pipe and fitting, insoluble in water, and nontoxic shall be applied to male threads. Caution shall be used during assembly to prevent over tightening of the CPVC components once the thread sealant has been applied. Female CPVC threaded fittings shall be used with plastic male threads only.

410.4 CPVC/AL/CPVC Plastic Pipe and Joints. Chlorinated polyvinyl chloride/aluminum/chlorinated polyvinyl chloride (CPVC/AL/CPVC) plastic pipe and fittings joining methods shall be installed in accordance with one of the following methods: the manufacturer's installation instructions and shall comply with Section 410.4.1 or Section 410.4.2.

(1) Mechanical joints shall include, but not be limited to, flanged, grooved and push-fit fittings.

(2) **410.4.1 Solvent Cement Joints.** Solvent cement joints for CPVC/AL/CPVC pipe and fittings shall be clean from dirt and moisture. Solvent cements in accordance shall comply with ASTM F493, requiring the use of a primer shall be orange in color. The primer shall be colored and be in accordance shall comply with ASTM F656. Listed solvent cement in accordance that complies with ASTM F493 and that does not require the use of primers, yellow in color, shall be permitted for to join pipe that comply with ASTM F2855 and fittings manufactured in accordance that comply with ASTM D2846, 1/2 of an inch (15 mm) through 2 inches (50 mm) in diameter, 1/2 inch (15 mm) through 3 inches (80 mm) in diameter. Apply primer where required inside the fitting and to the depth of the fitting on pipe. Apply liberal coat of cement to the outside surface of pipe to depth of fitting and inside of fitting. Place pipe inside fitting to forcefully bottom the pipe in the socket and hold together until joint is set.

410.4.2 Mechanical Joints. Mechanical joints shall include flanged, grooved and push-fit fittings.

410.4.2.1 Push Fit Fittings. Removable and nonremovable push fit fittings that employ a quick assembly push fit connector shall comply with ASSE 1061.

410.5 Polyethylene (PE) Plastic Pipe/Tubing and Joints. Joints between polyethylene (PE) plastic pipe or tubing and fittings joining methods shall be installed in accordance with one of the following methods: the manufacturer's installation instructions and shall comply with Section 410.5.1 or Section 410.5.2.

410.5.1 Heat-Fusion Joints. Heat-fusion joints between PE pipe or tubing and fittings shall be assembled in accordance with Section 410.5.1.1 through Section 410.5.1.3 using butt, socket, and electro-fusion heat methods.

(+) **410.5.1.1 Butt-Fusion Joints.** Butt-fusion joints shall be installed made in accordance with ASTM F2620 and. Joints shall be made by heating the squared ends of two pipes, pipe and fitting, or two fittings by holding ends against a heated element. The heated element shall be removed where the proper melt is obtained and joined ends shall be placed together with applied force.

(2) **410.5.1.2 Electro-Fusion Joints.** Electro-fusion joints shall be heated internally by a conductor at the interface of the joint. Align and restrain fitting to pipe to prevent movement and apply electric current to the fitting. Turn off the current when the proper time has elapsed to heat the joint. The joint shall fuse together and remain undisturbed until cool.

(3) **410.5.1.3 Socket-Fusion Joints.** Socket-fusion joints shall be installed made in accordance with ASTM F2620 and. Joints shall be made by simultaneously heating the outside surface of a pipe end and the inside of a fitting socket. Where the proper melt is obtained, the pipe and fitting shall be joined by inserting one into the other with applied force. The joint shall fuse together and remain undisturbed until cool.

(4) **410.5.2 Mechanical Joints.** Mechanical joints between PE pipe or tubing and fittings shall include insert and mechanical compression fittings that provide a pressure seal resistance to pullout. Joints for insert fittings shall be made by cutting the pipe square, using a cutter designed for plastic piping, and removal of sharp edges. Two stainless steel clamps shall be placed over the end of the pipe. Fittings shall be checked for proper size based on the diameter of the pipe. The end of pipe shall be placed over the barbed insert fitting, making contact with the fitting shoulder. Clamps shall be positioned equal to 180 degrees (3.14 rad) apart and shall be tightened to provide a leak tight joint. Compression type couplings and fittings shall be permitted for use in joining PE piping and tubing. Stiffeners that extend beyond the clamp or nut shall be prohibited. Bends shall be not less than 30 pipe diameters, or the coil radius where bending with the coil. Bends shall not be permitted closer than 10 pipe diameters of a fitting or valve. Mechanical joints shall be designed for their intended use.

410.6 Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Plastic Pipe/Tubing and Joints. Joints between polyethylene/aluminum/polyethylene (PE-AL-PE) plastic pipe or tubing and fittings joining methods shall be installed in accordance with one of the following methods: the manufacturer's installation instructions and shall comply with Section 410.6.1 and Section 410.6.1.1.

(+) **410.6.1 Mechanical Joints.** Mechanical joints for PE-AL-PE pipe or tubing and fittings shall be either of the metal insert fittings with a split ring and compression nut or metal insert fittings with copper crimp rings. Metal insert fittings shall comply with ASTM F1974. Crimp insert fittings shall be joined to the pipe by placing the copper crimp ring around the outer circumference of the pipe, forcing the pipe material into the space formed by the ribs on the fitting until the pipe contacts the

shoulder of the fitting. The crimp ring shall then be positioned on the pipe so the edge of the crimp ring is $\frac{1}{8}$ of an inch (3.2 mm) to $\frac{1}{4}$ of an inch (6.4 mm) from the end of the pipe. The jaws of the crimping tool shall be centered over the crimp ring and tool perpendicular to the barb. The jaws shall be closed around the crimp ring and shall not be crimped more than once.

(2) 410.6.1.1 Compression Joints. Compression joints for PE-AL-PE pipe or tubing and fittings shall be joined through the compression of a split ring, by a compression nut around the circumference of the pipe. The compression nut and split ring shall be placed around the pipe. The ribbed end of the fitting shall be inserted ~~onto~~into the pipe until the pipe contacts the shoulder of the fitting. Position and compress the split ring by tightening the compression nut onto the insert fitting.

~~410.9~~**410.7 Polyethylene of Raised Temperature (PE-RT).** ~~Joints between p~~Polyethylene of raised temperature (PE-RT) tubing and fittings ~~joining methods~~ shall ~~be installed with~~ comply with Section 410.7.1.

410.7.1 Mechanical Joints. ~~F~~Fittings for PE-RT tubing that comply with the applicable standards ~~refereneed~~listed in Table 409.1. ~~Metal insert fittings, metal compression fittings, and plastic fittings shall be manufactured to and marked in accordance with the standards for fittings in Table 409.1.~~ Mechanical joints for PE-RT tubing shall be installed in accordance with the manufacturer's installation instructions.

~~410.5~~**410.8 Cross-Linked Polyethylene (PEX) Pipe Plastic Tubing and Joints.** ~~Joints between cross-linked polyethylene (PEX) plastic tubing pipe and fittings joining methods~~ shall be installed ~~with fittings for PEX tubing that comply with the applicable standards referenced in Table 409.1~~ in accordance with the manufacturer's installation instructions and shall comply with Section 410.8.1 through Section 410.8.3. PEX tubing labeled in accordance with ASTM F876 shall be marked with the applicable standard designation for the fittings specified for use with the tubing. ~~Mechanical joints shall be installed in accordance with the manufacturer's installation instructions.~~

410.8.1 Fittings. Fittings for PEX tubing shall comply with the applicable standards referenced in Table 409.1. PEX tubing that complies with ASTM F876 shall be marked with the applicable standard designation for the fittings, specified by the tubing manufacturer for use with the tubing.

410.8.2 Mechanical Joints. Mechanical joints shall be installed in accordance with the manufacturer's installation instructions.

410.8.3 Push Fit Fittings. Removable and nonremovable push fit fittings that employ a quick assembly push fit connector shall comply with ASSE 1061.

~~410.6~~**410.9 Cross-Linked Polyethylene/Aluminum/ Cross-Linked Polyethylene (PEX-AL-PEX) Pipe Plastic Tubing and Joints.** ~~Joints between cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) plastic pipe or tubing and fittings joining methods~~ shall be installed in accordance with ~~one of the following methods:~~ manufacturer's installation instructions and shall comply with Section 410.9.1 and Section 410.9.1.1.

(+) 410.9.1 Mechanical Joints. Mechanical joints between PEX-AL-PEX ~~pipe~~tubing and fittings shall include mechanical and compression type fittings and insert fittings with a crimping ring. Insert fittings utilizing a crimping ring shall ~~be in~~ accordancecomply with ASTM F1974 or ASTM F2434. Crimp joints for crimp insert fittings shall be joined to PEX-AL-PEX pipe by the compression of a crimp ring around the outer circumference of the pipe, forcing the pipe material into annular spaces formed by ribs on the fitting.

(2) 410.9.1.1 Compression Joints. Compression joints shall include compression insert fittings and shall be joined to PEX-AL-PEX pipe through the compression of a split ring or compression nut around the outer circumference of the pipe, forcing the pipe material into the annular space formed by the ribs on the fitting.

410.10 Polypropylene (PP) Pipe Piping and Joints. ~~Joints between polypropylene pipe and fittings shall be installed in accordance with one of the following methods:~~ PP pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 410.10.1 through Section 410.10.3.

(+) 410.10.1 Heat Fusion Joints. Heat-fusion joints for polypropylene (PP) pipe and fitting joints shall be installed with socket-type heat-fused polypropylene fittings, fusion outlets, butt-fusion polypropylene fittings or pipe, or electro-fusion polypropylene fittings. Joint surfaces shall be clean and free from moisture. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM F2389 or CSA B137.11.

(2) 410.10.2 Mechanical and Compression Sleeve Joints. Mechanical and compression sleeve joints shall be installed in accordance with the manufacturer's installation instructions.

410.10.3 Threaded Joints. ~~Polypropylene PP~~ pipe shall not be threaded. ~~Polypropylene PP~~ transition fittings for connection to other piping materials shall only be threaded by use of copper alloy or stainless steel inserts molded in the fitting.

410.11 Polyvinyl Chloride (PVC) Plastic Pipe and Joints. ~~Joints between polyvinyl chloride pipe and fittings shall be installed in accordance with one of the following methods:~~ PVC plastic pipe and fitting joining methods shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 410.11.1 through Section 410.11.3.

PVC piping shall not be exposed to direct sunlight unless the piping does not exceed 24 inches (610 mm) and is wrapped with not less than 0.04 of an inch (1.02 mm) thick tape or otherwise protected from UV degradation.

(+) 410.11.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint. The mechanical joint shall include a pipe spigot that has a wall thickness to withstand without deformation or collapse; the compressive force exerted where the fitting is tightened. The push-on joint shall have a minimum wall thickness of the bell at any point between the ring and the pipe barrel. The elastomeric gasket shall comply with ASTM D3139, and be of such size and shape as to provide a compressive force against the spigot and seal after assembly to provide a positive seal.