2021
REPORT ON PROPOSALS

THE PLUMBING TECHNICAL COMMITTEE REPORT ON PROPOSALS FOR PUBLIC REVIEW AND COMMENT
Information on IAPMO Codes and Standards Development

1. Applicable Regulations. The primary rules governing the processing of the Uniform Plumbing Code and Uniform Mechanical Code are the IAPMO Regulations Governing Committee Projects (RGCP). Other applicable rules include Bylaws, Assembly Consideration Session Rules, Technical Meeting Convention Rules, Guide for the Conduct of Participants in the IAPMO Codes and Standards Development Process, and the Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council. For copies of these documents, contact the Code Development Department at IAPMO World Headquarters at 4755 E. Philadelphia Street, Ontario, CA 91761-2816 USA, or at 909-472-4100. These documents are also available at the IAPMO website at www.iapmo.org.

The following is general information on the IAPMO process. All participants, however, should refer to the actual rules and regulations for a full understanding of this process and for the criteria that govern participation.

2. Technical Committee Report (TCR). The Technical Committee Report is defined as the Report of the Technical Committee and Technical Correlating Committee (if any) consisting of the Report on Proposals (ROP), as modified by the Report on Comments (ROC), published by the Association (see 1-4 of RGCP).

3. Report on Proposals (ROP). The ROP is defined as “a report to the Association on the actions taken by Technical Committees and/or Technical Correlating Committees, accompanied by a ballot statement and one or more proposals on text for a new Document or to amend an existing Document” (see 1-4 of RGCP). The ROP and the ROC together comprise the Technical Committee Report. Anyone who does not pursue an issue as a proposed amendment of the Association Meeting will be considered as having their objection resolved.

4. Assembly Comment. The Assembly Consideration Session, held during the second year of the code development cycle, will be held during IAPMO’s annual conference from September 26 – 30, 2021 being held virtually. The Assembly Consideration Session is scheduled for September 28, 2021. Anyone in the Assembly who objects to an action of the Technical Committee, as published in the ROP, may make a motion in accordance with Section 4-4.3.1.2 of the RGCP and, if such motion is sustained by majority vote, both the TC action established by a letter ballot and the Assembly’s action, which shall be considered as a comment in accordance with Section 4-4.3.1, shall be included in the ROC.

5. Report on Comments (ROC). The ROC is defined as “a report to the Association on the actions taken by Technical Committees and/or Technical Correlating Committees accompanied by a ballot statement and one or more comments resulting from public review of the Report on Proposals (ROP)” (see 1-4 of RGCP). The ROP and the ROC together constitute the Technical Committee Report. Anyone who does not pursue an issue, either in person or by designated representative in accordance with Section 4-5.4(c) of the RGCP, as a proposed amendment of the Association Meeting will be considered as having their objection resolved.

6. Association Amendments. The Technical Committee Reports, consisting of the ROP and ROC, will be presented at the Association Technical Meeting Convention for action. This meeting, held during the final year of the code development cycle, will be held during IAPMO’s annual conference from September 11 - 15, 2022, in Charlotte, North Carolina. Amending motions made to the Technical Committee Reports may be made only at the Association Technical Meeting Convention in accordance with 4-5 and other applicable sections of the RGCP. Amending motions may be made in person or by a designated representative in accordance with Section 4-5.4(c) of the RGCP. Objections are deemed to be resolved if not pursued at this level.

7. Council Appeals. Anyone can appeal to the Standards Council concerning procedural or substantive matters related to the development, content, or issuance of any Document of the Association or on matters within the purview of the authority of the Council. Such appeals must be in written form and filed with the Secretary of the Standards Council (see 1-6 of RGCP). Time constraints for filing an appeal must be in accordance with 1-6.2 of the RGCP. Objections are deemed to be resolved if not pursued at this level.

8. Document Issuance. The Standards Council is the issuer of the Uniform Plumbing Code and Uniform Mechanical Code. The Council acts on the issuance of a Document within sixty days from the date of the recommendation from the Association Technical Meeting Convention, unless this period is extended by the Council (see 4-7 of RGCP).

9. Petitions to the Board of Directors. The Standards Council has been delegated the responsibility for the administration of the codes and standards development process and the issuance of documents. However, where extraordinary circumstances requiring the intervention of the Board of Directors exist, the Board of Directors may take any action necessary to fulfill its obligations to preserve the integrity of the IAPMO codes and standards development process. The rules for petitioning the Board of Directors can be found in the Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council and in 1-7 of the RGCP.
To:  IAPMO Members and Other Interested Parties

Date:  September 2021

Enclosed is your 2021 Report on Proposals (ROP). These proposals were presented to the Plumbing Technical Committee who met via Virtual Webinar on May 3 - 7, 2021.

At the Annual Education and Business Conference, which will be held September 26 - 30, 2021 Virtually via Zoom, IAPMO members and others attending the conference will have the opportunity to discuss and debate these proposals during the Assembly Consideration Session.

All comments for consideration by the Technical Committee should be submitted to IAPMO by January 4, 2022.

On May 2 - 3, 2022, the Technical Committee will consider all of the comments received in response to the actions contained within the ROP and will vote on whether to modify any of their previous actions.

Thereafter, from September 11 - 15, 2022, IAPMO will be holding its 93th Annual Education and Business Conference in Charlotte, North Carolina. The IAPMO voting membership present at that conference will then vote on the actions taken by the Technical Committee during the Technical Meeting Convention. Please visit the IAPMO web site at www.iapmo.org for more information on the consensus code development process and timeline.

Following the ROP is a preprint of the Uniform Plumbing Code, as it would appear in the event that all of the proposals accepted by the Plumbing Technical Committee in May 2021 are ultimately approved for inclusion in the final version of the 2024 edition of the Uniform Plumbing Code. This preprint is provided to you as a courtesy. All changes are tentative and subject to revision. This document is not to be considered the final version of the 2024 Uniform Plumbing Code. Specific authorization from IAPMO is required for republication or quotation.
# PLUMBING TECHNICAL COMMITTEE

(as of 03/12/2021)

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<tr>
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<tr>
<td>Dan Daniels, Chair</td>
<td>Self</td>
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<tr>
<td>Bob Adler</td>
<td>4Leaf, Inc.</td>
<td>Enforcing Authority</td>
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<td>David Gans, Ex-Officio*</td>
<td>IAPMO</td>
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<td>Domenico Barbato, Principal</td>
<td>City of Los Angeles Department of Building &amp; Safety</td>
<td>Enforcing Authority</td>
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<td>Rawand Aryan, Alternate</td>
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<td>John Nielsen</td>
<td>State of Idaho – Division of Building Safety</td>
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<td>Brad Senecaute</td>
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<tr>
<td>Brian Fenty</td>
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<td>Arnold Rodio</td>
<td>Pace Setter Plumbing</td>
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<td>Chuck White</td>
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<td>Doug Marian *</td>
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<td>Research/Standards/ Test Lab</td>
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<td>Ephraim Kreitenberg</td>
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<td>Special Expert</td>
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<td>Billy Smith, Principal</td>
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<td>Ramiro Mata, Alternate</td>
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<td>Julius Ballanco</td>
<td>JB Engineering &amp; Code Consulting</td>
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<td>Phil Ribbs</td>
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<td>Lingyan Gorsuch</td>
<td>Arup</td>
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<td>National ITC Corporation</td>
<td>User</td>
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<td>Don Taylor</td>
<td>Dittmann Plumbing</td>
<td>User</td>
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<tr>
<td>Bob Sewell</td>
<td>Lesecure Company</td>
<td>User</td>
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<tr>
<td>Enrique Gonzalez, Staff Liaison</td>
<td>IAPMO Staff</td>
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Total Voting Members: 26  
*Total Non-Voting Members: 3

The above listed TC Members are in order of classification (see far right column).
FORM FOR COMMENTS ON IAPMO UPC/UMC COMMITTEE DOCUMENTS-2021

NOTE: All Comments MUST be received by 5:00 PM PST on January 4, 2022

PLEASE USE SEPARATE FORM FOR EACH COMMENT

Forms to be submitted electronically and accessed at the following:

https://codes.iapmo.org/form_comments_upc_umc_2024.aspx

Date __________ Name __________________________ Tel. No. __________________________

Organization __________________________________________ Email Address __________________________

Street Address __________________________ City __________________________ State _____ Zip. __________

Please Indicate Organization Represented (if any) __________________________________________

Recommendation:

Check one (see instructions)

☐ Add new text

☐ Revise text

☐ Delete text without substitution

Section number: ____________________ Code:    UPC  UMC

Comment on Proposal Item number: ______________

Proposed Text [Note: Proposed text must be in legislative format i.e., using underscore to denote wording to be inserted (wording) and strike through to denote wording to be deleted (wording).

Statement of Problem and Substantiation/Resolution:

Are you referencing standards in your comment? Check one ☐ Yes ☐ No

If yes, please provide two hard copies or one electronic copy with your comment. Please note that if a standard is referenced above in your comment you must submit such standard in order for your comment to be processed. If the standard is not received by the closing date, your comment is considered incomplete and will not be processed.

Where additional supplementary materials such as tests, research papers, or other documents need to be submitted, please provide supporting material electronically. Please note that if supporting material is not received by the closing date, it will not be accepted for review by the Technical Committee.

Copyright Assignment (This comment is original materials and is considered to be the submitter’s own idea based on, or as a result of, research and experience, and is not copied from another source).

I hereby irrevocably grant and assign IAPMO all and full rights in copyright, in this proposal. I understand and intend that I acquire no rights, including rights as a joint author, in any publication of IAPMO in which this comment in this or another similar or analogous form is used. I hereby warrant that I am the author of this comment and that I have full power and authority to enter into this copyright assignment.

☐ By checking this box, I affirm that I am, and agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature.

Note: If you are not the author of this comment (this text is copied from another source) please do not submit. The author of the comment must give copyright assignment (which is the submitter’s own idea based on or as a result of research, experience and is not copied from another source).

Patent Policy. IAPMO’s patent policy is to adhere fully to the ANSI patent policy. Every proponent of a code change proposal should familiarize him or herself with the ANSI patent policy which is available in its entirety at www.ansi.org/essentialrequirements. Upon receipt of a notice of an essential patent claim, IAPMO will coordinate with the claimant to ensure collection of the assurance(s) required by IAPMO’s adherence to the ANSI patent policy before the proposal that includes an essential patent claim is introduced into the code development process.
INSTRUCTIONS FOR SUBMITTING COMMENTS
PLEASE READ CAREFULLY

1. Check the appropriate box to indicate whether this comment recommends adding new text, revising existing text, or delete text without substitution (see examples below).
2. Enter the appropriate comment on proposal item number that the proposed text applies to.
3. In the space identified as “Proposed Text” indicate the exact wording you propose as new or revised text or the text you propose to be deleted.
4. In the space titled, “Statement of Problem and Substantiation/Resolution,” state the problem that will be resolved by your recommendation and give the specific reason for your comment.
5. Where referencing a standard in your comment, such standard needs to be submitted. Please provide two hard copies or one electronic copy with your comment. Please note that if the standard is not received by the closing date, your comment is considered incomplete and will not be processed.
6. Where additional supplementary materials such as tests, research papers, or other documents, need to be submitted, please provide supporting material electronically. Please note that if supporting material is not received by the closing date, it will not be accepted for review by the Technical Committee.
7. Check the box for copyright assignment. Please note if you are not the author of this comment (this text is copied from another source) please do not submit the proposed change. The author of the comment must give copyright assignment (which is the submitter’s own idea based on or as a result of research, experience and is not copied from another source).

Note: Content of Comments shall be in accordance with Section 4-4.5 of the IAPMO Regulations Governing Committee Projects of the UPC and UMC. Failure to comply with the above requirements will result in the comment not being processed. For further information on the standards process, please contact Code Development at 909-427-4111. For technical assistance, please call 909-230-5535 or 909-218-8122 or email alma.ramos@iapmo.org.

Please support IAPMO’s green initiative to remain paper free by providing the Proposed Monographs, Report on Proposals and Report on Comments in digital Adobe PDF. Note printed copies of the above referenced documents will not be available at the hearings.

Examples for applying charging statement for adding text, deleting text and revising text

Add new text as follows (applies only when adding a new section or all new text):
Water Service. Piping from the water main or source of water supply to the water distribution piping of the building or premises served irrespective of the water meter location.

Revises text as follows (applies when revising an existing section by deleting text, adding text or both as follows):
Building Supply. The pipe carrying potable water from the water meter or other source of water supply to the building or other point of use or distribution on the lot. Building supply shall also mean water service. Piping from the water main or source of water supply to the water distribution piping of the building or premises served irrespective of the water meter location.

Delete text without substitution (applies when deleting an entire section, table or both as follows):
302.0 Iron Pipe Size (IPS) Pipe. Iron, steel, brass and copper pipe shall be standard weight iron pipe size (IPS) pipe. 306.1 It shall be unlawful for any person to deposit, by any means whatsoever, into any plumbing fixture, floor drain, interceptor, sump, receptacle, or device, which is connected to any drainage system, public sewer, private sewer, septic tank, or cesspool, any ashes; cinders; solids; rage; inflammable, poisonous, or explosive liquids or gas; oil; grease; or any other thing whatsoever that would, or could, cause damage to the drainage system or public sewer.
Assembly Consideration Session Rules

Adopted by the IAPMO Board of Directors on July 9, 2007 and approved by the Standards Council on June 19, 2007. Revision pending Standards Council approval.

The Assembly Consideration Session is an important step in developing a complete record to assist the Standards Council in determining the degree of consensus achieved. These Rules, or any part of same, may not be suspended. The transaction of business at the Assembly Consideration Session shall be governed, in order of precedence, first by the Regulations Governing Committee Projects (see especially section 4-4.3.1.1), second by these Rules, and third by Robert’s Rules of Order Revised.

1. Meetings. The Secretary of the Standards Council shall develop and publish in advance, an agenda for each Assembly Consideration Session. At the discretion of the Secretary, the meeting may take place in a single session or may be divided into more than one session. All items on the agenda scheduled for consideration at a session shall be completed before the adjournment of that session.

2. Adjournment. Adjournment of each session shall take place only upon completion of the scheduled agenda.

3. Recess. A session may be recessed at any time at the discretion of the Chair. A motion to recess shall be allowed at the discretion of the Chair.

4. Question of Privilege. Ruled on by the Chair.

5. Call for Orders of the Day. Any change to the published agenda is to be announced by the Chair at the commencement of the session.


7. Previous Question. Requires a two-thirds vote of those present. For informational purposes prior to the vote, the Chair has the authority to ask if there is anyone who wishes to speak, who has not spoken, and who has something new to add. A successful motion of the previous question will close debate on the pending motion and bring it to an immediate vote.

8. Limit or Extend Debate. Each speaker is allowed ten minutes to present their arguments.


10. Commit or Refer. Not allowed.

11. Motions. See Regulations Governing Committee Projects at section 4-4.3.1.1 and 4-4.3.1.2.

13. **Voting on Motions.** Except as otherwise provided in these rules, the vote on motions shall be taken by a show of hands or, when meeting virtually, via electronic voting. If the Chair is uncertain of the result of the vote, he or she can order a counting of the vote. A successful main motion requires a majority vote of those present.

14. **Point of Order.** Allowed.

15. **Appeal.** Decisions of the Chair can be appealed except as otherwise prohibited by these rules. The proper venue for appeal of these rules is by an appeal filed with the Standards Council.

16. **Suspend Rules.** Not allowed.

17. **Division of Question.** Allowable at the discretion of the Chair.

18. **Division of Assembly.** Not allowed.

19. **Parliamentary Inquiry or Point of Information.** Allowed.

20. **Withdraw Motion.** A motion can be withdrawn only by a majority vote of the members assembled.

21. **Take from the Table.** Not allowed.

22. **Visual Aids and Physical Simulations.** Visual aids and physical simulations of any kind are prohibited. Only verbal presentations are allowed.

23. **Distribution of Materials.** All materials distributed within the Association Technical Meeting room shall have prior approval by the secretary of the Standards Council. Only IAPMO staff shall be permitted to distribute such materials.

24. **Reconsider, Rescind, or Amend Something Previously Adopted.** Applicable only within the period of discussion of the specific document and prior to the final vote.
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**Technical Correlating Committee Report**

**2021 Uniform Plumbing Code Preprint**

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Proposals

Item #: 001
UPC 2024  Section: 103.2

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

103.0 Duties and Powers of the Authority Having Jurisdiction.

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 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 provisions of this code shall be defended by legal counsel provided by this jurisdiction until final termination of such proceedings. When the Authority Having Jurisdiction has not acted in good faith or has acted with malice, such jurisdiction shall be rendered liable.

SUBSTANTIATION:
While the AHJ has the authority to enforce this code, it does not allow a free reign to approve unauthorized, prohibited, hazardous, or otherwise unsafe systems to be installed. The AHJ or person(s) making such decisions should be held liable, including their jurisdictions. AHJs are government or private entities that have the force of law behind them. The AHJ may be a federal, state, local, or other regional department or individual such as a building official, fire chief, fire marshal, labor department, health department, or others having statutory authority.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The language is not relevant to the code and not needed as legal action is not the same as administration. It would be difficult to determine when a person has “not acted in good faith or malice.” Making the jurisdiction liable is not feasible.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 002
UPC 2024  Section: 104.3.1

SUBMITTER: Adam Segura
Self

RECOMMENDATION:
Revise text

104.0 Permits.

104.3 Application for Permit. (remaining text unchanged)
104.3.1 Construction Documents. Construction documents, engineering calculations, diagrams, and other data shall be submitted in two or more sets, or in a digital format where permitted by the Authority Having Jurisdiction, with each application for a permit. The construction documents, computations, and specifications shall be prepared by, and the plumbing designed by, a registered design professional. Construction documents shall be drawn to scale with clarity to identify that the intended work to be performed is in accordance with the code.

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

SUBSTANTIATION:
While paper documentation is still used in the field, digital versions of documentation is also permitted by jurisdictions. The addition of this language will eliminate the paper documents from being printed where not necessary and will allow faster submission of documents where digital format is allowed and accepted.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24  ABSTAIN: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF ABSTAIN:
SOSKIN: This is an administrative section and each jurisdiction uses their own administrative sections.
Proposals

Item #: 003
UPC 2024  Section: 104.4.5

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

104.0 Permits.

104.4 Permit Issuance. (remaining text unchanged)

104.4.5 Suspension or Revocation. The Authority Having Jurisdiction shall be permitted to, in writing, with written notification, to 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.

SUBSTANTIATION:
The phrasing of Section 104.4.5 is being revised for clarity as the language is awkwardly written.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 004
UPC 2024  Section: 203.0

SUBMITTER: Bruce A Pfeiffer  
Retired - City of Topeka

RECOMMENDATION:  
Add new text

203.0  -A-

**Anodeless Riser. An assembly of steel-cased plastic pipe used to make the transition between plastic piping installed underground and metallic piping installed aboveground. [NFPA 54:3.3.3]**

SUBSTANTIATION:  
The Uniform Plumbing Code does not currently have a definition of Anodeless riser. There is some confusion in the trade that a compression PE adapter to a steel riser is comparable to an anodeless riser. This definition will eliminate the misconception and correlate with the existing UMC definition.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 005
UPC 2024 Section: 203.0

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION: Revise text

203.0 - A -

Appliance. A device that utilizes fuel or electricity as an energy source to produce light, heat, power, refrigeration, or air conditioning, or compressed fuel gas. This definition also shall include a vented decorative appliances and electric storage or tankless water heaters.

SUBSTANTIATION: The change removes enforceable language that is not permitted in a definition per the Manual of Style. The update also removes “compressed fuel gas” as it is used out of context and is now addressed under “fuel.” Furthermore, the additional language to the “Appliance” definition reintroduces electric water heater into the plumbing code.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 18 NEGATIVE: 7 NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: Adding the "fuel or electricity" eliminates appliances that have alternative energy sources such as solar, wind, or water.

BARBATO: "Fuel or electrical" is too restrictive. Energy can also come from other sources such as sun, wind, geothermal, tides, etc.

BROWN, FEEHAN: Fuel or electricity is not necessary and may be limiting.

CUADAHY: Fuel or electricity might be limiting.

GORSUCH: "Fuel or electricity as" is too restrictive, the original text "an energy source" is better. We should not start a list.

WHITE: The addition of "fuel or electricity" is not necessary, the original language, "an energy source" encompasses those forms of energy. Additionally, the addition of electric water heaters is the start of list-making, which can be confusing. Why not add gas water heaters too? List-making should be avoided.
Item #: 006

UPC 2024  Section: 203.0

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Add new text

203.0 – A –

**Authorized Personnel.** Any person who is designated by the appointing authority.

SUBSTANTIATION:
A definition is being added for “Authorized Personnel” as the term is used in the UPC but is not currently defined. See Sections 1205.1, 1208.10, and F 701.2.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as it is overly restrictive, and it is unclear who the “appointing authority” is.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 007
UPC 2024  Section: Chapter 2

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 54 Extract Update

RECOMMENDATION:
Revise text

CHAPTER 2
DEFINITIONS

203.0  – A –  
Appliance Categorized Vent Diameter/Area. The minimum vent diameter/area permissible for Category I appliances to maintain a nonpositive vent static pressure when tested in accordance with nationally recognized standards. [NFPA 54:3.3.6 3.3.5]

204.0  – B –  
Bonding Conductor or Jumper. A reliable conductor to ensure the required electrical conductivity between metal parts required to be electrically connected. [NFPA 70:100 (Part I)]

205.0  – C –  
Chimney. One or more passageways, vertical or nearly so, for conveying flue or vent gases to the outdoors. [NFPA 54:3.3.18 3.3.17]
Chimney, Factory-Built. A chimney composed of listed factory-built components assembled in accordance with the manufacturer’s installation instructions to form the completed chimney. [NFPA 54:3.3.18.2 3.3.17.2]
Chimney, Masonry. A field-constructed chimney of solid masonry units, bricks, stones, listed masonry chimney units, or reinforced Portland cement concrete, lined with suitable chimney flue liners. [NFPA 54:3.3.18.3 3.3.17.3]
Chimney, Metal. A chimney field-constructed chimney of metal with a minimum thickness not less than 0.127 inches (3.23 mm) (No. 10 manufacturer’s standard gauge) steel sheet. [NFPA 54:3.3.18.4]

206.0  – D –  
Direct-Vent Appliances. Appliances that are constructed and installed so that all air for combustion is derived directly from the outdoors and all flue gases are discharged to the outdoors. [NFPA 54:3.3.5 3.3.4.2]

207.0  – E –  
Effective Ground-Fault Current Path. An intentionally constructed, low impedance electrically conductive path designed and intended to carry current under ground-fault conditions from the point of a ground fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device or ground-fault detectors. [NFPA 70:1064:3.3.34]
Excess Flow Valve (EFV). A valve designed to activate when the fuel gas passing through it exceeds a prescribed flow rate. [NFPA 54:3.3.99.3 3.3.98.3]

219.0  – Q –  
Quick-Disconnect Device, (Fuel Gas). A hand-operated device that provides a means for connecting and disconnecting an appliance or an appliance connector to a gas supply; and that is equipped with an automatic means to shut off the gas supply when the device is disconnected. [NFPA 54:3.3.28.3 3.3.27.3]
224.0 — V —
Vent Offset. An arrangement of two or more fittings and pipe installed for the purpose of locating a vertical section of vent pipe in a different but parallel plane with respect to an adjacent section of vertical vent pipe. [NFPA 54:3.3.102 3.3.101]

SUBSTANTIATION:
The above sections have been revised to correlate with NFPA 54-2021 (latest version) in accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines).

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 008
UPC 2024  Section: 205.0

SUBMITTER: Adam Segura
Self

RECOMMENDATION:
Revise text

205.0  - C -

Confined Space. A room or space having a volume less than 50 cubic feet per 1000 British thermal units per hour (Btu/h) (4.83 m³/kW) of the aggregate input rating of all fuel burning appliances installed in that space with limited entrance and egress that is not suitable for inhabitants and not intended for continuous human occupancy.

( below shown for reference only )

1603.12 Marking. Rainwater tanks shall be permanently marked with the capacity and the language: “NONPOTABLE RAINWATER.” Where openings are provided to allow a person to enter the tank, the opening shall be marked with the following language: “DANGER-CONFINED SPACE.”

SUBSTANTIATION:
The definition for “confined space” does not match the use of the term in the UPC, Section 1603.12. The term is used once in the UPC for rainwater tanks and does not have anything to do with the definition in Chapter 2. For this reason, the definition is being updated to address the intent of the term “confined space” as used in the UPC.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

CUDEHY: Should simply delete the term.
Proposals

Item #: 009

UPC 2024  Section: 206.0

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

206.0      - D -

Dead Leg. Section of potable water pipe which contains water that has no flow or does not circulate. Pipe lengths equal to, or greater than 1.5 times the diameter of the pipe constitutes a dead leg.

SUBSTANTIATION:
Defining the length of a dead leg will eliminate interpretation issues between the installer and AHJ.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Requirements do not belong within Chapter 2 (Definitions) as definitions are not enforceable. The definition is also overly restrictive and conflicts with current industry standards. Furthermore, there are concerns that the language would prevent common industry piping practices from being done, such as capping the end of a pipe.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 010
UPC 2024  Section: 206.0

SUBMITTER: Arnie Rodio
   Self

RECOMMENDATION:
Revise text

206.0  – D –

Dry Vent. A vent serving a horizontal wet vent system that does not receive the discharge of any sewage or waste.

SUBSTANTIATION:
This helps clarify the location and proper use of a dry vent.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is unnecessary and does not further enhance the provided terminology.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 011
UPC 2024  Section: 206.0, 209.0

SUBMITTER: Garry Sato
Greensmart Sustainable Concepts

RECOMMENDATION:
Revise text

206.0 - D -

Diverter Valve, Gray Water. A valve that directs gray water to the sanitary drainage system or a subsurface irrigation system.
Diverter Valve, On Site Treated Nonpotable Water. A key component in the collection system to control inflow and overflow in collection tanks intended for on-site treatment and direct beneficial use.
Diverter Valve, Rainwater. A key component in commercial rainwater catchment systems to control high inflow and overflow volumes in rainwater storage tanks.

209.0 - G -

Gray Water. Untreated wastewater that has not come into contact with toilet waste, kitchen sink waste, dishwasher waste or similarly contaminated sources. Gray water includes, but not limited to, wastewater from bathtubs, showers, lavatories, clothes washers, and laundry tubs. Also known as grey water, graywater, and greywater.

SUBSTANTIATION:
The intent is to define new items that fill an unmet need and to clarify their specific uses that previously did not exist in the industry with regards to water sustainability. There are now existing regulations that require certain sustainable water practices that were not mentioned in previous code editions that require greater conformity and definition.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

206.0 - D -

Diverter Valve, Gray Water. A valve that directs gray water to the sanitary drainage system or a subsurface irrigation system.
Diverter Valve, On Site Treated Nonpotable Water. A key component in the collection system to control inflow and overflow in collection tanks intended for on-site treatment and direct beneficial use.
Diverter Valve, Rainwater. A key component in commercial rainwater catchment systems to control high inflow and overflow volumes in rainwater storage tanks.

209.0 - G -

Gray Water. Untreated wastewater that has not come into contact with toilet waste, kitchen sink waste, dishwasher waste or similarly contaminated sources. Gray water includes, but not limited to, wastewater from bathtubs, showers, lavatories, clothes washers, and laundry tubs. Also known as grey water, graywater, and greywater.
COMMITTEE STATEMENT:
The phrase “but not limited to” is unnecessary as the Technical Committee is aware of what is considered “gray water.” If language is inserted, this may open the door for various interpretations for “gray water.”

Additionally, the phrase “key component” in the definition for rainwater diverter valve should be revised to remove the word “key” as this is inaccurate for commercial rainwater catchment systems. Simply indicating “component” is sufficient.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25    NOT RETURNED: 1    Daniels
Proposals

Item #: 012
UPC 2024  Section: 207.0, 209.0

SUBMITTER: Samantha Liu
Self

RECOMMENDATION:
Revise text

207.0 - E -

Essentially Nontoxic Transfer Fluid. Essentially nontoxic at practically nontoxic, Toxicity Rating Class 1 (reference “Clinical Toxicology of Commercial Products” by Gosselin, Smith, Hodge, & Braddock). A fluid having a Gosselin toxicity rating of 1, or is generally recognized as safe (GRAS) by the U.S. Food and Drug Administration (FDA).

209.0 - G -

GRAS. A food substance approved by FDA because it is generally recognized to be safe under the intended conditions of use. An example is propylene glycol.

SUBSTANTIATION:
This definition was added in 2003 to support the use of single wall heat exchangers based on the success of the use of Propylene Glycol as a heat exchange medium in solar hot water systems. While the use of Propylene Glycol was a huge advance from Ethylene Glycol you can note in the paragraph above, taken from the ingredients index of the "Clinical Toxicology of Commercial Products" by Gosselin, Smith, Hodge, & Braddock) that Propylene Glycol has a toxicity rating closer to 2 than 1 and even that is questioned. Reviewing the same ingredients index, a toxicity rating of 1 is rare, and relying on that document, which appears to have last been last published in 1984, seems ill advised.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC
Amend proposal as follows:

207.0 - E -

Essentially Nontoxic Transfer Fluid. A fluid having a Gosselin toxicity rating of 1, or is generally recognized as safe (GRAS) by the U.S. Food and Drug Administration (FDA). A fluid generally recognized as safe by the Food and Drug Administration (FDA) as food grade.

209.0 - G -

GRAS. A food substance approved by FDA because it is generally recognized to be safe under the intended conditions of use. An example is propylene glycol.

COMMITTEE STATEMENT:
The modification to “Essentially Nontoxic Transfer Fluid” simplifies the terminology and clarifies the intent of the definition. In addition, the current definition for "GRAS" is being deleted as it is no longer relevant or listed within the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 013
UPC 2024  Section: 208.0

SUBMITTER: Phillip H Ribbs
            PHR Consultants

RECOMMENDATION:
Revise text

208.0 - F -
Flood-Level Rim. The top edge of a receptor or fixture from which water overflows.

(below shown for reference only)

Receptor. An approved plumbing fixture or device of such material, shape, and capacity as to adequately receive the discharge from indirect waste pipes, so constructed and located as to be readily cleaned.

Air Break. A physical separation which may be a low inlet into the indirect waste receptor from the fixture, appliance, or device indirectly connected.

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

Area Drain. A receptor designed to collect surface or storm water from an open area.

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.

SUBSTANTIATION:
As currently written, the term “flood-level rims” is limited to “receptors” which seems like an oversight in the language. The term “flood-level rim” applies to water closets, urinals and other fixtures that are not considered a receptor. The simple addition of “or fixture” will clarify the intended use for flood-level rims and not just limit it to a receptor.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 23  NEGATIVE: 2  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:
MANN: While the definition of a receptor is "an approved plumbing fixture," it goes on to state, "as to adequately receive the discharge from indirect waste pipes." A receptor is a specific plumbing fixture and this added verbiage clarifies the definition.

EXPLANATION OF NEGATIVE:
CUDAHY: Agree with Matt Sigler’s statement.
SIGLER: The definition for "receptor" already includes a "plumbing fixture." Therefore, the proposed change is not needed. Also, requirements that apply to "plumbing fixtures" are clearly stated throughout the UPC [e.g., Section 603.5.9 (Aspirators), 905.3 (Vent Pipe) Rise, 909.1 (Island Sink Venting), etc.].
Proposals

Item #: 014

UPC 2024  Section: 209.0

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

209.0  -- G --
Gas Piping. An installation of pipe, valves, or fittings that are used to convey fuel gas, installed on a premise or in a building, but shall not include:
(1) A portion of the service piping.
(2) An approved piping connection 6 feet (1829 mm) or less in length between an existing gas outlet and a gas appliance in the same room with the outlet.

(below shown for reference only)

1202.0 Coverage of Piping System.
1202.1 General. Coverage of piping systems shall extend from the point of delivery to the appliance connections. For other than undiluted liquefied petroleum gas (LP-Gas) systems, the point of delivery shall be the outlet of the service meter assembly or the outlet of the service regulator or service shutoff valve where no meter is provided. For undiluted LP-Gas systems, the point of delivery shall be considered to be the outlet of the final pressure regulator, exclusive of line gas regulators where no meter is installed. Where a meter is installed, the point of delivery shall be the outlet of the meter. [NFPA 54:1.1.1.1(A)]

1212.0 Appliance and Equipment Connections to Building Piping.
1212.3.1 Indoor. Indoor gas hose connectors shall be used only to connect laboratory, shop, and ironing appliances requiring mobility during operation and installed in accordance with the following:
(1) An appliance shutoff valve shall be installed where the connector is attached to the building piping.
(2) The connector shall be of minimum length and shall not exceed 6 feet (1829 mm).
(3) The connector shall not be concealed and shall not extend from one room to another or pass through wall partitions, ceilings, or floors. [NFPA 54:9.6.2(1)]

SUBSTANTIATION:
The change is removing the term “shall” from the definition for “Gas Piping” as the IAPMO Manual of Style indicates that definitions shall not be written in mandatory language.

The language in (1) is not necessary as it is already covered under the 1202.1 (General) indicating that gas piping systems extend from the point of delivery.

The change also removes (2), the “limit of 6 feet” and “within the same room” for gas connectors as it does not belong in a definition. Furthermore, the limit of 6 feet is already addressed in Section 1212.3.1 (Indoor) for nonmetallic gas hose connectors.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 015
UPC 2024  Section: 209.0

SUBMITTER: Phillip H Ribbs  
PHR Consultants

RECOMMENDATION: 
Add new text

209.0  - G -

Granular Fill. A Class 1 fill that is a graded, crusher run material, which is screened and crushed.

SUBSTANTIATION:
The term “granular fill” is used in the UPC but not defined. The proposed language is common in construction sites. The additional text will provide the minimum requirements for the end user to make a decision when preparing and filling trenches for thermoplastic piping.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed terminology is overly restrictive and may eliminate the use of other commonly used materials as fill.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  
AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 016

UPC 2024  Section: 209.0

SUBMITTER: Bruce A Pfeiffer
   Retired - City of Topeka

RECOMMENDATION:
Add new text

209.0      – G –

Groundwater. Water that exists beneath the earth's surface. Originating as rainfall or snow and ice melt, the precipitation infiltrates the soil replenishing the groundwater system. The water may remain below grade in aquifers or underground streams or make its way back to the surface to feed streams, rivers or lakes.

SUBSTANTIATION:
The term "groundwater" is used multiple times in the Uniform Plumbing Code. A definition will clarify the intent of the applicable Code sections using the term.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

209.0      – G –

Groundwater. Water that exists beneath the earth's surface. Originating as rainfall or snow and ice melt, the precipitation infiltrates the soil replenishing the groundwater system. The water may remain below grade in aquifers or underground streams or make its way back to the surface to feed streams, rivers or lakes.

COMMITTEE STATEMENT:
The length of time and where the water originates from is irrelevant within the definition for groundwater. In addition, the language "originating as rainfall or snow and ice melt" is inaccurate as it is not all inclusive of other water sources such as water collected in aquifers.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 017
UPC 2024  Section: 212.0

SUBMITTER: Donald (DJ) Berger
Self

RECOMMENDATION:
Revise text

212.0  - J -

Joint, **Press-Connect Elastomeric**, A **permanent mechanical** removable or non-removable joint incorporating an elastomeric seal or an elastomeric seal and corrosion resistant grip ring. The joint is made with a pressing tool and jaw or ring that complies with the manufacturer's installation instructions.

SUBSTANTIATION:
The word “Press-Connect” describes one type of technology using elastomeric materials for the joint seal. By revising the definition with the word “Elastomeric” this definition may be expanded to include similar joining technologies employing an elastomeric material for its seal, e.g., push-fit, grooved (Victaulic), bolted (Dresser), compression repair couplings, etc.

The words “permanent mechanical” are inconsistent with other “permanent” and “mechanical” joint definitions within this section of the code. By revising the definition with the removal of the phrase “The joint is made with a pressing tool and jaw or ring that complies with the manufacturer’s installation instructions,” the definition would be inclusive of similar joining technologies employing elastomeric materials. This revision would provide additional consistency within the code as the 2021 UPC has specific sections that provide information on how joints are to be made.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The term “elastomeric joint” is not used within the provisional body of the code and therefore requires no accompanying terminology. In addition, the provided definition is incorrect and does not appropriately represent the specified type of joint. Furthermore, the terminology for “press-connect” is necessary and should not be removed.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

CUDAHY: The proposed revision of the definition of “Press-Connect Joint” will make the UPC and the UMC the only publications that lump together Press-Connect fittings with other types of mechanical joints. Changing the definition would completely confuse the industry when an established definition is already prevalent and include Press-Connect fittings which are a permanent joining method into the same category as Non-Permanent joining methods. Specific standards are written to address Press-Connect fittings; IAPMO PS 117 (Press Connections), ANSI LC-4/CSA 6.32 (Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems), ASME B16.51 (Copper and Copper Alloy Press-Connect Pressure Fittings), ASTM F3226 (Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing System), to name a few. Also, NFPA 31, NFPA 54, NFPA 55, NFPA 58, CGA P-18, Uniform Plumbing Code, Uniform Mechanical Code, National Standard Plumbing Code, CSA B149.1 (National Gas and Propane Code for Canada), and many other publications all directly reference Press-Connect fittings.
Proposals

Item #: 018
UPC 2024  Section: 214.0

SUBMITTER: John Taecker  
UL LLC

RECOMMENDATION:
Revise text

214.0  – L –

Listed (Third Party Certified). Equipment or materials included in a list published by a listing agency (accredited conformity assessment body) that maintains periodic inspection of current production of listed equipment or materials 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. Terms used to identify listed equipment, products, or materials include "listed," "certified," or other terms as determined appropriate by the listing agency.

SUBSTANTIATION:
The proposed revision to the definition for "Listed" recognizes that listing organizations may use other terms to identify "listed" equipment, products, or materials. An example of other terms used that meet the definition of "listed" include "certified." The term "certified" is a more globally recognized term used by listing organizations compared to the term "listed."

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Terms are determined by the code and not by the listing agency. The language is already covered within the terminology provided for "listing agency."

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 20  NEGATIVE: 5  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: If the additional wording adds clarity to the code, it should be accepted.

CUDAHY: The proposal is an add-on to the definition, other terms that have the same meaning as "Listed," fairly neutral here.

MATA: The proposal is simply informing the code user that they may encounter other terms that have the same meaning as "Listed." It does not alter the original definition.

SIGLER: The modification does not adversely impact the definition for "listed" as used in the UPC, but instead, expands its application to more appropriately account for terms used by third-party certifiers throughout the world.

WHITE: The intent of the definition is to inform the user that the appropriate agency has a list of products that conform. What that agency calls that list is not dictated by the code, rather, that agencies named list comply with the definition of the complete term "Listed (Third Party Certified)." There is no problem with the submitted modification.
Proposals

Item #: 019
UPC 2024  Section: 214.0, 216.0

SUBMITTER: Phil Pettit
Control Air Conditioning Corporation
Rep. Self

RECOMMENDATION:
Add new text

214.0 — L —
Limited-Combustible Material. A material with limited burning characteristics that, in the form in which it is used, has a potential for combustion and does not comply with the definition of noncombustible material.

216.0 — N —
Noncombustible Material. A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.

SUBSTANTIATION:
This proposal adds the definitions for “Limited-Combustible Material” and “Noncombustible Material” for clarification as the terms are used in the UPC and are not defined. A similar proposal has been submitted to the UMC.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the definitions are unnecessary within the UPC and the terms are already generally understood.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 020
UPC 2024  Section: 215.0

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Add new text

215.0  – M –
Mid-Story Guide. A support designed to keep piping in alignment, located half-way between floors or a floor and ceiling.

SUBSTANTIATION:
The term is used several times in Table 313.3 but not defined in the code. This will assist the end user on the intent of such term.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC
Amend proposal as follows:

215.0  – M –
Mid-Story Guide. A support designed to keep piping in alignment, located half-way between floors or a floor and ceiling.

COMMITTEE STATEMENT:
The proposed modification is necessary as a guide may not be located exactly half way.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 021
UPC 2024  Section: 218.0

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Add new text

218.0 – P –

Public Use Occupancy. Commercial buildings that include, but are not limited to office buildings, retail stores, restaurants, industrial, multi-family housing, hotels, motels, arenas, stadiums, and other structures not used for one and two family dwellings.

SUBSTANTIATION:
There is no definition for the term “public use occupancy” in the Code. That term is used in Section 710.9 and Section 1101.14 of the 2021 UPC to require multiple pumps for sanitary and storm water wastes. Defining the term “public use occupancy” gives the user a clearer understanding of when two pumps would be needed and, therefore, the proposed definition is being rejected.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The term “Public Use Occupancy” is already implied in the code by the definition of “Private or Private Use” and, therefore, being rejected.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 022
UPC 2024  Section: 221.0

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

L-201.0 Definitions. 221.0 – S –

Stormwater. Natural precipitation that has contacted a surface at grade or below grade and has not been put to beneficial use.

SUBSTANTIATION:
This term is being relocated to Chapter 2 as it is used throughout the UPC.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The definition provided should remain in Appendix L. In addition, the definition should not be removed from Appendix L as the term is relevant to the language within the appendix. It should be noted that the term should be modified throughout the code for consistency.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 023

UPC 2024  Section: 221.0

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

L-201.0 Definitions: 221.0 – S –

Stormwater. Natural precipitation, including rain, snow, and ice melt, that discharges across land surfaces, including manmade surfaces, or through other conveyances to one or more waterways that has contacted a surface at grade or below grade and has not been put to beneficial use.

SUBSTANTIATION:
The definition for stormwater is being updated to clarify that stormwater includes runoff water from concrete surfaces, some of which may include pollutants. This would require pretreatment of the stormwater prior to use as a non-potable water source.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The definition provided should remain in Appendix L. In addition, the definition should not be removed from Appendix L as the term is relevant to the language within the appendix. It should be noted that the term should be modified throughout the code for consistency.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 024

UPC 2024 Section: 222.0

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Add new text

222.0 -T-

Thermoplastic. A type of plastic made of polymer resins that becomes soft and pliable when heated, reverting to its original hard form when cooled. This type of plastic material is used when joining pipe and fittings utilizing heat-fusion welding methods. Thermoplastic pipe and fittings do not show chemical property changes when they are heated and cooled multiple times.

SUBSTANTIATION:
With thermoplastic pipe and fittings becoming more prominent in the industry, a definition is needed in the UPC to describe the properties of the material and how it is being used.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the language may create confusion regarding PVC and ABS, which are not joined by heat fusion methods.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1  Daniels
Proposals

Item #: 025
UPC 2024  Section: 224.0

SUBMITTER: Adam Segura
Self

RECOMMENDATION:
Revise text

224.0 — V —

Vacuum Relief Valve. A device that automatically allows air to enter the piping system to prevent conditions that could siphon water from the system and prevent excessive vacuum in a pressure vessel.

SUBSTANTIATION:
The proposed language broadens the definition of a vacuum relief valve as used in a plumbing system. The valve is not only protecting the pressure vessel from excessive vacuum, but also preventing conditions that could siphon the water from system and possibly cause damage to water heater and equipment.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is being rejected as the current definition clearly defines the intent of vacuum relief valves which is to prevent excessive vacuum in a pressure vessel. Furthermore, the proposed modification could create confusion for defining such valves.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 026
UPC 2024  Section: 224.0

SUBMITTER: Chris Sweeny
Specification Sales

RECOMMENDATION:
Add new text

224.0 – V –

Valve, Balancing. A valve that regulates and controls the return of hot water to the water heater in a recirculating potable or nonpotable hot water piping system to ensure that specified hot water temperatures are delivered to all point-of-use fixtures within specified time frames or volumes. These include the following:

(1) Flow Balancing Valve with Memory Stop. Includes globe valve, needle valve, or venturi valve design with ports for reading temperature and pressure, knob adjustment with graduated set-point markings, and lockable memory setting.
(2) Preset Automatic Flow Control Valve. A fixed orifice valve regulates flow by using a spring mechanism to maintain a specified flow over a variety of pressures. These function with replaceable flow cartridges, each having a different flow rate orifice assembly and with different pressure differentials.
(3) Thermostatic Flow Regulating Valve. Mechanical thermostatically controlled valves that automatically self-adjust return water flow to maintain specified temperatures in the hot water circuits.

SUBSTANTIATION:
What exactly is a domestic hot water (DHW) balancing valve? Despite code enhancements and increased emphasis around domestic hot water design, a critical component of any DHW recirculation system has gone largely unaddressed. Due to the lack of a definition of a balancing valve, any valve that regulates flow can theoretically be used in a DHW recirculation system, including a ball valve. The addition of a clear definition of what a balancing valve is will allow plumbing designers to require a balancing valve designed and intended for use in DHW recirculation systems.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

Valve, Balancing. A valve that regulates and controls the return of hot water to the water heater in a recirculating potable or nonpotable hot water piping system to ensure that specified hot water temperatures are delivered to all point-of-use fixtures within specified time frames or volumes. These include the following:

(1) Flow Balancing Valve with Memory Stop. Includes globe valve, needle valve, or venturi valve design with ports for reading temperature and pressure, knob adjustment with graduated set-point markings, and lockable memory setting.
(2) Preset Automatic Flow Control Valve. A fixed orifice valve regulates flow by using a spring mechanism to maintain a specified flow over a variety of pressures. These function with replaceable flow cartridges, each having a different flow rate orifice assembly and with different pressure differentials.
(3) Thermostatic Flow Regulating Valve. Mechanical thermostatically controlled valves that automatically self-adjust return water flow to maintain specified temperatures in the hot water circuits.

COMMITTEE STATEMENT:
The modification removes unnecessary verbiage that can cause confusion. Additionally, it will make the definition concise and will prevent the end user from using any valve.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 027
UPC 2024  Section: 224.0

SUBMITTER: Amie Rodio
Self

RECOMMENDATION:
Revise text

224.0  – V –

Vent Connector, Gas. That portion of a gas venting system that connects a listed gas appliance beginning at the draft hood or flue collar to a gas vent and is installed entirely within the space or area in which the appliance is located.

SUBSTANTIATION:
The current simple definition of a vent connector is not clear. It can be interpreted under the current language that you could install a single wall vent for a water heater starting in the garage and run it up into the attic. This change state specifically where it begins and that it remains in the space where it begins.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 028
UPC 2024  Section: 225.0

SUBMITTER: Bob Adler
Self

RECOMMENDATION:
Add new text

225.0  – W –

**Water Station.** A designated location intended to provide access to drinking water through a device or appliance.

SUBSTANTIATION:
The term “water station” is used in the code and not currently defined. This definition will assist the end user to the intent of the term and how it will apply to the section and note of the UPC.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 21  NEGATIVE: 4  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

BALLANCO: I found two locations where the term "water station" is used. Hence, it appears appropriate to include this definition.

EXPLANATION OF NEGATIVE:

BROWN, SIGLER: There are already definitions for “bottle filling station” and “drinking fountain” in the code, and the proposed definition for “water station” could lead to confusion. If it is determined that a definition for "water station" is necessary, it should be based on its application in Section 415.2 which is specific to where food is consumed indoors.

CUDAHY, GORSUCH: Agree with Matt Sigler’s statement.
Proposals

Item #: 029
UPC 2024  Section: 301.2.4, 313.8, 313.9, Table 1701.1, Table 1701.2

SUBMITTER: Mr John Wilson
Taylor Kerr Engineering Ltd (Teekay Couplings)

RECOMMENDATION:
Revise text

301.0 General.

301.2.4 Cast-Iron Soil Pipe, Fittings, and Hubless Couplings. Cast-iron soil pipe, fittings, and hubless couplings shall be third party certified in accordance with ASTM C1277, and CISPI 310 or ASTM F1476 for couplings and ASTM A888, ASTM A74, and CISPI 301 for pipes and fittings.

313.0 Hangers and Supports.

313.8 Pipe Anchorage. Anchorage shall be provided to restrain drainage piping from axial movement.

313.9 Location. For pipe sizes more than 4 inches (102 mm), restraints shall be provided for drainpipes at all changes in direction and at all changes in diameter greater than two pipe sizes. Braces, blocks, rodding or other suitable methods as specified by the coupling manufacturer for ASTM F1476 Type II Class 2, flexible and restrained shall be utilized.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F1476-2007(R2019)</td>
<td>Performance of Gasketed Mechanical Couplings for Use in Piping Applications</td>
<td>Joints</td>
<td>301.2.4</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASTM F1476 meets the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
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</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
The ASTM F1476 specification provides the performance characteristics and qualification tests required for gasketed mechanical couplings (GMC) including groove-type mechanical couplings for grooved end pipe, mechanical restraint couplings for plain end pipe and mechanical compression couplings for plain end pipe.

These couplings are for use at temperatures within the recommended temperature range of their respective gaskets.
Couplings manufactured to perform to this standard are utilized around the world for many pipework systems for
civils, water, oil & gas, marine, plumbing and mechanical installations with a wide range of pipe materials. Gasketed
mechanical pipe couplings allow pipes to be permanently joined without the need for welding, soldering or brazing,
eliminatng the need for on-site hot work. No pipe threading, grooving, or alternative preparation is required. This
gives the system designer and contractor access to a widely used and accepted modern construction method in
today’s industry.

Health and safety benefits come from the simple tools required and the use of plain end pipe. There is no heating,
welding or manipulation of material on site, so handling is easy and safe. The coupling is light in weight, has no
loose parts and all materials are REACH and RoHS compliant and manufactured under an ISO 9001 quality
programme. Gaskets are NSF 61 compliant.

The high-level performance of GMCs allows gravity systems to be uprated. For example, where CISPI 310 states
that thrust restraint systems are required, a GMC can fulfil the regulation. Global manufacturers of hubless cast iron
utilize GMCs in sensitive locations as part of their overall systems.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The proposal is being rejected as it would require restraints for all drainage piping over 4 inches in diameter and
would require bracing to be done in accordance with the manufacturer rather than the code. The standards being
proposed do not contain any sizing requirements and, therefore, not providing any guidance. Lastly, the language is
overly restrictive and will not allow the use of other fittings.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 030

UPC 2024 Section: 301.3

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

301.0 General.

301.3 Alternate Materials and Methods of Construction Equivalency. Unless specifically prohibited, 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 prior to installation. 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.

SUBSTANTIATION:
Section 301.3 grants authority to AHJ's to approve materials or products at their discretion. However, Section 301.3 places an obligation on the AHJ to approve only those alternate materials or products which comply "with the intent of this code," which are "at least the equivalent of that prescribed in this code," and are not specifically prohibited elsewhere in the code.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 19 NEGATIVE: 6 NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: This change violates Federal Trade Laws. The provisions in this section date back more than 50 years when it was deemed that codes cannot restrain the use of new and innovative products or methods. In 1963, the Seventh Circuit Court of Appeals stated: "A building code should be reasonably related to the goals of public health, safety, and welfare. The exercise of police power cannot be used as a cloak to prevent the use of new materials and methods of construction merely because they are new and may displace older methods and materials. Home Building Contractors, Inc. v. County of Page 322 F. 2d 635, 637 (7th Cir. 1963)."

CUDAHY: This seems legally problematic to the code and IAPMO. "Nothing in this code" is deliberate, boilerplate language. Codes are not intended to prevent the use of designs or materials not prescribed.

FEEHAN: This language is confusing. Unless specifically prohibited means, everything that is not prohibited is allowed. Is that what you want a codebook to say? You better get your list of prohibited items started.

GORSUCH: I have a problem with the wording "specifically prohibited;" If the code specifically prohibits something today (in some cases), it may become obsolete tomorrow, and the code becomes incorrect or counterproductive. So, I think it is better to keep it the way it is.
KREITENBERG: The Code should not limit designers and or ingenuity.

WHITE: The additional language is contrary to the intent of Section 301.3. The section allows the jurisdiction to evaluate alternate methods and make allowances. Most of the time the case could be made that the code specifically prohibits actions, specifically stating this will greatly inhibit jurisdictional latitude. The jurisdiction already has the option to say no to any of these proposed alternates.
Proposals

Item #: 031
UPC 2024  Section: 301.6

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Add new text

301.0 General.

301.6 Tall Wood (Mass Timber) Buildings. Plumbing systems installed in Type IV-A, Type IV-B, or Type IV-C tall wood (mass timber) buildings, shall comply with the following:
(1) Be designed by a licensed plumbing contractor or a registered design professional in accordance with this code and the building code.
(2) Have a flame-spread index of not more than 25 and a smoke developed index of not more than 50, where tested in accordance with ASTM E84 or UL 723.
(3) Be designed to accommodate expansion, contraction, and differential movement between parts of a mass timber building.

SUBSTANTIATION:
The building codes include Type IV tall wood building (also known as mass timber construction) which are constructed with fire resistant ratings of either three or two hours. Proposed Section 301.6 provides information and direction for fire resistant ratings associated with mass timber construction.

Additionally, the language is adding prescriptive requirements for allowance of expansion and contraction of mass timber buildings either during or after completion of construction. Current studies are monitoring the moisture performance of mass timber building during construction utilizing monitors, and there is indication that the mass timber expands during construction and contracts over time. Proposed Section 301.6 provides guidance for the plumbing system design within wood buildings constructed of Type IV-A, Type IV-B, or Type IV-C.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

301.0 General.

301.6 Tall Wood (Mass Timber) Buildings. Plumbing systems installed in Type IV-A, Type IV-B, or Type IV-C tall wood (mass timber) buildings, shall comply with the following:
(1) Be designed by a licensed plumbing contractor or a registered design professional in accordance with this code and the building code.
(2) Have a flame-spread index of not more than 25 and a smoke developed index of not more than 50, where tested in accordance with ASTM E84 or UL 723.
(3) Be designed to accommodate expansion, contraction, and differential movement between parts of a mass timber building.

COMMITTEE STATEMENT:
The modification removes the plumbing system types (IV-A, IV-B, IV-C) as they are already referenced in the building code. Including the types may cause confusion for the users of the code.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 18  NEGATIVE: 7  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: This proposed change is not consistent with the Building Code. There are no provisions in the Building Code requiring plumbing systems to have a flame spread of 25 or less and a smoke develop index of 50 or less. This would eliminate the use of plastic pipes and plastic plumbing fixtures without any technical justification.

BROWN: The new language places restrictions on plumbing systems without adequate justification. This is inconsistent with the Building Code.

CUDAHY: All components of this proposal are unnecessary. Limiting design and construction of one type of building is overly restrictive, limiting piping to plenum piping is technically unjustified, and expansion and contraction engineering is needed in every type of construction. This should have failed.

FEEHAN: I am opposed to the entire proposal. If it is approved, it needs to include all types of buildings.

GORSUCH: Item numbers (1) and (3) are not unique to the tall mass timber buildings. More reasoning is required to provide a better justification why tall mass timber buildings require plenum piping.

KREITENBERG: It seems to be directing the plumbing systems to have a 25/50 rating. That is not consistent with the Plumbing Code.

WHITE: These restrictions are not justified. Tall buildings expand and contract, systems need to be designed by a professional, and there is no justification for the flame spread language.
Proposals

Item #: 032

UPC 2024 Section: 305.8, 305.8.1, 305.8.2

SUBMITTER: Robert Nicholas (Don Illingworth & Assoc., Inc., Structural Engineers Association of Texas); R. Craig McKee, P.E. (Huckabee, Inc.)

RECOMMENDATION:
Add new text

305.0 Damage to Drainage System or Public Sewer.

305.8 Expansive Soil. Where expansive soil is identified but not removed under foundations, plumbing shall be protected in accordance with Section 305.8.1 or Section 305.8.2.

305.8.1 Non-Isolated Foundations. Under foundations with slabs that are structurally supported by a subgrade, it shall be permitted for plumbing to be buried.

305.8.2 Isolated Foundations. Under foundations with a slab or framing that structurally spans over an under-floor space which isolates the slab from the effects of expansive soil swelling and shrinking, the plumbing system shall be suspended so that piping, fittings, hangers and supports are isolated, by adequate void space, from the effects of expansive soil swelling and shrinking.

To protect the void space, soil shall be sloped, benched or retained in accordance with an approved design methodology. It shall not be permitted for the piping, fittings, hangers and supports below the slab or below the framing to be in contact with soil or any assemblage of materials that is in contact with soil within the active zone. It shall not be permitted for a slab and plumbing to be lifted as an assembly to create the void space unless the under-floor space has a crawl space with access to allow inspection and repair of plumbing after lifting.

Exception: It shall be permitted for the piping, fittings, hangers, and supports below the slab or below the framing to be in contact with structural elements of the foundation that are designed to resist the effects of expansive soil swelling and shrinking.

Organic materials shall not be used for hangers, supports and soil retention systems. Materials subject to corrosion shall not be used for hangers, supports and soil retention systems unless protected in an approved manner.

Where piping transitions to a buried condition beyond the perimeter of the foundation, an adequately flexible fittings shall be provided in the piping system to accommodate the effects of expansive soil swelling and shrinking.

SUBSTANTIATION:
The UPC currently does not require protection of piping, fittings, hangers and supports from expansive soil. In some instances, millions of dollars of damages per facility to plumbing have been caused by expansive soil. This proposed change would require protection of piping, fittings, hangers, and supports from expansive soil under buildings to avoid these cases. Refer to the 14 page supporting document.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
These provisions are better suited in the building code. In addition, these requirements involve the use of a soil report developed by a soils engineer. Plumbers are not required to complete such reports or tasks.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 Daniels

EXPLANATION OF AFFIRMATIVE:
BALLANCO: There is good technical content in this code change. It needs further clarification before it can be included in the code.
WHITE: I am supporting the rejection, but not for the stated reasons. This should be addressed by the UPC, but additional work should be made to the form of the proposal and to indicate that the indicated soil conditions are determined by others such that the plumbing design professional may make appropriate decisions during the design process.

EXPLANATION OF NEGATIVE:

GORSUCH: I think this is a very needed content that should be in the code; perhaps need more refinement. This is about the protection of plumbing systems; this should belong in the plumbing code. I have heard of cases that substantial property damage caused by plumbing systems installed in expansive soil without proper protective measures.
Proposals

Item #: 033

UPC 2024 Section: 308.0, 308.1

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

308.0 Improper Prohibited Locations.

308.1 General. Piping, fixtures, appliances, or equipment shall not be so located as to interfere with the normal use thereof or with the normal operation and use of windows, doors, or other required facilities.

SUBSTANTIATION:
This change adds “appliance” as an appliance can also interfere with the normal use of windows, doors, and facilities. Furthermore, the term "improper" is a subjective term and "prohibited" is clear, concise, and enforceable.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 034
UPC 2024  Section: 309.6

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

309.0 Workmanship.

309.6 Dead Legs. Dead legs shall have a method of flushing. The maximum length of a dead leg shall be not more than 1.5 times the diameter of the branch pipe.

(below is shown for reference only)

209.0 – G –

Dead Leg. A section of potable water pipe which contains water that has no flow or does not circulate.

SUBSTANTIATION:
These new guidelines are recommended by industry experts for Legionella and bacteria control in potable water systems. Currently there are no restrictions in the Code on the length of pipe for a dead leg.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as it is overly restrictive. There are concerns that the language would prevent common industry piping practices from being done such as capping the end of a pipe.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

GORSUCH: I think it is a good idea to define a volume for “Dead legs.” I do agree the proposed language is too restrictive.

SENECAUT: I like the idea of setting allowable lengths for dead legs but feel this language is too restrictive, particularly in the smaller diameter pipes.
Proposals

Item #: 035
UPC 2024  Section: 310.1

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

310.0 Prohibited Fittings and Practices.

310.1 Fittings. No double hub fitting, single or double tee branch, single or double tapped tee branch, side inlet quarter bend, running thread, band, or saddle shall be used as a drainage fitting, except that a double hub sanitary tapped tee shall be permitted to be used on a vertical line as a fixture connection.

SUBSTANTIATION:
According to representatives of the Cast Iron Soil Pipe Institute (CISPI), the double hub sanitary tapped tee has not been made for 75 years. The reference to this fitting needs to be removed from the Code.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 036
UPC 2024  Section: 310.9

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Add new text

310.0 Prohibited Fittings and Practices.

310.9 ABS and PVC Transition Joints. Except as provided in Section 705.9.4, PVC and ABS pipe and fittings shall not be solvent welded to any other unlike material.

(below shown for reference only)

705.9.4 Transition Joint. A solvent cement transition joint between ABS and PVC building drain and building sewer shall be made using listed transition solvent cement in accordance with ASTM D3138.

SUBSTANTIATION:
The current language under Section 705.9.4 allows for a single transition from ABS to PVC or PVC to ABS exterior of the structure. Transition glue is not being represented to be allowable to make transition joints between ABS and PVC anywhere in the building. This code change clarifies that this practice is not approved. I have seen residences where the below slab plumbing was PVC and then the above slab plumbing all PVC with the joints being made with transition glue. This is an improper use of the product. There is a separate code change to place this proposed change in Section 705.10.3; however, it is also important that this be in the general regulations as a prohibited practice.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 037
UPC 2024  Section: 310.9

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Add new text

310.0 Prohibited Fittings and Practices.

310.9 Female Plastic Connections. Female plastic threaded connections shall not be allowed to be used when threaded onto a male metallic connection.

SUBSTANTIATION:
It is common practice for installers to use female plastic fittings in installations where a male metal outlet is. This is common on condensate pans and HVAC units. It is often used at water services where a metal nipple is used. This issue is that this type of installation often cracks and then leaks or floods. When the female fitting is over tightened (which is hard not to do as there is no way to really torque it) it creates a stress on the fitting. Plastic products relieve stress by cracking. It is also important that this be in the general regulations as a clearly prohibited practice.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 038
UPC 2024  Section: 311.1

SUBMITTER: Bob Adler
Self

RECOMMENDATION:
Revise text

311.0 Independent Systems.
311.1 General. The drainage system of each new building and new work installed in an existing building shall be separate and independent from that of any other building, and, where available, every building shall have an independent connection with a public or private sewer.
Exception: Where one building stands in the rear of another building on an interior lot, and no public or private sewer is available or can be constructed to the rear building through an adjoining court, yard, or driveway, the building drain from the front building shall be permitted to be extended to the rear building.

SUBSTANTIATION:
The proposed change clarifies that the exception applies where no “public” or private sewer is available.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 039

UPC 2024 Section: 312.9, Table 1701.1, Table 1701.2

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

312.0 Protection of Piping, Materials, and Structures.

312.9 Steel Nail Plates. Plastic and copper or copper alloy piping penetrating framing members to within 1 inch (25.4 mm) of the exposed framing shall be protected by steel nail plates not less than No. 18 gauge (0.0478 inches) (1.2 mm) in thickness. The steel nail plate shall extend along the framing member not less than 1 1/2 inches (38 mm) beyond the outside diameter of the pipe or tubing. Steel nail plates shall comply with IAPMO IGC 193. Exception: See Fuel gas piping shall be protected in accordance with Section 1210.4.3.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 193-2020</td>
<td>Safety Plates, Plate Straps, Notched Plates and Safety Collars</td>
<td>Miscellaneous</td>
<td>312.9</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: IAPMO IGC 193 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
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<tbody>
<tr>
<td>IAPMO IGC 193-2010</td>
<td>Safety Plates, Plate Straps, Notched Plates and Safety Collars</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
The section is being revised to add the existing standard for safety plates for the protection of concealed pipes running through the framing of a building. These plates are used in the industry on a daily basis and the standard will ensure such plates meet minimum safety requirements. Additionally, fuel gas tubing is required to be protected by specific requirements in Section 1210.4.3 which may include steel plates. Therefore, not an exception.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:
312.0 Protection of Piping, Materials, and Structures.

312.9 Steel Nail Plates. Plastic and copper or copper alloy piping penetrating framing members to within 1 inch (25.4 mm) of the exposed framing shall be protected by steel nail plates not less than No. 18 gauge (0.0478 inches) (1.2 mm) in thickness. The steel nail plate shall extend along the framing member not less than 1 1/2 inches (38 mm) beyond the outside diameter of the pipe or tubing. Steel nail plates shall comply with IAPMO IGC 193. Fuel gas piping shall be protected in accordance with Section 1210.4.3.

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<td>Safety Plates, Plate Straps, Notched Plates and Safety Collars</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(COMMITTEE STATEMENT:
The reference to IAPMO IGC 193 is overly restrictive since there are field fabricated nail plates that meet the thickness requirements in the code. The last sentence clarifies that fuel gas piping plates shall comply with Section 1210.4.3 and is a good update for clarity and direction.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 23 NEGATIVE: 2 NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:

FEEHAN: This is overly restrictive and does not allow for field adaptation.

NIELSEN: I do not feel it is necessary to have a standard on “nail plates.” It serves no purpose and will only cause issues out in the field.

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 039, Section 312.9 (Steel Nail Plates) and UMC Item # 086, Section 316.6 (Steel Nail Plates) resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

312.9 Steel Nail Plates. Plastic piping or tubing, and copper or copper alloy piping or tubing penetrating framing members to within 1 inch (25.4 mm) of the exposed framing shall be protected by steel nail plates not less than No. 18 gauge (0.0478 inches) (1.2 mm) in thickness. The steel nail plate shall extend along the framing member not less than 1 1/2 inches (38 mm) beyond the outside diameter of the pipe or tubing. Fuel gas piping shall be protected in accordance with Section 1210.4.3.

TCC ACTION: ACCEPT AS SUBMITTED
TCC STATEMENT:
The language in UPC Item # 039, Section 312.9 (Steel Nail Plates) is being revised to correlate with the action taken by the UMC TC for Item # 086, Section 316.6 (Steel Nail Plates) to include the phrase “piping or tubing” and add “tubing” to the title of Section 312.0.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 312.9 regarding the inclusion of the phrase “piping or tubing” and adding “tubing” to the title of Section 312.0.
Proposals

Item #: 040

UPC 2024  Section: 312.13, 312.13.1, 312.13.2

SUBMITTER: R. Craig McKee, PE
Huckabee, Inc.

RECOMMENDATION:
Add new text

312.0 Protection of Piping, Materials, and Structures.

312.13 Expansive Soil. Where expansive soil is identified but not removed under foundations, plumbing shall be protected in accordance with Section 312.13.1 or Section 312.13.2.

312.13.1 Non-Isolated Foundations. Under foundations with slabs that are structurally supported by a subgrade, it shall be permitted for plumbing to be buried.

312.13.2 Isolated Foundations. Under foundations with a slab or framing that structurally spans over an under-floor space which isolates the slab from the effects of expansive soil swelling and shrinking, the plumbing shall be suspended so that plumbing, hangers and supports are isolated, by adequate voidspace, from the effects of expansive soil swelling and shrinking.

Exception: It shall be permitted to bury plumbing that provides drainage of an under-floor space.

To protect the voidspace, soil shall be sloped, benched or retained in accordance with an approved design methodology. It shall not be permitted for the piping, fittings, hangers and supports below the slab or below the framing to be in contact with soil or any assemblage of materials that is in contact with soil within the active zone. It shall not be permitted for a slab and plumbing to be lifted as an assembly to create the voidspace unless the under-floor space is a crawlspace with access to allow inspection of plumbing after lifting.

Exception: It shall be permitted for the piping, fittings, hangers, and supports below the slab or below the framing to in contact with structural elements of the foundation that are designed to resist the effects of expansive soil swelling and shrinking.

Organic materials subject to decay shall not be used for hangers, supports and soil retention systems. Materials subject to corrosion shall not be used for hangers, supports and soil retention systems unless protected in an approved manner.

Where piping transitions to a buried condition beyond the perimeter of the foundation, an adequately flexible expansion joint shall be provided in the plumbing.

SUBSTANTIATION:
The UPC currently does not require protection of plumbing hangers and supports from expansive soil. In some instances, millions of dollars of damages per facility to plumbing have been caused by expansive soil. This proposed change would require protection of plumbing, hangers, and supports from expansive soil under buildings to avoid these cases.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
These provisions are better suited in the building code. In addition, these requirements involve the use of a soil report developed by a soils engineer. Plumbers are not required to complete such reports or tasks.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels
EXPLANATION OF AFFIRMATIVE:

BALLANCO: There is good technical content that needs to be further developed to be included in the Plumbing Code.

EXPLANATION OF NEGATIVE:

GORSUCH: I think the plumbing code should provide guidance on how to deal with expansive soil in terms of underground piping support. I think this is important information that should be included in the Plumbing Code. In my opinion, plumbing system design shall be based on site-specific Geotech reports and recommendations. This proposal is very similar to Item # 032 though.
Proposals

Item #: 041

UPC 2024  Section: 313.0, 313.1, 313.2

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

313.0 Hangers, and Supports, and Anchors.
313.1 General. Piping, fixtures, appliances, and appurtenances shall be supported in accordance with this code, the manufacturer's installation instructions, and in accordance with the Authority Having Jurisdiction. Seismic restraints shall be in accordance with the building code.
313.2 Material. Hangers, supports, and anchors shall be of sufficient strength to support the weight of the pipe and its contents. Piping shall be isolated from incompatible materials.

SUBSTANTIATION:
The proposed text is adding seismic restraints to ensure these provisions are not overlooked when designing or working in areas prone to seismic conditions. Additionally, "anchors" is being added to the title as the subsections also include anchors.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 041, Section 313.1 (General) and Section 313.2 (Material) and UMC Item # 080, Section 313.1 (General) and Section 313.2 (Material) resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

313.0 Hangers, Supports, and Anchors.
313.1 General. Piping, tubing, fixtures, appliances, and appurtenances shall be supported in accordance with this code, the manufacturer's installation instructions, and in accordance with the Authority Having Jurisdiction. Seismic restraints shall be in accordance with the building code.
313.2 Material. Hangers, supports, and anchors shall be of sufficient strength to support the weight of the pipe or tubing and its contents. Piping or tubing shall be isolated from incompatible materials.

TCC ACTION:  ACCEPT AS SUBMITTED

TCC STATEMENT:
The language in UPC Item # 041, Section 313.1 (General) and Section 313.2 (Material) are being revised to correlate with the action taken by the UMC TC for Item # 080, Section 313.1 (General) and Section 313.2 (Material) to include the term "tubing."
The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 313.1 and Section 313.2 regarding the inclusion of the term “tubing.”
313.0 Hangers and Supports.

313.4 Seismic-Support. Where required by the building code, seismic restraints, anchorage, supports, and bracing for plumbing piping shall be provided in accordance with the building code.

313.5 Horizontal Restraints. Drainage piping that makes a horizontal-to-horizontal change in direction greater than 45 degrees (0.79 rad) shall be supported by one of the following methods or by other approved means:

1. Suspended drainage piping 4 inches (102 mm) or larger shall be rigidly supported by bracing or similar restraint to resist the pipe movement in the direction of flow.
2. Drainage piping 4 inches (102 mm) or larger supported in trenches shall be restraints to prevent separation of fittings using thrust blocking or similar restraint.

313.6 Axial Movement. Drainage piping shall be anchored or similarly restrained to prevent axial movement between joints.

(renumber remaining sections)

SUBSTANTIATION:
There are currently no provisions that speak on the thrust forces from the momentum of the waste within drainage piping. The combination of the mass and velocity can create a force that can quite large and can cause damage to the piping, fittings, or surrounding. These provisions need to be taken into account when the drainage piping makes sharp turns beyond a 45 degree angle. Additionally, there needs to be a reference for protection against seismic forces.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is overly restrictive as this would require thrust blocking to be installed for all piping in the drainage system 4” or larger. This is not applicable to all applications or installations. Seismic zoning should be used to make this determination.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Item #: 043

UPC 2024  Section: 314.2, 314.2.1

**RECOMMENDATION:**
Revise text

314.0 Trenching, Excavation, and Backfill.

314.2 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. **The length of the tunneling shall be the distance required to clear the obstacle above.**

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.

**314.2.1 Tunnels.** Pipe installed in tunnels via tunneling or jacking shall be protected from uneven loading. Supporting structures, walls, and ceilings shall be designed to withstand the earth loads and account for earth movement and settling.

**SUBSTANTIATION:**
Where pipe is to be installed by jacketing or tunneling to clear a slab, driveway, or other paved area, such tunnels should not be longer than necessary, as it is difficult to refill with the appropriate backfill in longer tunnels. Furthermore, a new section is being added to address the earth loads that must be taken into account for any tunneling and to account for any earth settlement in order to protect the piping within.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The proposal is being rejected as it is overly restrictive and unenforceable. Furthermore, it is outside of the scope of the UPC.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  
**AFFIRMATIVE:** 25  
**NOT RETURNED:** 1  
Daniels
Proposals

Item #: 044

UPC 2024 Section: 205.0, 208.0, 211.0, 318.0 – 318.6

SUBMITTER: Jeff Hutcher
Building in California
Rep. Self

RECOMMENDATION:
Add new text

318.0 Indoor Cannabis and Horticulture Facilities.

318.1 General. Plumbing for indoor horticulture spaces, including cannabis facilities, shall be in accordance with this code. This section shall apply to indoor horticulture within new and existing buildings.

318.2 Horticulture Facilities Water Supply. Potable water lines supplying water for irrigation purposes shall be provided with back-flow preventers to protect the domestic water supply from contamination in accordance with Table 603.2.

318.2.1 Alternate Water Supply. Where permitted, recycled and reclaimed water shall be permitted to be used for indoor horticulture in accordance with Chapter 15 or Chapter 16. Water tanks used for fertigation shall be listed for chemical use. Tanks stored in exterior of shall not be clear or translucent to prevent algae growth.

318.3 Floor Drains and Receptors. Fertigation water shall discharge through floor drains or other approved receptors receiving the waste from grow tables. Drains shall be trapped and vented in accordance with Chapter 10.

Exception: Class 1, Division 1 (C1/D1) rooms shall not contain floor drains.

318.3.1 Floor Drain Material. Floor drain material shall be in accordance with Section 418.1.

318.4 Emergency Equipment Stations. Eyewash stations shall be required in accordance with Section 416.2.

318.5 Nutrient Supply Equipment. Nutrient water tanks shall be installed in accordance with the manufacturer’s instructions. Potable water to nonpotable water connections shall be protected by an air gap or a reduced zone pressure (RZP) backflow device.

318.6 Nonpotable Water Tank. Nonpotable water storage tanks used for irrigation shall be in accordance with Chapter 15 or Chapter 16.

Definitions:

205.0 – C –
Cannabis Facility. A business, facility, or establishment where retail Cannabis is grown, cultivated, tested, stored, dried, extracted, weighed, packaged, sold, or processed, including dispensaries, cultivators, manufacturers, distributors, or testing laboratories.

208.0 – F –
Fertigation. The process of injecting nutrients into the irrigation water.

211.0 – I –
Indoor Horticulture. The cultivation and processing of floricultural and horticultural plants, including cannabis, in an indoor space by controlling various interior environmental variables including, but not limited to, temperature, air quality, humidity, artificial lighting, nutrients, and carbon dioxide.

SUBSTANTIATION:
This code change adds plumbing requirements for cannabis and horticulture facilities, including protection of water supply, alternate water sources and means of draining such systems. Growing plants transpire wastewater that may require special attention because of the necessities of cannabis which include water, nutrients, and a growing medium. To maximize public health and safety, potable water protection, and protection of the plumbing system, such requirements must be maintained.
COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

Appendix T
Indoor Cannabis and Horticulture Facilities

T 101.0 348.0 Indoor Cannabis and Horticulture Facilities.
T 101.1 348.4 General. Plumbing for indoor horticulture spaces, including cannabis facilities, shall be in accordance with this code. This section shall apply to indoor horticulture within new and existing buildings.

T 102.0 Definitions:
205.0 C Cannabis Facility. A business, facility, or establishment where retail Cannabis is grown, cultivated, tested, stored, dried, extracted, weighed, packaged, sold, or processed, including dispensaries, cultivators, manufacturers, distributors, or testing laboratories.
208.0 F Fertigation. The process of injecting nutrients into the irrigation water.
211.0 I Indoor Horticulture. The cultivation and processing of floricultural and horticultural plants, including cannabis, in an indoor space by controlling various interior environmental variables including, but not limited to, temperature, air quality, humidity, artificial lighting, nutrients, and carbon dioxide.

T 103.0 Requirements.
T 103.1 348.2 Horticulture Facilities Water Supply. Potable water lines supplying water for irrigation purposes shall be provided with back-flow preventers to protect the domestic water supply from contamination in accordance with Table 603.2.
T 103.1.1 348.2.1 Alternate Water Supply. Where permitted, recycled and reclaimed water shall be permitted to be used for indoor horticulture in accordance with Chapter 15 or Chapter 16. Water tanks used for fertigation shall be listed for chemical use. Tanks stored in exterior of shall not be clear or translucent to prevent algae growth.
T 103.2 348.3 Floor Drains and Receptors. Fertigation water shall discharge through floor drains or other approved receptors receiving the waste from grow tables. Drains shall be trapped and vented in accordance with Chapter 10.
Exception: Class 1, Division 1 (C1/D1) rooms shall not contain floor drains.
T 103.3 348.4 Emergency Equipment Stations. Eyewash stations shall be required in accordance with Section 416.2.
T 103.4 348.5 Nutrient Supply Equipment. Nutrient water tanks shall be installed in accordance with the manufacturer’s instructions. Potable water to nonpotable water connections shall be protected by an air gap or a reduced zone pressure (RZP) backflow device.
T 103.5 348.6 Nonpotable Water Tank. Nonpotable water storage tanks used for irrigation shall be in accordance with Chapter 15 or Chapter 16.

COMMITTEE STATEMENT:
These provisions are important but would be better suited as an appendix to allow further development to this specific need.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 18 NEGATIVE: 7 NOT RETURNED: 1 Daniels

EXPLANATION OF AFFIRMATIVE:
FEEHAN: Because it is being moved to the appendix, I am voting in favor. It still needs some work.
RIBBS: I agree that the title needs to be changed, but I believe the Task Group will make the change. However, I agree with the TC action of relocating the proposal to an appendix is correct.

EXPLANATION OF NEGATIVE:
BALLANCO: I agree with Domenico Barbato that the word "cannabis" should not be used in the section. Let the Task Group address the needed changes on this subject.
BARBATO: Currently, cannabis is not legal at the federal level, therefore the word "cannabis" should be changed to the word "hydroponic culture."

CUDAHY, GORSUCH, SENECAUT: Agree with Domenico Barbato.

KREITENBERG: Important and needed but to a far greater extent and detail. Should also be in the appendix.

RODIO: The word "cannabis" should not be used. It is still a controlled substance Federally. This would make a great appendix for the states that have legalized it.
Proposals

Item #: 045

UPC 2024  Section: 321.0 – 321.3

SUBMITTER: Joanne Carroll
Subtegic Group Inc.

RECOMMENDATION:
Add new text

321.0 Trenchless Methodology.
321.1 General. Trenchless methodology for shall be permitted for replacement or rehabilitation of drainage piping, building sewers or building storm sewers in accordance with Section 321.2 or Section 321.3.
321.2 Cured-In-Place Pipe. Cured-in-place pipe materials shall be in accordance with Section 715.3.
321.3 Pipe Bursting. Pipe bursting trenchless methodology shall use high density polyethylene (HDPE) in compliance with ASTM F714.

Note: ASTM F714 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
There are instances where under slab and buried piping requires replacement or repair and excavation is difficult or even impossible. The addition of this section will provide clarity for the use of trenchless methodology in accordance with existing referenced standards in the code.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as Chapter 3 is for general provisions and not specific requirements. Rehabilitation of drainage piping is already addressed in Chapter 7. Section 321.1 and Section 321.2 are already specifically addressed in Section 715.3. Also, the proposed Section 321.1 is referencing rehabilitation for "drainage piping," and will be in conflict with ASTM F714 as ASTM F714 is only for building sewers or building storm sewers.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
**Proposals**

**Item #: 046**

UPC 2024  Section: 402.6

**SUBMITTER:** Bob Adler  
Self

**RECOMMENDATION:**
Revise text

**402.0 Installation.**

**402.6 Flanged Fixture Connections.** Fixture connections between drainage pipes and water closets, floor outlet service sinks and urinals shall be made using an approved copper alloy, hard lead, ABS, PVC, or iron flanges caulked, soldered, solvent cemented; rubber compression gaskets; or screwed to the drainage pipe. The connection shall be bolted with an approved gasket, washer, or setting compound between the fixture and the connection. The bottom of the flange shall be set on an approved firm base.

Wall-mounted water closet fixtures shall be securely bolted to the structure with an approved carrier fitting. The connecting pipe between the carrier fitting and the fixture shall be an approved material and designed to accommodate an adequately sized gasket. Gasket material shall be neoprene, felt, or similar approved types.

**SUBSTANTIATION:**
It might go without saying but the carrier needs to be secured to the structure. The added text will ensure that the flange is secured to the structure as directed by the manufacturer.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The proposal is being rejected as the change pertaining to carrier fittings is already being addressed in Item # 048.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  
AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 047
UPC 2024  Section: 402.6, Table 1701.1, Table 1701.2

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

402.0 Installation.

402.6 Flanged Fixture Connections. Fixture connections between drainage pipes and water closets, floor outlet service sinks and urinals shall be made using an approved copper alloy, hard lead, ABS, PVC, or iron flanges caulked, soldered, solvent cemented; rubber compression gaskets; or screwed to the drainage pipe. The connection shall be bolted with an approved gasket, washer, or setting compound between the fixture and the connection. The waste connection shall be joined with an approved elastomeric gasket, flange to fixture connector complying with ASME A112.4.3, or an approved setting compound. The bottom of the flange shall be set on an approved firm base.

Wall-mounted water closet fixtures shall be securely bolted to an approved carrier fitting. The connecting pipe between the carrier fitting and the fixture shall be an approved material and designed to accommodate an adequately sized gasket. Gasket material shall be neoprene, felt, or similar approved types.

### TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME A112.4.3-1999(R2019)</td>
<td>Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System</td>
<td>Fittings</td>
<td>402.6</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASME A112.4.3 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

### TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME A112.4.3-1999(R2015)</td>
<td>Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System</td>
<td>Fittings</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
This change will add the appropriate standard for plastic water closet fittings for connecting a water closet to the sanitary drainage system. These connections are a safety issue, and the addition of this standard will add clarity and direction for the end user.

COMMITTEE ACTION: REJECT
COMMITTEE STATEMENT:
The change is overly stringent and would prevent the use of other waste connection materials.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 048

UPC 2024  Section: 402.6

SUBMITTER: Bruce A Pfeiffer  
Retired - City of Topeka

RECOMMENDATION:
Revise text

402.0 Installation.

402.6 Flanged Fixture Connections. Fixture connections between drainage pipes and water closets, floor outlet service sinks and urinals shall be made using an approved copper alloy, hard lead, ABS, PVC, or iron flanges caulked, soldered, solvent cemented; rubber compression gaskets; or screwed to the drainage pipe. The connection shall be bolted with an approved gasket, washer, or setting compound between the fixture and the connection. The bottom of the flange shall be set on an approved firm base the top of the finished floor.

Wall-mounted water closet fixtures shall be securely bolted to an approved carrier fitting. The connecting pipe between the carrier fitting and the fixture shall be an approved material and designed to accommodate an adequately sized gasket. Gasket material shall be neoprene, felt, or similar approved types.

SUBSTANTIATION:
This Code section allows a water closet flange to be set on the subfloor (approved firm base) which would require the use of multiple closet wax rings to create a water tight seal between the fixture and flange. The installation instructions by manufacturers is to install the flange so the bottom of the flange rests on the finished floor. This installation requires only a single bowl wax to create a water tight seal.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

402.0 Installation.

402.6 Flanged Fixture Connections. Fixture connections between drainage pipes and water closets, floor outlet service sinks and urinals shall be made using an approved copper alloy, hard lead, ABS, PVC, or iron flanges caulked, soldered, solvent cemented; rubber compression gaskets; or screwed to the drainage pipe. The connection shall be bolted with an approved gasket, washer, or setting compound between the fixture and the connection. The bottom of the flange shall be set on the top of the finished floor.

Wall-mounted water closet fixtures shall be securely bolted to an approved carrier fitting. The approved carrier fitting shall be securely attached to the structure. The connecting pipe between the carrier fitting and the fixture shall be an approved material and designed to accommodate an adequately sized gasket. Gasket material shall be neoprene, felt, or similar approved types.

COMMITTEE STATEMENT:
The amendment will clarify that the carrier needs to be securely bolted to the structure for the proper installation of wall-mounted water closet fixtures.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 049
UPC 2024  Section: 402.6.1, 402.6.3

SUBMITTER: Bob Adler
Self

RECOMMENDATION:
Revise text

402.0 Installation.

402.6.1 Closet Rings (Closet Flanges). Closet rings (closet flanges) for water closets or similar fixtures shall be of an approved type and shall be copper alloy, copper, hard lead, cast-iron, galvanized malleable iron, ABS, PVC, or other approved materials. Each such The closet ring (closet flange) shall be approximately 7 inches (178 mm) in diameter and, where installed, shall, together with the soil pipe, present a 1 1/2 inch (38 mm) wide flange or face to receive the fixture gasket or closet seal.

Caulked-on closet rings (closet flanges) shall be not less than 1/4 of an inch (6.4 mm) thick and not less than 2 inches (51 mm) in overall depth.

Closet rings (closet flanges) shall be burned or soldered to lead bends or stubs, shall be caulked to cast-iron soil pipe, shall be solvent cemented to ABS and PVC, and shall be screwed or fastened in an approved manner to other materials.

Closet bends or stubs shall be cut-off to present a smooth surface even with the top of the closet ring before the rough inspection is called. Where the closet ring is installed on the closet bend or riser, the finished joint shall be present a smooth surface flush with the top of the closet ring.

402.6.3 Securing Floor-Mounted, Back-Outlet Water Closet Bowls. Floor-mounted, back-outlet water closet bowls shall be set level with an angle of 90 degrees (1.57 rad) between the floor and wall at the centerline of the fixture outlet. The floor and wall shall have a flat mounting surface not less than 5 inches (127 mm) to the right and left of the fixture outlet centerline. The fixture shall be secured to the wall outlet flange or drainage connection and the floor by corrosion resistant screws or bolts. The closet flange shall be firmly secured to a firm base. Where floor mounted, back-outlet water closets are used, the soil pipe shall be not less than 3 inches (80 mm) in diameter. Offset, eccentric, or reducing closet flanges shall not be used permitted with these fixtures.

SUBSTANTIATION:
For Section 402.6.1:
(Paragraph 4) Since closet flanges (closet flange) are unlikely to be installed, for dozens of reasons, before the rough inspection is called, that language should be eliminated. It is likely unenforceable because rarely has a finished floor level been established.
(Paragraph 5) The question has been asked thousands of time as to where the closet flange sets in relation to the floor. Here it is answered… it is designed to sit on and be securely attached to the “finished floor.” One of the reasons for the problem in paragraph 2.
(Last paragraph) This is an often asked question which needs a direct answer in the text of the code. The last paragraph of Section 402.6.3 is sometimes mistakenly used to prevent ANY offset closet ring.

For Section 402.6.3, the proposed language will make the language concise and clarify the intent of the section. Pipe size is not needed, it is clearly addressed in Tables 702.1 and 703.2.
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The current language already has the necessary requirements for the installation of closet rings. The proposed language is subjective and the text “positioned on the finished floor” creates confusion.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 050
UPC 2024  Section: 402.6.1

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION: Revise text

402.0 Installation.

402.6 Flanged Fixture Connections. (portions of text not shown remains unchanged)

402.6.1 Closet Rings (Closet Flanges). Closet rings (closet flanges) for water closets or similar fixtures shall be of an approved type and shall be copper alloy, copper, hard lead, cast-iron, galvanized malleable iron, ABS, PVC, or other approved materials. Each such closet ring (closet flange) shall be approximately 7 inches (178 mm) in diameter and, where installed, shall, together with the soil pipe, present a 1 1/2 inch (38 mm) wide flange or face to receive the fixture gasket or closet seal.

- Caulked-on closet rings (closet flanges) shall be not less than 1/4 of an inch (6.4 mm) thick and not less than 2 inches (51 mm) in overall depth.
- Closet rings (closet flanges) shall be joined as approved for the specific material in accordance with Section 705.0 burned or soldered to lead bends or stubs, shall be caulked to cast-iron soil pipe, shall be solvent cemented to ABS and PVC, and shall be screwed or fastened in an approved manner to other materials.

- Closet bends or stubs shall be cut-off to present a smooth surface even with the top of the closet ring before the rough inspection is called.
- Closet rings (closet flanges) shall be adequately designed and secured to support fixtures connected thereto.

(above shown for reference only)

705.0 Joints and Connections.

SUBSTANTIATION:
Cleans up the language by eliminating all the ways the closet ring or flange shall be joined to the riser and just references Section 705.0 (Joints and Connections).

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The current language better addresses the joining methods of closet rings. The reference to Section 705.0 is too broad and may cause confusion.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
402.6 Flanged Fixture Connections. (remaining text unchanged)

402.6.1 Closet Rings (Closet Flanges). Closet rings (closet flanges) for water closets or similar fixtures shall be of an approved type and shall be copper alloy, copper, hard lead, cast-iron, galvanized malleable iron, ABS, PVC, or other approved materials. Each such closet ring (closet flange) shall be approximately 7 inches (178 mm) in diameter and, where installed, shall, together with the soil pipe, present a 1 1/2 inch (38 mm) wide flange or face to receive the fixture gasket or closet seal.

Caulked-on closet rings (closet flanges) shall be not less than 1/4 of an inch (6.4 mm) thick and not less than 2 inches (51 mm) in overall depth.

Closet rings (closet flanges) shall be burned or soldered to lead bends or stubs, shall be caulked to cast-iron soil pipe, shall be solvent cemented to ABS and PVC, and shall be screwed or fastened in an approved manner to other materials.

Closet bends or stubs shall be cut-off to present a smooth surface even with the top of the closet ring before the rough inspection is called.

Offset, eccentric, or reducing floor mounted closet flanges that create a ledge or otherwise constrict the full opening of the water closet shall not be used.

SUBSTANTIATION:
Currently the Code only addresses the use of offset, eccentric or reducing closet flanges for floor-mounted back-outlet water closets (see Section 402.6.3). Flanges for all water closets that constrict the full opening of a water closet into the sanitary waste piping create an obstruction in flow and are not compliant with the Code per Section 310.5. The proposed language reinforces the requirement that closet flanges that cause a restriction in flow, regardless of if they are floor or wall mounted, are not Code compliant.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
This language is not needed as it is already addressed in Section 310.5 (Obstruction of Flow).

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 052
UPC 2024  Section: 402.6.3

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

402.0 Installation.

402.6 Flanged Fixture Connections. (remaining text unchanged)

402.6.3 Securing Floor-Mounted, Back-Outlet Water Closet Bowls. Floor-mounted, back-outlet water closet bowls shall be set level with an angle of 90 degrees (1.57 rad) between the floor and wall at the centerline of the fixture outlet. The floor and wall shall have a flat mounting surface not less than 5 inches (127 mm) to the right and left of the fixture outlet centerline. The fixture shall be secured to the wall outlet flange or drainage connection and the floor by corrosion-resistant screws or bolts. The closet flange shall be secured to a firm base. Offset, eccentric, or reducing closet flanges shall not be permitted with these fixtures.

Where floor-mounted, back-outlet water closets are used, the soil pipe shall be not less than 3 inches (80 mm) in diameter. Offset, eccentric, or reducing closet flanges shall not be used.

SUBSTANTIATION:
This change is an attempt to be clear and direct. Pipe size is not needed, as it is clearly stated in Table 702.1 and Table 703.2. The last sentence is moved up and modified to clarify that such offset, eccentric, or reducing closet flanges should not be permitted with the fixtures mentioned in Section 402.6.3.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 053

UPC 2024  Section: 403.4

SUBMITTER:  Ronald L George
Plumb-Tech Design & Consulting Services LLC

RECOMMENDATION:
Add new text

403.0 Accessible Plumbing Facilities.

403.4 Temperature Limits at Accessible Plumbing Fixtures. The maximum water temperature discharging from any accessible plumbing fixture shall be limited to a maximum of 110°F (43°C) by one of the methods prescribed in Section 408.3.2.

(remaining text unchanged)

408.3 Individual Shower and Tub-Shower Combination Control Valves. (remaining text unchanged)

408.3.2 Temperature Limiting. The maximum water temperature discharging from an individual showerhead shall be limited to 120°F (49°C) by one of the following methods:
(1) A shower or tub/shower combination valve conforming to ASSE 1016/ASME A112.1016/CSA B125.16 where either:
   (a) The valve is field-adjusted to the required maximum temperature, or
   (b) The handle position, stop, or temperature limiting control is set in accordance with the manufacturer’s instructions to the required maximum temperature.
(2) For gang showers supplied by a single water supply pipe, a mixing valve that conforms to ASSE 1069 that is field-adjusted to the required maximum temperature.
(3) A limiting device conforming to either ASSE 1070/ASME A112.1070/CSA B125.70 or CSA B125.3.
(4) A water heater conforming to ASSE 1084.
(5) A temperature actuated flow reduction device conforming to ASSE 1062.

SUBSTANTIATION:
Persons using accessible fixtures do not always have feeling or sensation in their body and may be scalded inadvertently because many disabled people using accessible fixtures cannot feel temperature in their extremities. Burn Studies by Dr. Moritz & Dr. Henriques at Harvard medical college showed that, at a temperature of 110°F, it took hours to develop a serious scald burn.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
This should be addressed by ADA requirements. The temperature limits for the proposed text are for 110 deg F, however, the referenced Section (408.3.2) are for temperature limits of 120 deg F, which may not apply.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 24   NEGATIVE: 1   NOT RETURNED: 1   Daniels

EXPLANATION OF AFFIRMATIVE:

BALLANCO: While the concept has merit, it is overextending since the temperature limit identified applies to lavatories, not showers and bathtubs.
EXPLANATION OF NEGATIVE:

GORSUCH: This is a good proposal and it should be in the Plumbing Code; perhaps the language can be further refined. Currently, code Section 403.3 (Exposed Pipes and Services) requires protective insulation to protect those who do not always have feelings/sensations in their legs. This proposal is in the same way to protect people who do not always have feelings/sensations in their hands.
Proposals

Item #: 054
UPC 2024  Section: 404.2 – 404.2.2

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION: Revise text

404.0 Waste Fittings and Overflows.

404.2 Overflows. Where a fixture is provided with an overflow, the overflow shall comply with Section 404.2.1 and Section 404.2.2.

404.2.1 Sinks and Bathtubs. The waste shall be so arranged that the standing water in the fixture shall not rise in the overflow where the stopper is closed or remain in the overflow where the fixture is empty. The overflow pipe from a fixture shall be connected to the house or inlet side of the fixture trap, except that overflow on flush tanks shall be permitted to discharge into the water closets or urinals served by them, but it shall be unlawful to connect such overflows with any other part of the drainage system.

404.2.2 Water Closets and Urinals. Overflows on flush tanks shall be permitted to discharge into the water closets or urinals served by them.

SUBSTANTIATION: This section is mixing overflows between sinks, water closets, urinals, and bathtubs all within the same section. However, there are different types of overflows for these sets of fixtures. The language separates the types of overflows and relocates the appropriate provision for each. This will clean up the language and add clarity to the intent.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

404.0 Waste Fittings and Overflows.

404.2 Overflows. Where a fixture is provided with an overflow, the overflow shall comply with Section 404.2.1 and Section 404.2.2.

404.2.1 Sinks, Lavatories, and Bathtubs. The waste shall be so arranged that the standing water in the fixture shall not rise in the overflow where the stopper is closed or remain in the overflow where the fixture is empty. The overflow pipe from a fixture shall be connected to the house or inlet side of the fixture trap. It shall be unlawful to connect such overflows with any other part of the drainage system.

404.2.2 Water Closets and Urinals. Overflows on flush tanks shall be permitted to discharge into the water closets or urinals served by them.

COMMITTEE STATEMENT: The existing language in Section 404.2 stating "shall be unlawful to connect such overflows with any other part of the drainage system" is outdated, overly stringent, and may create confusion regarding application to water closets, and is therefore being deleted. There are overflow and drains that are now part of the same assemblies. Additionally, the term "lavatories" is being added to Section 404.2.1 as lavatories usually have an overflow.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 055

UPC 2024 Section: 407.1, Table 1701.1

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

407.0 Lavatories.
407.1 Application. Lavatories shall comply with ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, ASME A112.19.3/CSA B45.4, ASME A112.19.12, CSA B45.5/IAPMO Z124, CSA B45.8/IAPMO Z403, CSA B45.11/IAPMO Z401 or CSA B45.12/IAPMO Z402. Group wash fixtures shall comply with the requirements of Section 401.2 and IAPMO IGC 156. Every 20 inches (508 mm) of rim space of a group wash fixture shall be considered as one lavatory for determining the number of lavatories required in accordance with Table 422.1. Lavatory assemblies with automatic soap dispensers, faucets, or hand dryers shall comply with IAPMO IGC 127.

**TABLE 1701.1**
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 156-2021</td>
<td>Wash Fountains and Lavatory Systems with or without Water Closets</td>
<td>Miscellaneous</td>
<td>407.1</td>
</tr>
</tbody>
</table>

( порtions of table not shown remain unchanged)

Note: IAPMO IGC 156 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The IAPMO IGC 156 standard covers multi faucet assemblies which are a multi-user hand washing plumbing fixture with a single water supply or single drain. This type of technology is commonly installed in public buildings such as hospitals, penal facilities, schools, factories, or places of assembly. This standard will assist the consumer and end user in verifying that such fixture assemblies are compliant with an industry standard.
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed standard is not needed as it would make the provisions for group wash fixtures overly restrictive. Furthermore, the addition of the standard does not enhance the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

SIGLER: The TC was correct in rejecting this proposed change as IAPMO IGC 156 is not the only standard that pertains to group wash fixtures (e.g., CSA B45.8/IAPMO Z403).
Proposals

Item #: 056

UPC 2024  Section: 407.7

SUBMITTER: Julius Ballanco, P.E. (JB Engineering and Code Consulting, P.C.; Bradley Corp); Jim Kendzel (ASA)

RECOMMENDATION:
Add new text

407.0 Lavatories.

407.7 Soap Dispenser. Each public lavatory shall have an accompanying soap dispenser.

SUBSTANTIATION:
The COVID-19 pandemic has identified the importance of washing one’s hand with soap. It is interesting that the code does not require soap dispensers for public lavatories. However, most engineers and architects specify soap dispensers. Plumbing contractors install soap dispensers when located in a countertop lavatory. This is an important health issue that the Plumbing Code must address.

Bibliography:
https://www.cdc.gov/handwashing/when-how-handwashing.html

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The language is overly restrictive. This should be addressed by the local jurisdiction. Additionally, the proposed language requires “each public lavatory” to have a soap dispenser which is unnecessary as there may be shared dispensers.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 18  NEGATIVE: 6  ABSTAIN: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

BONETTI, RIBBS: Overly restrictive, the concept is good but needs refinement.

GORSUCH: This proposal has good intentions, however, is not necessarily able to achieve its intent. Facilities change soaps/detergents all the time, very often the soap dispensers originally installed become obsolete after several years, then they occupy precious space, and sitting there allows pathogens to grow. Unless the industry can regulate soap dispensers and detergents, so they can be interchangeable with different detergents refills. Furthermore, it is the building owner/ facility’s responsibility to maintain soap dispensers; otherwise, empty soap dispensers will not help maintain public health either.

MANN: This is overly restrictive and should stay rejected.

NORRIS: I agree with the comments from Matt Sigler and Ramiro Mata.
EXPLANATION OF NEGATIVE:

BROWN: Agree with Matt Sigler.

CUDAHY: The proposal should include "wall or sink mounted," and it may be changed out when the building enters service, but in general, a mounted soap dispenser is a good inclusion.

FEEHAN: This language is necessary in the code.

MATA: The original proposal is overly restrictive but could have been amended to require soap dispensers and allow design professionals to determine the required number of soap dispensers according to the estimated use.

SIGLER: The TC was correct that the current language was overly restrictive as a single soap dispenser can be utilized by two public lavatories. However, a simple modification of the proposed change could have taken care of this issue. The TC was incorrect that the installation of soap dispensers should be left up to the AHJ as it is quite common for designers who use the UPC to specify the installation of soap dispensers. Furthermore, the main purpose of the UPC is to provide minimum requirements for safeguarding public health and safety. Installing a soap dispenser to help prevent the spread of disease is definitely such a requirement.

WHITE: It is within the scope of the code to promote sanitary practices; perhaps an amendment could be made to allow adjoining lavatories to share a dispenser, but the committee was wrong to reject this.

EXPLANATION OF ABSTAIN:

BALLANCO: I am abstaining because I submitted the change on behalf of a client. I was receptive to the modification offered by Matt Sigler.
Proposals

Item #: 057

UPC 2024  Section: 204.0, 408.2

SUBMITTER: Julius Ballanco, P.E.
   JB Engineering and Code Consulting, P.C.
   Rep. Self

RECOMMENDATION:
Revise text

408.0 Showers.

408.2 Water Consumption. Showerheads shall have a maximum flow rate of not more than 2.5 gpm at 80 psi (9.5 L/m at 552 kPa). [Body sprays shall have a flow rate for the shower enclosure of not more than 2.5 gpm at 80 psi (9.5 L/m at 552 kPa).]

204.0  - B -

Body Spray. A shower device for spraying water onto a bather from other than the overhead position.

SUBSTANTIATION:
The U.S. Department of Energy added a definition of body spray to Federal Law regarding water conservation. The new definition excludes body sprays from the water conservation requirements for showerheads. This change will add the definition of body spray to Chapter 2. The definition is consistent with the DOE definition. The second part of the change is to add water conservation requirements for body sprays to the shower section. The water conservation requirements are the same as the water conservation requirements for showerheads. Body sprays discharging 2.5 gpm of water provide an adequate amount of water for cleansing while showering. This has been proven with the years of experience taking showers with showerheads discharging 2.5 gpm.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

408.0 Showers.

408.2 Water Consumption. Showerheads shall have a maximum flow rate of not more than 2.5 gpm at 80 psi (9.5 L/m at 552 kPa). [Body sprays shall have a flow rate for the shower enclosure of not more than 2.5 gpm at 80 psi (9.5 L/m at 552 kPa).]

204.0  - B -

Body Spray. A shower device for spraying water onto a bather from other than the overhead position.

COMMITTEE STATEMENT:
The modification removes the phrase "the shower enclosure" to clarify that the 2.5 gpm flow rate is intended for each body spray. This will be consistent with the current shower head requirements in the UPC.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24  ABSTAIN: 1  NOT RETURNED: 1  Daniels
EXPLANATION OF ABSTAIN:

BALLANCO: As the proponent of this code change, I am abstaining to avoid any perceived conflict of interest.
Proposals

Item #: 058
UPC 2024 Section: 408.2, Table 1701.1, Table 1701.2

SUBMITTER: Bruce A Pfeiffer  
Retired - City of Topeka

RECOMMENDATION:  
Add new text

408.0 Showers.


408.2 Tileable Shower Receptors. Tileable shower receptors shall comply with CSA B45.5/IAPMO Z124. Field installed tileable and pre-tiled shower kits shall comply with IAPMO PS 106.

(renumber remaining sections)

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO PS 106-2015e¹</td>
<td>Tileable Shower Receptors and Shower Kits</td>
<td>Fixtures</td>
<td>408.2</td>
</tr>
</tbody>
</table>

(Note: CSA B45.5/IAPMO Z124 and IAPMO PS 106 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.)

<table>
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<tbody>
<tr>
<td>IAPMO-PS-106-2015e²</td>
<td>Tileable Shower Receptors and Shower Kits</td>
<td>Fixtures</td>
</tr>
</tbody>
</table>

(SUBSTANTIATION:  
This standard specifies requirements for materials, manufacture, physical characteristics, performance testing, and markings for prefabricated, tileable shower receptors; and tileable and pre-tiled shower kits that are field installed, which are not currently covered in the UPC.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

408.0 Showers.

408.1 Application. Manufactured shower receptors and shower bases shall comply with ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, ASME A112.19.3/CSAB45.4, CSA B45.12/IAPMO Z402, or CSA B45.5/IAPMO Z124. Prefabricated shower enclosures shall comply with IAPMO IGC 154.)
408.2 Tileable Shower Receptors. Tileable shower receptors and shall comply with CSA B45.5/IAPMO Z124. Field installed tileable and pre-tiled shower kits shall comply with IAPMO PS 106.

(renumber remaining sections)

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<td>Tileable Shower Receptors and Shower Kits</td>
<td>Fixtures</td>
<td>408.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

COMMITTEE STATEMENT:
The modification removes reference to the CSA B45.5/IAPMO Z124 standard as it is already referenced in IAPMO PS 106 and would be repetitive.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 059
UPC 2024  Section: 408.3.2

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Revise text

408.0 Showers.

408.3 Individual Shower and Tub-Shower Combination Control Valves. (remaining text unchanged)

408.3.2 Temperature Limiting. The maximum water temperature discharging from an individual showerhead shall be limited to 120°F (49°C) by one of the following methods:
(1) A shower or tub/shower combination valve conforming to ASSE 1016/ASME A112.1016/CSA B125.16 where either:
   (a) The valve is field-adjusted to the required maximum temperature, or
   (b) The handle position, stop, or temperature limiting control is set in accordance with the manufacturer's instructions to the required maximum temperature.
(2) For gang showers supplied by a single water supply pipe, a mixing valve that conforms to ASSE 1069 that is field-adjusted to the required maximum temperature.
(3) A limiting device conforming to either ASSE 1070/ASME A112.1070/CSA B125.70 or CSA B125.3.
(4) A water heater conforming to ASSE 1084.
(5) A temperature actuated flow reduction device conforming to ASSE 1062.

SUBSTANTIATION:
ASSE 1070, ASSE 1084 and ASSE 1062 are not designed for this application of individual showers.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
408.3 Individual Shower and Tub-Shower Combination Control Valves. Showers and tub-shower combinations shall be provided with individual control valves of the pressure balance, thermostatic, or combination pressure balance/thermostatic mixing valve type that provide scald and thermal shock protection for the rated flow rate of the installed showerhead. These valves shall be installed at the point of use and comply with ASSE 1016/ASME A112.1016/CSA B125.16 or ASME A112.18.1/CSA B125.1.

408.3.1 Gang Showers. Where gang showers are supplied with a single temperature-controlled water supply pipe, it shall be controlled by a mixing valve that complies with ASSE 1069.

408.3.2 Temperature Limiting. The maximum water temperature discharging from an individual showerhead shall be limited to 120°F (49°C) by one of the following methods:

(1) A shower or tub/shower combination valve conforming to ASSE 1016/ASME A112.1016/CSA B125.16 where either:
   (a) The valve is field-adjusted to the required maximum temperature, or
   (b) The handle position, stop, or temperature limiting control is set in accordance with the manufacturer's instructions to the required maximum temperature.

(2) For gang showers supplied by a single water supply pipe, a mixing valve that conforms to ASSE 1069 that is field-adjusted to the required maximum temperature.

(3) A limiting device conforming to either ASSE 1070/ASME A112.1070/CSA B125.70 or CSA B125.3.

(4) A water heater conforming to ASSE 1084.

(5) A temperature actuated flow reduction device conforming to ASSE 1062.

(6) Remote temperature monitoring, control and alert when lack line of sight. Temperature shall be permitted to be monitored remotely via a sensor and App to alert if mixed water exceeds 120°F (49°C) at the outlet. Temperature can also be adjusted via remote means.

SUBSTANTIATION:
The addition of this language adds public safety. The provision provides visibility to shower temperatures in a commercial facility mitigating scalding and Legionella risk, and allowing facility staff to respond quickly to over- and under-temperature performance.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language goes beyond the minimum requirements of the UPC as it addresses the monitoring of the temperature. Section 408.3.2 lists methods for limiting the temperature not monitoring. Furthermore, there is no direction as to who will do the monitoring and, therefore, unenforceable.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 061
UPC 2024  Section: 408.3.3, Table 1701.1, Table 1701.2

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Add new text

408.0 Showers.

408.3 Individual Shower and Tub-Shower Combination Control Valves. (remaining text unchanged)

408.3.3 Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings. Where individual pressure balancing in-line valves for individual fixture fittings are installed, such valves shall comply with ASSE 1066. Such valves shall be installed in an accessible location. The valves shall not be utilized alone as a substitute for the balanced pressure, thermostatic or combination shower valves requirements.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSE 1066-1997</td>
<td>Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings</td>
<td>Valves</td>
<td>408.3.3</td>
</tr>
</tbody>
</table>

Note: ASSE 1066 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

(portions of table not shown remains unchanged)

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSE-1066-1997</td>
<td>Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings</td>
<td>Valves</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
This standard applies to automatic pressure balancing in-line valves which are used to equalize incoming hot and cold water line pressures for the purpose of minimizing mixed water temperature variations due to pressure fluctuations when used in conjunction with a mixing valve or two handle valve set. They are not designed to limit the maximum outlet temperature at the point-of-use. These devices are intended for use in individual plumbing fixtures such as shower heads, bath utility faucets, and sink and lavatory faucets.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is not needed as pressure balancing valves are already addressed in Section 408.3.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 18  NEGATIVE: 7  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

FEEHAN: The language may create confusion. I think it needs to be cleaned up.

GORSUCH: Since the proposal itself said this in-line pressure-balancing valve cannot be used alone (replacing ASSE 1016), then it should not be in the mandatory standard Table 1701.1.

RIBBS: The TC action is correct. The proposed language is confusing to the AHJ. Do we need 1 or 2 valves when dealing with shower applications?

EXPLANATION OF NEGATIVE:

BROWN, CUDAHY: Agree with Matt Sigler.

KREITENBERG: Overly restrictive requirement.

MATA: Approving this proposal provides another option to the design professional.

NIELSEN: I feel the proponent gave a legitimate reason for adding devices listed to ASSE 1066 and the committee's substantiation for rejection is not.

SIGLER: The committee's statement for rejecting this proposed change is not correct as individual pressure balancing in-line valves that are installed in accordance with ASSE 1066 are not recognized in Section 408.3. Such valves should be a viable option for a plumbing designer or contractor.

WHITE: These devices should be recognized in the code for the specific reasons listed and given by the proponent.
Proposals

Item #: 062

UPC 2024  Section: 408.3.4

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Add new text

408.0 Showers.

408.3 Individual Shower and Tub-Shower Combination Control Valves. (remaining text unchanged)

408.3.4 Temperature-Actuated, Flow-Reduction Devices for Individual Fixture Fittings. Temperature-actuated, flow-reduction devices, where installed for individual fixture fittings, shall comply with ASSE 1062. A temperature-actuated, flow-reduction device shall be an approved method for limiting the water temperature to not more than 120°F (49°C) at the outlet of a faucet or fixture fitting. Such devices shall not be used alone as a substitute for the balanced-pressure, thermostatic or combination shower valves requirements or as a substitute for bathtub or whirlpool tub water-temperature-limiting valves requirements.

Note: ASSE 1062 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
This standard applies to temperature actuated, flow reduction (TAFR) valves for individual supply fittings (herein referred to as the “device”) that react to high temperature water. These valves are intended for use in-line with, or integrated into, individual plumbing supply fittings such as shower heads, bath and utility faucets, and sink and lavatory faucets. When intended for use by people with disabilities, TAFR valves covered by this standard shall also comply with ICC Standard A117.1. The use of TAFR valves does not replace the requirements for valves compliant to ASSE 1016 / ASME A112.1016 / CSA B125.16, ASSE 1069, or ASSE 1070 / ASME A112.1070 / CSA B125.70, as outlined in the model codes.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

408.0 Showers.

408.3 Individual Shower and Tub-Shower Combination Control Valves. (remaining text unchanged)

408.3.4 Temperature-Actuated, Flow-Reduction Devices for Individual Fixture Fittings. Temperature-actuated, flow-reduction devices, where installed for individual fixture fittings, shall comply with ASSE 1062. A temperature-actuated, flow-reduction device shall be an approved method for limiting the water temperature to not more than 120°F (49°C) at the outlet of a faucet or fixture fitting. Such devices shall not be used alone as a substitute for the balanced-pressure, thermostatic or combination shower valves requirements or as a substitute for bathtub or whirlpool tub water-temperature-limiting valves requirements.

COMMITTEE STATEMENT:
The proposal is being modified to strike the second sentence as it is already addressed in the standard and product literature and does not need to be repeated.
TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 063
UPC 2024  Section: 408.4

SUBMITTER: Kevin Ernst
OS&B

RECOMMENDATION:
Revise text

408.0 Showers.

408.4 Waste Outlet. Showers shall have a waste outlet and fixture tailpiece not less than 2 inches (50 mm) in diameter. Fixture tailpieces shall be constructed from the materials specified in Section 701.2 for drainage piping. Strainers serving shower drains shall have a waterway at least equivalent to the area of the tailpiece.

(below shown for reference only)

404.0 Waste Fittings and Overflows.

404.1 Waste Fittings. Waste fittings shall comply with ASME A112.18.2/CSA B125.2, ASTM F409 or Table 701.2 for aboveground drainage piping and fittings.

SUBSTANTIATION:
Current wording is design restrictive. The shower drain must comply to the requirements of ASME A112.18.2/CSA B125.2 - 2020 as per Section 404.1. Within this standard there is a flow performance test in Sections 5.8.1 - 5.8.2. As long as the shower drain is certified to the standard and meets the required flow rate, there isn't a need to be prescriptive with the grate sizing.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The provided substantiation is insufficient to justify the change being proposed. In addition, the requirement being stricken needs to be included in the code so the installer has access to necessary provisions and guidance.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 18  NEGATIVE: 7  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

BONETTI: The size and design of the strainer need to remain.

MANN: I agree with the comment by Ramiro Mata. Furthermore, the sentence should be stricken as it is confusing.

NORRIS: I agree with the comment from Ramiro Mata.

RIBBS: I agree with the TC action to reject the proposal. The last sentence is needed to ensure proper drainage of the shower compartment.

EXPLANATION OF NEGATIVE:

BALLANCO: The change was properly substantiated and should have been approved as submitted.

BROWN, GORSUCH, WHITE: I agree with Ramiro Mata.
FEEHAN: The last sentence is not necessary because of Section 404.1.

MATA: The proponent has provided adequate technical justification using flow rate requirements stipulated in CSA B125.2/ASME A112.18.2.

SIGLER: I agree with Ramiro Mata. ASME A112.18.2/CSA B125.2 addresses shower drain requirements, which is referenced in Section 404.1. Therefore, the last sentence in Section 408.4 should be deleted.
Item #: 064

UPC 2024  Section: 408.5

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Revise text

408.0 Showers.

408.5 Finished Curb or Threshold. Where a shower receptor has a finished dam, curb, or threshold, it shall be not less than 1 inch (25.4 mm) lower than the sides and back of such receptor. In no case, shall a dam or threshold be less than 2 inches (51 mm) or exceeding 9 inches (229 mm) in depth where measured from the top of the dam or threshold to the top of the drain. Each such receptor shall be provided with an integral nailing flange either integral or field installed in accordance with the manufacturer's installation instructions, to be located where the receptor meets the vertical surface of the finished interior of the shower compartment. The flange shall be watertight and extend vertically not less than 1 inch (25.4 mm) above the top of the sides of the receptor. The finished floor of the receptor shall slope uniformly from the sides towards the drain not less than 1/8 inch per foot (10.4 mm/m), nor more than 1/2 inch per foot (41.6 mm/m). Thresholds shall be of sufficient width to accommodate a minimum 22 inch (559 mm) door. Shower doors shall open so as to maintain not less than a 22 inch (559 mm) unobstructed opening for egress. Where there is a shower without a threshold, the floor space within the same room shall be considered a wet location and shall comply with the requirements of the building, residential, and electrical codes.

Exceptions:
(1) Showers in accordance with Section 403.2.
(2) A cast-iron shower receptor flange shall be not less than 0.3 of an inch (7.62 mm) in height.
(3) For flanges not used as a means of securing, the sealing flange shall be not less than 0.3 of an inch (7.62 mm) in height.

SUBSTANTIATION:
The shower receptor must be installed with the nailing flange at rough wall. If the flange were at the finished interior the receptor would not be watertight. The 2021 UPC Section 408.1 requires manufactured shower receptors and shower bases to comply with ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, ASME A112.19.3/CSAB45.4, CSA B45.12/IAPMO Z402, or CSA B45.5/IAPMO Z124. All these standards give three options for the flanges:
(a) integral with the bathtub or shower base;
(b) added to an island tub or shower base in the factory; or
(c) field installed using a flange kit.

For this reason, Section 408.5 should be updated to allow for integral or field installed nailing flanges.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

408.0 Showers.

408.5 Finished Curb or Threshold. Where a shower receptor has a finished dam, curb, or threshold, it shall be not less than 1 inch (25.4 mm) lower than the sides and back of such receptor. In no case, shall a dam or threshold be less than 2 inches (51 mm) or exceeding 9 inches (229 mm) in depth where measured from the top of the dam or threshold to the
top of the drain. Each such receptor shall be provided with an integral nailing flange either integral or field installed in accordance with the manufacturer’s installation instructions. The flange shall be watertight and extend vertically not less than 1 inch (25.4 mm) above the top of the sides of the receptor. The finished floor of the receptor shall slope uniformly from the sides towards the drain not less than 1/8 inch per foot (10.4 mm/m), nor more than 1/2 inch per foot (41.6 mm/m).

Thresholds shall be of sufficient width to accommodate a minimum 22 inch (559 mm) door. Shower doors shall open so as to maintain not less than a 22 inch (559 mm) unobstructed opening for egress. Where there is a shower without a threshold, the floor space within the same room shall be considered a wet location and shall comply with the requirements of the building, residential, and electrical codes.

Exceptions:
(1) Showers in accordance with Section 403.2.
(2) A cast-iron shower receptor flange shall be not less than 0.3 of an inch (7.62 mm) in height.
(3) For flanges not used as a means of securing, the sealing flange shall be not less than 0.3 of an inch (7.62 mm) in height.

COMMITTEE STATEMENT:
The modification will correct a grammatical error by striking "an integral" as it was repetitive.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 065
UPC 2024  Section: 408.6

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

408.0 Showers.

408.6 Shower Compartments. Shower compartments, regardless of shape, shall have a minimum finished interior of in accordance with the following:

(1) Not less than 1024 square inches (0.6606 m²) and shall also be capable of encompassing a 30 inch (762 mm) circle.
(2) Be of sufficient dimension to accommodate a 30 inch (762 mm) circle.

The minimum required area and dimensions shall be measured at a height equal to the top of the threshold and a point tangent to its centerline. The area and dimensions shall be maintained to a point of not less than 70 inches (1778 mm) above the shower drain outlet with no protrusions other than the fixture valve or valves, showerheads, soap dishes, shelves, and safety grab bars, or rails. Fold-down seats in accessible shower stalls shall be permitted to protrude into the 30 inch (762 mm) circle.

Exceptions:
(1) Showers that are designed to be in accordance with ICC A117.1.
(2) The minimum required area and dimension shall not apply for a shower receptor having overall dimensions of not less than 30 inches (762 mm) in width and 60 inches (1524 mm) in length.

SUBSTANTIATION:
This change is intended to simplify the requirements for the area required for a shower compartment. Putting the requirements into a list format is preferable to the language in a paragraph form and is easier to comprehend. Additionally, an additional metric dimension is being added to simplify the dimension.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

408.0 Showers.

408.6 Shower Compartments. Shower compartments shall have a finished interior in accordance with the following:

(1) Not less than 1024 square inches (0.6606 m²).
(2) Be of sufficient dimension to accommodate a 30 inch (762 mm) circle.

The minimum required area and dimensions shall be measured at a height equal to the top of the threshold and a point tangent to its centerline. The area and dimensions shall be maintained to a point of not less than 70 inches (1778 mm) above the shower drain outlet with no protrusions other than the fixture valve or valves, showerheads, soap dishes, shelves, and safety grab bars, or rails. Fold-down seats in accessible shower stalls shall be permitted to protrude into the 30 inch (762 mm) circle.

Exceptions:
(1) Showers that are designed to be in accordance with ICC A117.1.
(2) The minimum required area and dimension shall not apply for a shower receptor having overall dimensions of not less than 30 inches (762 mm) in width and 60 inches (1524 mm) in length.
COMMITTEE STATEMENT:
The proposal is being modified to keep the language “capable of encompassing” for clarity and to keep the intent of the requirement regarding a 30 inch circle.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
408.0 Showers.

408.7 Lining for Showers and Receptors. Shower receptors built on-site shall be watertight and shall be constructed from approved-type dense, nonabsorbent, and noncorrosive materials. Each such receptor shall be adequately reinforced, shall be provided with an approved flanged floor drain designed to make a watertight joint on the floor, and shall have smooth, impervious, and durable surfaces. Unless the shower receptor is poured on the ground as part of a slab, an approved shower liner shall be provided in accordance with the requirements of this section.

Shower receptors shall have the subfloor and rough side of walls to a height of not less than 3 inches (76 mm) above the top of the finished dam or threshold shall be first lined with sheet plastic, lead, or copper, or shall be lined with other durable and watertight materials. Showers that are provided with a built in place, permanent seat or seating area that is located within the shower enclosure, shall be first lined with sheet plastic, lead, copper, or shall be lined with other durable and watertight materials that extend not less than 3 inches (76 mm) above horizontal surfaces of the seat or the seating area.

Lining materials shall be pitched 1/4 inch per foot (20.8 mm/m) to weep holes in the subdrain of a smooth and solidly formed subbase. Such lining materials shall extend upward on the rough jambs of the shower opening to a point not less than 3 inches (76 mm) above the horizontal surfaces of the seat or the seating area, the top of the finished dam or threshold and shall extend outward over the top of the permanent seat, permanent seating area, or rough threshold and be turned over and fastened on the outside face of both the permanent seat, permanent seating area, or rough threshold and the jams.

Nonmetallic shower subpans or linings shall be permitted to be built up on the job site of not less than three layers of standard grade 15 pound (6.8 kg) asphalt impregnated roofing felt. The bottom layer shall be fitted to the formed subbase and each succeeding layer thoroughly hot-mopped to that below. Corners shall be carefully fitted and shall be made strong and watertight by folding or lapping, and each corner shall be reinforced with suitable webbing hot-mopped in place.

Folds, laps, and reinforcing webbing shall extend not less than 4 inches (102 mm) in all directions from the corner, and webbing shall be of approved type and mesh, producing a tensile strength of not less than 50 pounds per square foot (lb/ft²) (244 kg/m²) in either direction. Nonmetallic shower subpans or linings shall be permitted to consist of multilayers of other approved equivalent materials suitably reinforced and carefully fitted in place on the job site as elsewhere required in this section.

Linings shall be properly recessed and fastened to the approved backing so as not to occupy the space required for the wall covering, and shall not be nailed or perforated at a point that is less than 1 inch (25.4 mm) above the finished dam or threshold. An approved type subdrain shall be installed with a shower subpan or lining. Each such subdrain shall be of the type that sets flush with the subbase and shall be equipped with a clamping ring or other device to make a tight connection between the lining and the drain. The subdrain shall have weep holes into the waste line. The weep holes located in the subdrain clamping ring shall be protected from clogging.
SUBSTANTIATION:
The proposed added language clarifies that an exception for onsite built shower receptors that are poured and built directly on the ground, adequately reinforced, and watertight do not required shower liners as prescribed in the first two sentences of the paragraph. The proposed change is consistent with the intent of the current language of this section (408.7) but adds clarity to avoid continued confusion, for a more consistent code enforcement of this provision. An acceptable shower receptor that qualifies is one that is poured-in-place receptor construction, complete with integral threshold, sides and back directly supported by the underlying ground, and impervious watertight receptor as prescribed. The existing language of this section requires sides and back of the receptor pour must extend at least three inches above the finished threshold before wall covering.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The text is not necessary as the code already requires the shower receptor to be watertight.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 067
UPC 2024  Section: 408.7.5

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Revise text

408.0 Showers.

408.7.5 Tests for Shower Receptors. Shower receptors shall be tested for watertightness by filling with water to the level of the rough threshold—a depth of not less than 2 inches (51 mm) for not less than 15 minutes. Where no threshold is present, a 2 inch (51 mm) barrier shall be temporarily constructed for testing. The test plug shall be so placed that both upper and under sides of the subpan shall be subjected to the test at the point where it is clamped to the drain.

SUBSTANTATION:
The existing language does not have guidance for water depth or time requirement for testing the shower beds. The proposed depths are standard in the industry and will assist the end user install a watertight shower receptor.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

WHITE: I agree that a time requirement would facilitate the inspection process, historically testing of shower pans has been to the overflow depth of the threshold, this would simulate the accumulated pressure of a stopped drain. I see no referenced standard for the 2-inch depth other than the statement that it is a "standard." Furthermore, if there is no threshold, there will be no accumulated pressure of retained water other than what accumulates on the floor, building a temporary retaining dam is burdensome and unnecessary.
Item #: 068
UPC 2024  Section: 408.9

SUBMITTER: Steven Hart
Public Health-Seattle & King County

RECOMMENDATION:
Revise text

408.9 Location of Valves and Heads. Control valves and showerheads shall be located on the a sidewall of the shower compartments or otherwise and arranged so that the showerhead does not discharge directly at the entrance to into the shower compartment so that and the bather can adjust the valve(s) before stepping into the shower spray.

Exception: Shower valve(s) or shower head(s) can be placed in an alternate location when approved by the Authority Having Jurisdiction.

SUBSTANTIATION:
There may be occasions when the shower valve may need to be installed opposite of the shower door entrance (rear wall) due to no access at side walls. There may be instances where the valves may need to be outside of the shower compartment for safety reasons to prevent thermal shock rather than arranged at the rear wall of the shower compartment. This is a concern for elderly, children, or persons with disabilities who would not expect thermal shock.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The language is not needed as the original language is direct and concise regarding the location of the shower valve.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

GORSUCH: I believe the current code language conflicts with building code language regarding ADA shower valve location. The current code needs to be revised to be aligned with the building code.
Proposals

Item #: 069
UPC 2024  Section: 409.4

SUBMITTER: Bruce Fathers
Watts Water Technologies

RECOMMENDATION:
Revise text

409.0 Bathtubs and Whirlpool Bathtubs.

409.4 Limitation of Hot Water Temperature in Bathtubs and Whirlpool Bathtubs. The maximum hot water temperature discharging from the bathtub and whirlpool bathtub filler shall be limited to 120°F (49°C). The maximum temperature shall be regulated by one of the following means:
(1) A limiting device conforming to either ASSE 1070/ASME A112.1070/CSA B125.70 or CSA B125.3.
(2) A water heater conforming to ASSE 1084.
(3) Remote temperature monitoring, control and alert when lack line of sight. Temperature shall be permitted to be monitored remotely via a sensor and App to alert if mixed water exceeds 120°F (49°C) at the outlet. Temperature can also be adjusted via remote means.

SUBSTANTIATION:
The addition of this language adds public safety. The provision provides visibility to whirlpool temperatures in a commercial/institutional facility mitigating scalding and Legionella risk and allowing facility staff to respond quickly to over- and under-temperature performance via App alerts.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language goes beyond the minimum requirements of the UPC as it addresses the monitoring of the temperature. Section 409.4 lists methods for limiting the temperature not monitoring. Furthermore, there is no direction as to who will do the monitoring and, therefore, unenforceable.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 070
UPC 2024  Section: 409.6.1

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

409.0 Bathtubs and Whirlpool Bathtubs.

409.6 Installation and Access. Bathtubs and whirlpool bathtubs shall be installed in accordance with the manufacturer’s installation instructions. Access openings shall be of a size and opening to permit the removal and replacement of the circulation pump.

   Whirlpool pump access located in the crawl space shall be located not more than 20 feet (6096 mm) from an access door, trap door, or crawl hole.
   The circulation pump shall be located above the crown weir of the trap.
   The pump and the circulation piping shall be self-draining to minimize water retention.

409.6.1 Suction Fittings. Suction fittings on whirlpool bathtubs shall comply with ASME A112.19.7/CSA B45.10. (renumber remaining sections)

SUBSTANTIATION:
Whirlpool suction fitting are too important to be lost in a paragraph. This change relocates the suction fitting into it’s own section as it has nothing to do with access or installation.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 071
UPC 2024  Section: 411.2

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

411.0 Water Closets.

411.1 Application. Water closets shall comply with ASME A112.19.2/CSA B45.1, ASME A112.19.3/CSA B45.4, or CSA B45.5/IAPMO Z124. Water closet bowls for public use shall be of the elongated type. In nurseries, schools, and other similar places where plumbing fixtures are provided for the use of children less than 6 years of age, water closets shall be of a size and height suitable for children’s use.

411.2 Hydraulic Performance. Water closet hydraulic performance shall be in accordance with ASME A112.19.2/CSA B45.1.

Note: ASME A112.19.2/CSA B45.1 meets the requirements for a mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The maximum water closet flushing volume requirements and acceptable testing variations are specified in ASME/ANSI A112.19.6 for hydraulic performance.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is being rejected as hydraulic performance is already addressed in the existing standards in Section 411.1.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 072
UPC 2024  Section: 411.2.1, 411.2.2. Table 1701.1, Table 1701.2

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

411.0 Water Closets.

411.2 Water Consumption. (remaining text unchanged)
411.2.1 Dual Flush Water Closets. Dual flush water closets shall comply with ASME A112.19.14 or IAPMO PS 50. The effective flush volume for dual flush water closets shall be defined as the composite, average flush volume of two reduced flushes and one full flush.
411.2.2 Dual Flush Valves. Dual flush water closet valves shall comply with IAPMO PS 50 or ASME A112.19.10.

(renumber remaining sections)

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME A112.19.10-2017</td>
<td>Retrofit Dual Flush Devices for Water Closets</td>
<td>Fixtures</td>
<td>411.2.2</td>
</tr>
<tr>
<td>IAPMO PS 50-2019</td>
<td>Flush Valves with Dual Flush Device for Water Closets or Water Closet Tanks with Integral Flush Valves with a Dual Flush Device</td>
<td>Fixtures</td>
<td>411.2.1, 411.2.2</td>
</tr>
</tbody>
</table>

Note: ASME A112.19.10 and IAPMO PS 50 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME A112.19.10-2017</td>
<td>Retrofit Dual Flush Devices for Water Closets</td>
<td>Fixtures</td>
</tr>
<tr>
<td>IAPMO PS 50-2019</td>
<td>Flush Valves with Dual Flush Device for Water Closets or Water Closet Tank with an Integral Flush Valves with a Dual Flush Device</td>
<td>Fixtures</td>
</tr>
</tbody>
</table>

SUBSTANTIATION:
The current language is only covering water closets with integrated dual flush valves. However, there are dual flush valves that are either separate flush valves or as part of a complete water closet assembly. The proposed change will clarify the appropriate standard required for either.
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as ASME A112.19.10 is not an equivalent standard to IAPMO PS 50 regarding dual flush water closets. Furthermore, the ASME A112.19.10 standard is not needed as it does not address all the necessary requirements for dual flush water closets.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels

EXPLANATION OF AFFIRMATIVE:

SIGLER: The TC was correct to reject this proposal. However, the committee statement, in my opinion, does not accurately capture the reasons why this proposal should be rejected, such as:
• IAPMO PS 50 requires water closets with new devices installed, and water closets with integral flush valves, to comply with ASME A112.19.14. Therefore, IAPMO PS 50 cannot be listed in Section 411.2.1 as being equivalent to ASME A112.19.14.
• ASME A112.19.10 should be discontinued. Products covered by this standard modifies an existing product made by a different manufacturer. There is no guarantee that the water consumption will be reduced and performance of the water closet will comply with ASME A112.19.2. When this is done, the warranty of the product that got modified becomes null and void, and the consumer is the one who suffers if something were to go wrong with the original product.
411.0 Water Closets.

411.3 Water Closet Seats. Water closet seats shall be properly sized for the water closet bowl type, and shall be of smooth, non-absorbent material. Seats, for public or employee use, shall be of the elongated type and either of the open front type or have an automatic seat cover dispenser. Plastic seats shall comply with IAPMO Z124.5. Seats that are integral to the water closet shall be of the same material as the fixture.

SUBSTANTIATION:
The proposed language will prevent different materials to be utilized as water closet seats. This will prevent unsanitary conditions where bacteria can grow and collect in seams and glue if two or more materials are used. Furthermore, the addition of employees clarifies the intent of place of work or public workspace as meeting the same intent as the public.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is overly stringent and unenforceable as a permit is not required to replace a water closet seat.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

SIGLER: Additional reasons for rejecting this proposal:
- As proposed, this would prohibit plastic toilet seats from being used with ceramic toilets.
- What technical data exists to show that there are health risks associated with a toilet seat that is of a different material than the toilet fixture?
Proposals

Item #: 074

UPC 2024  Section: 411.3

SUBMITTER:  Bruce A Pfeiffer  
Retired - City of Topeka

RECOMMENDATION:  
Revise text

411.0 Water Closets.

411.3 Water Closet Seats.  Water closet seats shall be properly sized for the water closet bowl type, and shall be of smooth, non-absorbent material.  Seats, for public use, shall be of the elongated type and either of the open front type or have an automatic seat cover dispenser.  Plastic seats with or without covers shall comply with IAPMO Z124.5.

SUBSTANTIATION:  
The proposed change is to concede with the reference standard as it addresses toilet seat covers as part of the standard and therefore, it is needed for clarity.

COMMITTEE ACTION:  REJECT

COMMITTEE STATEMENT:  
The language is not needed as the standard already states that it addresses water closets with or without seat covers.

TOTAL ELIGIBLE TO VOTE:  26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 075
UPC 2024  Section: 412.1

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

412.0 Urinals.

412.1 Application. Urinals shall comply with ASME A112.19.2/CSA B45.1, ASME A112.19.19, or CSA B45.5/IAPMO Z124. Urinals shall have an average water consumption not to exceed 1 gallon (3.8 Lpf) of water per flush. The hydraulic performance for urinals using water for flushing shall be in accordance with ASME A112.19.2/CSA B45.1 or CSA B45.5/IAPMO Z124.

Note: ASME A112.19.2/CSA B45.1 and CSA B45.5/IAPMO Z124 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The maximum water volume supplied water-urinal should meet the requirements and acceptable testing variations that are specified in ASME/ANSI A112.19.2/CSA B45.1 and CSA B45.5/IAPMO Z124 for hydraulic performance.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the hydraulic performance is already addressed in the referenced standards of Section 412.1.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 076
UPC 2024 Section: 412.1.1

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

412.0 Urinals.

412.1 Application. (remaining text unchanged)

412.1.1 Nonwater Urinals. Nonwater urinals shall have a liquid barrier sealant to maintain a trap seal. **Nonwater urinals shall permit the uninhibited flow of waste through the urinal to the sanitary drainage system.** Nonwater urinals shall be cleaned and maintained in accordance with the manufacturer’s instructions after installation. Where nonwater urinals are installed, not less than one water supplied fixture rated at not less than 1 water supply fixture unit (WSFU) shall be installed upstream on the same drain line to facilitate drain line flow and rinsing. Where nonwater urinals are installed, they shall have a water distribution line rough-in to each individual urinal location to allow for the installation of an approved backflow prevention device in the event of a retrofit.

SUBSTANTIATION:
Many of the new non-water type urinals include integral mechanical devices in their cartridges for the purpose of odor control. The urinals and cartridges must be tested and must meet applicable standards, including tests for adequate flow through the devices. They do not however meet the requirements of the Code because they may cause a small reduction in flow. Removing this sentence would allow manufacturers the ability to explore the use of designs that could possibly reduce or eliminate the odors associated with these products. These odor control devices are not intended to take the place of the required liquid barrier seal and one is still required on all non-water urinals as prescribed by Code.

COMMITTEE ACTION: **REJECT**

COMMITTEE STATEMENT:
The language being stricken is required for health and safety. There are also concerns that the flow may become restricted and cause backups.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: **AFFIRMATIVE: 25**  **NOT RETURNED: 1  Daniels**
Proposals

Item #: 077

UPC 2024  Section: 222.0, 412.1.1

SUBMITTER: Fredi Heimberg
STEADYFREDY LLC
Rep. URIMAT Schweiz AG

RECOMMENDATION:
Revise text

412.0 Urinals.

412.1.1 Nonwater Urinals. Nonwater urinals shall have a liquid barrier sealant or a membrane valve to maintain a trap seal. Nonwater urinals shall permit the uninhibited flow of waste through the urinal to the sanitary drainage system. Nonwater urinals shall be cleaned and maintained in accordance with the manufacturer’s instructions after installation. Where nonwater urinals are installed, not less than one water supplied fixture rated at not less than 1 water supply fixture unit (WSFU) shall be installed upstream on the same drain line to facilitate drain line flow and rinsing. Where nonwater urinals are installed, they shall have a water distribution line rough-in to each individual urinal location to allow for the installation of an approved backflow prevention device in the event of a retrofit.

222.0  — T —
Trap. A fitting or device so designed and constructed as to provide, where properly vented, a liquid seal or a membrane valve that will prevent the back passage of air without materially affecting the flow of sewage or wastewater through it.

SUBSTANTIATION:
Technical substantiation / reason statement for including membrane valves/traps for waterless urinals in the new standard:

Membrane valves (traps) in waterless urinal applications were introduced more than 15 years ago and they have proven their quality & effectiveness since then in worldwide applications. Traps operating according to the principle described below are used by the majority of companies in the urinal market segment such as Geberit, Sloan/Falcon Water Technologies, Franke, Keramag, Ideal Standard, Duravit, Kuhfuss, SphinX, Culu, Whiffaway, URIMAT and others. In Europa, Asia, South America and Australia they are widely used in waterless urinals. Today the majority of the worldwide waterless urinal market operates on membrane-/trap- technology.

The membrane valves/traps are designed as one-way valves. The membrane traps can be made of waterproof materials such as Rubber, Silicon or even plastic (LDPE) and these materials make the membrane trap hold the lips close. When used, the valve opens in only one direction. It allows liquid (urine) to flow through and immediately closes shut afterward. It prevents the stink by not letting the odor from the drainage pass back into the urinal. Just like the liquid sealant, the membrane valve also needs to be replaced after a few thousand uses. Therefore, the performance of such membrane valves is very good compared to the technology of a liquid barrier.

Another advantage of membrane valves in waterless urinals is the fact, that no barrier liquid is needed or has to be renewed. Due to that chemicals which can cause health and safety issues can be completely avoided on these products. In addition membranes are more reliable in terms of service and maintenance. They offer more security when "flushing the urinal", because there is no liquid barrier to break.
The similar rubber membrane technology is used for floor drains to prevent odor problems when water-siphons become dry. These products are also well-established in the American market, for instance Green Drain.

The European guideline (https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32013D0641&from=DE) makes no difference for the trap technology, the trap as such (with liquid barrier or with a membrane valve) has to fulfill the different test procedures.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
There is no standard for a membrane valve. A urinal is required to maintain a liquid seal and should remain that way. A membrane seal is a mechanical seal and may fail.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 078
UPC 2024  Section: 414.1

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Delete text without substitution

414.0 Dishwashing Machines.

414.1 Application. Domestic dishwashing machines shall comply with UL 749. Commercial dishwashing machines shall comply with NSF 3 and UL 921.

(renumber remaining sections)

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF 3-2017</td>
<td>Commercial Warewashing Equipment</td>
<td>Appliances</td>
<td>414.1</td>
</tr>
<tr>
<td>UL-749-2018</td>
<td>Household Dishwashers</td>
<td>Appliances</td>
<td>414.1</td>
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<tr>
<td>UL 921-2016</td>
<td>Commercial Dishwashers (with revisions through September 20, 2017)</td>
<td>Appliances</td>
<td>414.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
This section is not enforceable and does not provide any information to the installer. These standards are not marked on the dishwashers and are not contained in the manufacturer's specifications.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Dishwashers are commonly used and the standards are needed to confirm that they are meeting minimum requirements. The language is needed for sanitation of dishwashers as it is an important health and safety requirement in the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

FEEHAN: This is necessary information for field inspectors.

EXPLANATION OF NEGATIVE:

RODIO: This section is not enforceable and provides no information to the installer. Dishwashers are typically provided by the developer and not selected by the plumbing contractor. Once they are installed it is difficult if not impossible for an inspector to confirm that the dishwasher meets these listed standards. Typically, the standards are not marked on the
dishwashers. The installation instructions often do not contain a listing of any standards that they may meet. The inspector and installer typically look for the UL stamp and that is sufficient.
Proposals

Item #: 079

UPC 2024  Section: 414.1, Table 1701.1

SUBMITTER: Joel Rigler
Self

RECOMMENDATION:
Revise text

414.0 Dishwashing Machines.

414.1 Application. Domestic dishwashing machines shall comply with NSF 184 and UL 749. Commercial
dishwashing machines shall comply with NSF 3 and UL 921.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>NSF/ANSI 184-2019</td>
<td>Residential Dishwashers</td>
<td>Appliance</td>
<td>414.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: NSF/ANSI 184 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
NSF 184 is a standard for residential dishwashers. NSF 184 is very similar to NSF 3 regarding strict sanitary
requirements, but for residential dishwashers. This standard helps confirm that a residential dishwasher can achieve
a minimum 99.999 percent or 5-log reduction of bacteria when operated on the sanitizing cycle. In addition to
confirming the unit’s ability to sanitize dishes and cookware, NSF/ANSI 184 also establishes minimum design and
performance requirements related to cleaning effectiveness. This standard will be in addition to the UL 749 standard
which covers the domestic dishwasher’s electrical components.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
This requirement is overly stringent as the NSF 184 standard contains requirements for sanitation cycles which are
not included on all dishwashing machines.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 080

UPC 2024  Section: 414.3

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

414.0 Dishwashing Machines.

414.3 Drainage Connection. Domestic dishwashing machines shall discharge indirectly through an air gap fitting in accordance with Section 807.3 into a waste receptor, a wye branch fitting on the tailpiece of a kitchen sink, or dishwasher connection of a food waste disposer. Commercial dishwashing machines shall discharge indirectly through an air break or direct connection. The indirect discharge for commercial dishwashing machines shall be in accordance with Section 807.1, and the or by a direct connection discharge shall be in accordance with Section 704.3.

SUBSTANTIATION:
The modification is removing duplicate text regarding indirect connections for commercial dishwashing machines. The change will make the commercial dishwashing section direct and clear as to what connection options are permitted.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 081
UPC 2024  Section: 414.3

SUBMITTER: Cathy Tran
MN DEPT OF LABOR & INDUSTRY

RECOMMENDATION:
Revise text

414.0 Dishwashing Machines.

414.3 Drainage Connection. Domestic dishwashing machines shall discharge indirectly through an air gap fitting in accordance with Section 807.3 into a waste receptor, a wye branch fitting on the tailpiece of a kitchen sink, or dishwasher connection of a food waste disposer. Commercial dishwashing machines shall discharge indirectly by means of an air gap or an air break through an air break or direct connection. The indirect discharge for commercial dishwashing machines shall be in accordance with Section 807.1, and or the direct discharge shall be in accordance with Section 704.3.

SUBSTANTIATION:
The proposed change seeks to clarify that both an air break and air gap are acceptable means of indirect waste discharge for a commercial dishwasher. As currently written, the existing language precludes the indirect discharge of a commercial dishwasher through an air gap by allowing only an air break for the indirect discharge. An air gap is an acceptable indirect discharge method that is more protective than an indirect by an air break and consistent with Section 807.1 for drainage by indirect waste pipes discharging into an approved type of open receptor for commercial dishwashers, and should be amended to reflect as such. If splashing is a concern in an air gap discharge, it is already addressed under Section 804.1 for open waste receptors.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is too permissive by allowing an air gap or an air break. An air break is sufficient in accordance to the degree of hazard for such appliances.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Dishwashing machines shall comply with the lead content requirements of Section 604.2.

Water heaters shall comply with the lead content requirements of Section 604.2.

The maximum allowable lead content in pipes, pipe fittings, plumbing fittings, and fixtures intended to convey or dispense water for human consumption shall be not more than a weighted average of 0.25 percent with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures. For solder and flux, the lead content shall be not more than 0.2 percent where used in piping systems that convey or dispense water for human consumption.

Exceptions:
(1) Pipes, pipe fittings, plumbing fittings, fixtures, or backflow preventers used for nonpotable services such as manufacturing, industrial processing, irrigation, outdoor watering, or any other uses where the water is not used for human consumption.
(2) Flush valves, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are 2 inches (50 mm) in diameter or larger.

SUBSTANTIATION:
In September of 2020, the EPA finalized its final rule for interpreting the Safe Drinking Water Act. The final rule did change scope of products affected by the lead content requirements and sited dishwashers and water heaters as fixtures used for potable water according the final rule. See definition below:

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 083
UPC 2024  Section: 415.1, 415.2

SUBMITTER: Donald L. Strickland, FASPE, CPD, GPD
TK1SC

RECOMMENDATION:
Revise text

415.0 Drinking Fountains.
415.1 Application. Drinking fountains shall be self-closing and comply with ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, or ASME A112.19.3/CSA B45.4. Drinking fountains and bottle filling stations shall also comply with NSF 61. Permanently installed electric water coolers and bottle filling stations shall also comply with UL 399.

415.2 Drinking Fountain Alternatives. Where food is consumed indoors, water stations shall be permitted to be substituted for drinking fountains. Bottle filling stations shall be permitted to be substituted for drinking fountains up to 50 percent of the requirements for drinking fountains. Drinking fountains shall not be required for an occupant load of 30 or less.

SUBSTANTIATION:
The text is addressing a concern with health and safety. As written, the language is overly restrictive to allow only 50 percent of drinking fountains to be substituted with bottle filling stations. There are jurisdictions that find drinking fountains unsanitary as many persons use it and there are no means of sanitizing drinking fountains. Additionally, if bottle filling stations are accepted as an equal to drinking fountains, then bottle filling stations should comply to the same requirements.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

415.0 Drinking Fountains.
415.1 Application. Drinking fountains shall be self-closing and comply with ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, or ASME A112.19.3/CSA B45.4. Drinking fountains and bottle filling stations shall also comply with NSF 61. Permanently installed electric water coolers and bottle filling stations shall also comply with UL 399.

415.2 Drinking Fountain Alternatives. Where food is consumed indoors, water stations shall be permitted to be substituted for drinking fountains. Bottle filling stations shall be permitted to be substituted for drinking fountains up to 50 percent of the requirements for drinking fountains. Drinking fountains shall not be required for an occupant load of 30 or less.

COMMITTEE STATEMENT:
The proposal is being modified to retain the allowance of substituting up to 50 percent of drinking fountains with bottle filling stations as the language is necessary and not all occupants will have a bottle or cup available to utilize a bottle filling station.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 24  ABSTAIN: 1  NOT RETURNED: 1  Daniels
EXPLANATION OF ABSTAIN:

SIGLER: PMI's members could not reach a consensus on the number of bottle filling stations that should be permitted to be substituted for drinking fountains. Also, the text "refrigerated" should be placed in front of "bottle filling stations" in the last sentence of Section 415.1 as UL 399 only applies to electric bottle filling stations that are refrigerated or include a chiller.
Proposals

Item #: 084
UPC 2024  Section: 416.3

SUBMITTER: Bruce Fathers
Watts Water Technologies

RECOMMENDATION:
Add new text

416.0 Emergency Eyewash and Shower Equipment.

416.2 Water Supply. Emergency eyewash and shower equipment shall not be limited in the water supply flow rates. Where hot and cold water is supplied to an emergency shower or eyewash station, the temperature of the water supply shall be controlled by a temperature actuated mixing valve complying with ASSE 1071. Where water is supplied directly to an emergency shower or eyewash station from a water heater, the water heater shall comply with ASSE 1085. The flow rate, discharge pattern, and temperature of flushing fluids shall be provided in accordance with ISEA Z358.1.

416.3 Remote Temperature Monitoring. Control and alert when lack line of sight. Temperature may be monitored remotely via a sensor and App to alert if mixed water exceeds 85°F (29.4°C) at the outlet. Temperature can also be adjusted via remote means.

(renumber remaining sections)

SUBSTANTIATION:
The addition of this language adds Public Safety. The provision provides remote visibility to eye wash, face wash, drench showers and combination unit outlet temperature mitigating scalding risk to eyes, face and body, and allowing facility staff to respond quickly to over temperature conditions and bypass mode via App alerts.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language goes beyond the minimum requirements of the UPC as it addresses the monitoring of the temperature. Furthermore, there is no direction as to who will do the monitoring and, therefore, unenforceable.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
603.0 Cross-Connection Control.

603.5 Specific Requirements. Specific requirements for backflow prevention shall comply with Section 603.5.1 through Section 603.5.24.

417.2-603.5.19 Deck Mounted Bath/Shower Valves. Deck mounted bath/shower transfer valves with integral backflow protection shall comply with ASME A112.18.1/CSA B125.1. This shall include handheld showers, and other bathing appliances mounted on the deck of bathtubs or other bathing appliances that incorporate a hose or pull out feature.

417.3-603.5.20 Handheld Showers. Handheld showers shall comply with ASME A112.18.1/CSA B125.1. Handheld showers with integral backflow protection shall comply with ASME A112.18.1/CSA B125.1 or shall have a backflow prevention device that complies with ASME A112.18.3 or ASSE 1014.

417.4-603.5.21 Faucets and Fixture Fittings with Hose Connected Outlets. Faucets and fixture fittings with pull out spout shall comply with ASME A112.18.1/CSA B125.1. Faucets and fixture fittings with pull out spouts with integral backflow protection shall comply with ASME A112.18.1/CSA B125.1 or shall have a backflow preventer device that complies with ASME A112.18.3.

603.5.19-603.5.22 Plumbing Fixture Fittings. (remaining text unchanged)

603.5.20-603.5.23 Swimming Pools, Spas, and Hot Tubs. (remaining text unchanged)

603.5.21-603.5.24 Chemical Dispensers. (remaining text unchanged)

SUBSTANTIATION:
Section 417.2, Section 417.3 and Section 417.4 deal specifically with backflow protection for deck mounted bath/shower valves, handheld showers and faucets, and fixture fittings with hose connected outlets. Requirements for backflow protection of fixtures and appliances are found in Chapter 6 making it the logical chapter to relocate these sections.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as not all requirements of the sections being relocated are specific to fixtures and should stay in Chapter 4. The sections have more than backflow requirements that are necessary in Chapter 4. The change is not necessary as the provisions should remain in Chapter 4 where users will look for fixture requirements.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 086
UPC 2024  Section: 417.5

SUBMITTER: Bruce A. Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

417.0 Faucets and Fixture Fittings.

417.5 Separate Controls for Hot and Cold Water. Where two separate handles control the hot and cold water, the handles shall be marked in such a manner to indicate to the user that the left-hand control of the faucet where facing the fixture fitting outlet shall control the hot water. Faucets and diverters shall be connected to the water distribution system so that hot water corresponds to the left side of the fixture fitting.

Single-handle mixing valves installed in showers and tub-shower combinations shall have the flow of hot water corresponding to the markings on the fixture fitting.

SUBSTANTIATION:
While the Code states that the left-hand control of the faucet is to control the hot water supply, it does not require markings on the faucet to indicate to the user which handle regulates the hot and cold water supply. This additional language will require those markings.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is overly restrictive. Hot on the left and cold on the right is an industry standard and does not need to be marked on the handles. There are many manufacturers that have already put red and blue markings on their products.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:
GORSUCH: I think it is a good idea to mark the faucets to differentiate between hot and cold.
Proposals

Item #: 087
UPC 2024  Section: 417.6

SUBMITTER:  Jason M Shank
             ASSE International

RECOMMENDATION:
Revise text

417.0 Faucets and Fixture Fittings.

417.6 Low-Pressure Water Dispenser. Beverage faucets shall comply with ASME A112.18.1/CSA B125.1. Low-pressure water dispensers that dispense electrically heated water have a reservoir vented to the atmosphere shall comply with ASSE 1023. Electric devices that heat water shall comply with UL 499.

417.6 Water Dispensers. All potable water dispensers directly connected to the plumbing system shall comply with one of the following:
(1) Beverage faucets shall comply with ASME A112.18.1/CSA B125.1.
(2) Dispensers that supply electrically heated or cooled water shall comply with ASSE 1023.
(3) Electric devices that heat water shall comply with UL 499.
(4) Dispensers that include water treatment shall comply with ASSE 1023 and Section 611.0 based on the type of water treatment technology.

(below shown for reference only)

611.0 Drinking Water Treatment Units.

Note: ASME A112.18.1/CSA B125.1, ASSE 1023, and UL 499 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
ASSE 1023 has been updated with a change of the scope of the standard. This proposed change reflects these changes. Other referenced standards with in this section have remained but listed in an easier to read order.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The text is not currently written correctly regarding “one of the following” as some of the standards need to be used together. Additionally, the text will prohibit beverage dispensing machines from being used in bars.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

GORSUCH: The intent is good. The language needs to be further refined.
Proposals

Item #: 088
UPC 2024  Section: 417.7

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Add new text

417.0 Faucets and Fixture Fittings.

417.7 Head Shampoo Sink Faucets. Head shampoo sink faucets shall be supplied with hot water that is limited to not more than 120°F (49°C). Each faucet shall have integral check valves to prevent crossover flow between the hot and cold water supply connections. The means for regulating the maximum temperature shall be in accordance with one of the following:
(1) A limiting device conforming to ASSE 1070/ASME A112.1070/CSA B125.70.
(2) A water heater conforming to ASSE 1084.
(3) A temperature-actuated, flow-reduction device conforming to ASSE 1062.

Note: ASSE 1070/ASME A112.1070/CSA B125.70, ASSE 1062, and ASSE 1084 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
Currently the UPC does not address these types of faucet usage. These provisions will address the proper standards required for the health and safety of the public.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
This is overly restrictive as it will require hot water to all shampoo sinks.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 19  NEGATIVE: 6  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BROWN, GORSUCH: Agree with Matt Sigler

CUDAHY: Nobody wants a cold shower.

FEEHAN: This language and information are necessary in the code.

SIGLER: Section 601.2.1 requires plumbing fixtures that are installed for private and public use to be provided with hot water for bathing and washing purposes. Therefore, how can it be "overly restrictive" (in accordance with the Committee's statement) to require a head shampoo sink faucet to be provided with hot water when the code already mandates such a practice?

WHITE: Agree with Matt Sigler that these devices should be utilized to maintain safe temperatures to shampoo sinks.
Proposals

Item #: 089
UPC 2024  Section: 417.8

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Add new text

417.0 Faucets and Fixture Fittings.

417.8 Footbaths and Pedicure Baths. The water supplied to specialty plumbing fixtures, such as pedicure chairs having an integral foot bathtub and footbaths, shall be limited to not more than 120°F (49°C) by a water-temperature-limiting device that conforms to ASSE 1070/ASME A112.1070/CSA B125.70 or by a water heater complying with ASSE 1084.

Note: ASSE 1070/ASME A112.1070/CSA B125.70 and ASSE 1084 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
Currently the UPC does not address these types of faucet usage. These provisions will address the proper standards required for the health and safety of the public.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The language is overly restrictive and would require all pedicure sinks to contain hot water.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 19  NEGATIVE: 6  NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:

BROWN, GORSUCH: Agree with Matt Sigler

CUDAHY: Nobody wants a cold footbath.

FEEHAN: This language and information are necessary in the code.

SIGLER: Section 601.2.1 requires plumbing fixtures that are installed for private and public use to be provided with hot water for bathing and washing purposes. Therefore, how can it be "overly restrictive" (in accordance with the committee's statement) to require a footbath and pedicure bath to be provided with hot water when the code already mandates such a practice?

WHITE: Agree with Matt Sigler, these devices should be utilized to maintain safety for the user.
Proposals

Item #: 090
UPC 2024  Section: 418.3

SUBMITTER: Tyler Leighton
Watts Water Technologies

RECOMMENDATION:
Revise text

418.0 Floor Drains.

418.3 Location of Floor Drains. Floor drains shall be installed in the following areas:
(1) Toilet rooms containing two or more water closets or a combination of one water closet and one urinal, except in a
dwelling unit.
(2) Commercial kitchens and in accordance with Section 704.3.
(3) Laundry rooms in commercial buildings and common laundry facilities in multi-family dwelling buildings. Alternatively,
or in addition to a floor drain, a leak detection device equipped with automatic shut off shall be used. This automatic
shut off shall automatically turn off the valve from the water supply to the washing machine that is in place.
(4) Boiler rooms.

SUBSTANTIATION:
This solution would protect and insure safety to the building or home by reducing the risk of floods and proactively
turning off the water supply when there is a leak at either the water heater or washing machine. (this is to align with
Section 507.5).

The goal of this update in to enhance the protection and safety to building and home owner for the washing
machine shut off.
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is confusing, and it is unclear as to what is allowed. The change is restrictive to one type of requirement that may not be appropriate for the application.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 091
UPC 2024 Section: 420.3, Table 420.3

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Revise text

420.0 Sinks.

420.3 Pre-Rinse Spray Valve. Commercial food service pre-rinse spray valves shall have a maximum flow rate of 1.6 gallons per minute (gpm) at 60 pounds-force per square inch (psi) (6.0 L/m at 414 kPa) in accordance with Table 420.3 and shall be equipped with an integral automatic shutoff.

<table>
<thead>
<tr>
<th>PRODUCT CLASS BY SPRAY FORCE</th>
<th>MAXIMUM FLOW RATE, GPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Class 1 (&lt;/= 5.0 ounces-force)</td>
<td>1.00</td>
</tr>
<tr>
<td>Product Class 2 (&gt; 5.0 ounces-force and &lt;/= 8.0 ounces-force)</td>
<td>1.20</td>
</tr>
<tr>
<td>Product Class 3 (&gt; 8.0 ounces-force)</td>
<td>1.28</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 3.785 L/min, 1 ounce-force = 0.0625 pound-force

SUBSTANTIATION:
Effective as of January 2019, the Department of Energy requires all pre-rinse spray valves to have a maximum flow rate of 1.28 gallons per minute (or less, depending on the product’s spray force). See the energy conservation standards specified in the Code of Federal Regulations at 10 CFR 431.266 (https://www.law.cornell.edu/cfr/text/10/431.266).

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 092
UPC 2024  Section: Table 422.1

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>LAVATORIES (FIXTURES PER PERSON)</th>
<th>BATHTUBS OR SHOWERS (FIXTURES PER PERSON)</th>
<th>DRINKING FOUNTAINS/FACILITIES (FIXTURES PER PERSON)</th>
<th>OTHER6,7</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(ports of table not shown remain unchanged)

Notes:
1. The figures shown are based upon one fixture being the minimum required for the number of persons indicated or any fraction thereof.
2. A restaurant is defined as a business that sells food to be consumed on the premises.
   a. The number of occupants for a drive-in restaurant shall be considered as equal to the number of parking stalls.
   b. Hand-washing facilities shall be available in the kitchen for employees.
3. The total number of required water closets for females shall be not less than the total number of required water closets and urinals for males.
4. For each urinal added in excess of the minimum required, one water closet shall be permitted to be deducted. The number of water closets shall not be reduced to less than two-thirds of the minimum requirement.
5. Metering or self-closing faucets shall be installed on lavatories intended to serve the transient public.
6. Service sinks shall not be required for non-residential occupancies with an occupant load of 15 or less.
7. For business and mercantile occupancies, one common service sink shall be permitted when accessible to all businesses and mercantile within 300 feet and within the same story.

SUBSTANTIATION:
Note 6 is being added to remove the conflict with the building code and UPC regarding required service sinks. Note 7 is being added for flexibility as the language will allow businesses and mercantile occupancies to share a common service sink within the same work/business area. Similarly, with common facilities from Section 422.4, the UPC requires access to be within 300 feet on the same floor, it makes sense for the distance to be limited to the same.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 093
UPC 2024 Section: 422.2

SUBMITTER: Julius Ballanco, P.E.
JB Engineering and Code Consulting, P.C.
Rep. Self

RECOMMENDATION:
Revise text

422.0 Minimum Number of Required Fixtures.
422.2 Separate Facilities. Separate toilet facilities shall be provided for each sex.

Exceptions:
(1) Residential installations.
(2) In occupancies with a total occupant load of 10 or less, including customers and employees, one toilet facility, designed for use by no more than one person at a time, shall be permitted for use by both sexes.
(3) In business and mercantile occupancies with a total occupant load of 50 or less including customers and employees, one toilet facility, designed for use by no more than one person at a time, shall be permitted for use by both sexes.
(4) Separate facilities shall not be required where rooms have fixtures designed for use by both sexes and the water closets are installed in privacy compartments. Urinals shall be located in an area that is visually separated from the remainder of the room or each urinal shall be installed in a privacy compartment.

SUBSTANTIATION:
The Building Code added an allowance for all gender toilet rooms in the 2021 edition. This change provides a correlation with the Building Code. All gender toilet rooms have become common place in other countries. The water closets and urinals are located in privacy compartments while the lavatories are located in the open. There is no issue with waiting time since everyone has access to all the fixtures. All gender toilet rooms also avoid any discrimination regarding gender identity. This concept is gaining popularity in North America. Since the Building Code allows such a design, the Uniform Plumbing Code should have a similar requirement. Otherwise, the code are in conflict.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed text is already addressed in the building code. Furthermore, there is concern as to who will enforce such requirements.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 ABSTAIN: 1 NOT RETURNED: 1 Daniels

EXPLANATION OF AFFIRMATIVE:
BARBATO: I agree with the first sentence, however, the second sentence is overly restrictive.

EXPLANATION OF ABSTAIN:
BALLANCO: As the proponent of this change, I am abstaining to avoid any perceived conflict of interest.
422.0 Minimum Number of Required Fixtures.

422.2 Multiple Occupancy Buildings. Buildings having multiple types of occupancies, shall have separate toilet facilities for each occupancy with the minimum number of fixtures prescribed in Table 422.1. A common set of restrooms shall be permitted to be used to accommodate all of the building occupants when the following requirements are met:

1. Restrooms shall be accessible to the occupants at all times.
2. The maximum travel distance from the restrooms to any occupancy shall not exceed 300 feet (91 440 mm).
3. The total occupant load for the building shall be determined by adding the individual occupant loads together. The minimum number of fixtures for the common restrooms shall be calculated at 50 percent female and 50 percent male based on the total occupant load and by using the occupancy requiring the greatest number of fixtures per occupant load in accordance with Table 422.1.

SUBSTANTIATION:
The renovation of older buildings to accommodate multiple types of occupancies has prompted design professionals to request guidance on how to calculate the minimum fixtures required. This section will provide the guidelines for those types of occupancies.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is confusing as to what amount of fixtures would be required for each occupancy type. No justification was provided for the 300 foot requirement.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
422.0 Minimum Number of Required Fixtures.

422.4 Toilet Facilities Serving Employees and Customers. Each building or structure shall be provided with toilet facilities for employees and customers. Requirements for customers and employees shall be permitted to be met with a single set of restrooms accessible to both groups.

Required toilet facilities for employees and customers located in shopping malls or centers shall be permitted to be met by providing a centrally located toilet facility accessible to several stores. The maximum travel distance from entry to any store to the toilet facility shall not exceed 300 feet (91 440 mm).

Required toilet facilities for employees and customers in other than shopping malls or centers shall have a maximum travel distance not to exceed 500 feet (152 m).

422.4.1 Access to Toilet Facilities. In multi-story buildings, accessibility to the required toilet facilities shall not exceed one vertical story. Access to the required toilet facilities for customers shall not pass through areas designated as for employee use only such as kitchens, food preparation areas, storage rooms, closets, or similar spaces. Toilet facilities accessible only to private offices shall not be counted to determine compliance with this section.

422.4.2 Factory, Industrial and Storage. The location and maximum distances of travel to required public and employee facilities in factory, industrial and storage occupancies shall be permitted to exceed that required by Section 422.4, provided that the location and maximum distance of travel are approved.

SUBSTANTIATION:
This proposal provides the AHJ the authority to increase the travel distance to restrooms from 500 ft and the number of floors between restrooms from every other floor to something more appropriate in industrial and storage buildings. Because these types of occupancies have extremely low occupancy rates, it is not a cost-effective use of space or resources to require the same number of independent restrooms when they will rarely be utilized. The new section recognizes that even though there may be members of the public present in some of these types of occupancies, occupancy rates and dwell times are extremely low. This “exception allowance” is present in the I-Codes.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The language is ambiguous and not enforceable. There was no distance given for the maximum travel distance. Furthermore, "Factory, Industrial and Storage" are unique occupancy types.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
422.0 Minimum Number of Required Fixtures.
422.5 Toilet Facilities for Workers. Toilet facilities shall be provided and maintained in a sanitary condition for the use of workers during construction. Where provided, non-sewered waste disposal systems shall comply with PSAI Z4.3.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSAI Z4.3-2016</td>
<td>For Sanitation – Non-Sewered Waste Disposal Systems: Minimum Requirements</td>
<td>Toilet Facility</td>
<td>422.5</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: PSAI Z4.3 meets the requirements for a mandatory reference standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
Toilet facilities for workers are everywhere. PSAI Z4.3 is an ANSI standard specific for nonsewered disposal systems. The purpose of this standard is to assure that employees are provided with healthy and adequate sanitary waste-disposal facilities at places of employment not having sewered waste-disposal systems. It is important to protect the workers doing the plumbing and construction by ensuring their toilet facilities meet a minimum requirement for the health and safety of the workers. The code already addresses the important need of such facilities, this just adds the appropriate standard for such facilities.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
It will be difficult to enforce temporary toilet facilities on a work site. These systems are not connected to a fixed plumbing system. Additionally, "non-sewered waste disposal system" is not defined in the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 097

UPC 2024 Section: 422.6 – 422.6.3

SUBMITTER: Julius Ballanco, P.E.
JB Engineering and Code Consulting, P.C.
Rep. Adult Changing Table Committee of ICC A117.1

RECOMMENDATION:
Add new text

422.0 Minimum Number of Required Fixtures.

422.6 Adult Changing Station. Where adult changing stations are provided, they shall be located in accordance with one of the following:

1. The adult changing station shall be installed in a single-user toilet room or bathroom.
2. The adult changing station shall be installed in a family or assisted-use toilet room or bathroom.
3. The adult changing station shall be installed in a toilet room or bathroom with multiple water closet compartments. The adult changing station shall be provided with privacy by a curtain or wall or be installed within a privacy compartment. Where separate facilities are provided for each sex, the adult changing station shall be installed in both toilet rooms or bathrooms.
4. The adult changing station shall be installed in a separate room.

422.6.1 Lavatory Location. Where an adult changing station is installed in a privacy compartment or separate room, a lavatory shall be provided within that space. The lavatory shall comply with the accessibility requirement of ICC A117.1. Exception: In a separate room, an alcohol-based hand sanitizer dispenser shall be permitted in lieu of a lavatory.

422.6.2 Waste Receptacle. An approved self-closing waste receptacle shall be provided in the toilet room or bathing room. Where an adult changing station is installed in a privacy compartment, the waste receptacle shall be located within the compartment. The waste receptacle shall be a leak-resistant design with a minimum capacity of 2.8 gallons (10.6 L).

422.6.3 Floor Drain Required. A floor drain shall be installed in toilet rooms and bathing rooms having an adult changing station.

Note: ICC A117.1 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The Adult Changing Table Committee of ICC A117.1 developed this code change to address the installation of adult changing stations that are installed on a voluntary basis. There is no mandate within this code change. A companion code change was proposed to Chapter 11 of the ICC International Building Code that would mandate adult changing stations in certain buildings.

If an adult changing station is installed, this code change provides the requirements for public access, cleanliness, and sanitation. The access to an adult changing station is outlined in the first section which lists the rooms in which an adult changing station can be installed. The first two options are obvious in that they would be installed in an individual toilet or bathing room. The third option would allow the changing station to be installed in a men's or ladies room or all gender toilet room having multiple fixtures. Privacy requirements are specified to allow the adult diaper changing to take place out of public view. The fourth option would be a separate room similar to a lactating room in a commercial building or nurses' station in a school.
Every toilet or bathing room has a lavatory. The new requirement would stipulate that when an adult changing station is installed in a privacy compartment or separate room a lavatory would be required for that room to allow for cleanup during and after diaper changing. If there is a separate room without plumbing located in the close proximity, an alcohol-based hand sanitizer dispenser could be used as a substitute for a lavatory.

Since the adult changing station involves the changing of adult diapers, a waste receptacle is required to dispose of the diaper. To minimize the odor from the diaper, the waste receptacle is required to be self-closing. While the Committee considered mandating ventilation for the waste receptacle, it was decided to at a minimum require self-closing.

A floor drain is also required to facilitate the washing of the area in the event of an accident during the diaper changing operation. While floor drains are common in toilet rooms and bathing rooms, the Uniform Plumbing Code does not mandate the fixture for all toilet rooms or bathrooms. This section would result in mandating the floor drain when an adult changing station is installed.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The proposal is being rejected as it is better suited in the building code. There are hygiene and sanitation concerns about the exception to allow alcohol-based hand sanitizers in lieu of a lavatory for hand washing.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 24  ABSTAIN: 1  NOT RETURNED: 1  Daniels

**EXPLANATION OF ABSTAIN:**

**BALLANCO:** As the proponent of this change, I am abstaining. Since this change was submitted, the Adult Changing Table Committee has proposed to remove the requirements for waste receptacles and floor drains. A Public Comment will be forthcoming.
Proposals

Item #: 098
UPC 2024  Section: 422.6, 422.7, Table 1701.1

SUBMITTER: Julius Ballanco, P.E.
JB Engineering and Code Consulting, P.C.

RECOMMENDATION:
Add new text

422.0 Minimum Number of Required Fixtures.

422.6 Water Closet Compartment. Public water closets shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy. Partitions for water closets shall comply with the Type B security requirements of IAPMO Z124.XX.

Exceptions:
(1) Water closet compartments shall not be required in a single-occupant toilet room having a lockable door.
(2) Toilet rooms in day care facilities having more than one water closets shall be permitted to have one water closet without an enclosing compartment.

422.7 Urinal Partitions. Each urinal shall be separated with walls or partitions to provide privacy. The horizontal dimension between walls or partitions at each urinal shall comply with Section 402.5. Partitions for urinals shall comply with the Type C security requirements of IAPMO Z124.XX. Walls or partitions shall extend from not less than 12 inches (305 mm) above the finished floor to not less than 60 inches (1524 mm) above the finished floor. Walls shall extend outward from the wall surface not less than 18 inches (457 mm).

Exception: Urinal partitions shall not be required in a single occupant or family/assisted-use toilet room with a lockable door.

TABLE 1701.1
REFERRED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO Z124.XX</td>
<td>Plastic Water Closet and Urinal Partitions</td>
<td>Miscellaneous</td>
<td>422.6, 422.7</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: IAPMO Z124.XX is a working draft and is not completed at the time of this monograph.

SUBSTANTIATION:
This code change addresses the requirements for privacy partitions for water closets and urinals. Privacy for the user of water closets and urinals is a very important issue. The Plumbing Code regulates all aspects of proper use of plumbing fixtures. Included in the proper use is maintaining an environment that provides a person privacy to prevent paruresis or parcopresis.

The change specifies the level of privacy assured the user of water closets and urinals. The new standard being developed, IAPMO Z124.XX identifies privacy requirements for water closets and urinals. There are three levels of privacy identified in the draft of the standard, Type A, Type B, and Type C. Type A privacy requires partitions to prevent visual observation as well as security of the user. The current draft lists the partitions starting at 4 inches above the floor and extending to a height of 7 feet. The door must be the full height of the partition with both sides of the door sealed to prevent any visual observation. The draft requires the doors to be lockable from the inside with visual notification on the outside that the compartment is in use.
Type B privacy is equivalent to the common water closet partition that is used in men’s and ladies’ rooms. The doors to the partitions will allow a standard 1/2 inch gap.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT: The standard was not completed at the time of this monograph. Furthermore, partitions should be addressed by the building code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 ABSTAIN: 1 NOT RETURNED: 1 Daniels

EXPLANATION OF AFFIRMATIVE:

SIGLER: I am okay with the proposed change not being approved because the standard was not finalized in time for the public hearings. However, I disagree that partitions should only be addressed in the building code as the UPC, in Section 402.5 (Setting), provides spacing requirements between plumbing fixtures and partitions, and Appendix E (Recreational Vehicle Parks) provides requirements for water closet partitions.

EXPLANATION OF ABSTAIN:

BALLANCO: I submitted this code change on behalf of a client. The standard has since been assigned the number Z124.10.
501.0 General.

501.1 Applicability. The regulations of this chapter shall govern the construction, location, and installation of fuel burning and other types of water heaters heating potable water, together with chimneys, vents, and their connectors. The minimum capacity for storage water heaters shall be in accordance with the first-hour rating listed in Table 501.1(2). No water heater shall be hereinafter installed that does not comply with the manufacturer’s installation instructions and the type and model of each size thereof approved by the Authority Having Jurisdiction. A list of accepted water heater appliance standards is referenced in Table 501.1(1). Listed appliances shall be installed in accordance with the manufacturer’s installation instructions. Unlisted water heaters shall be permitted in accordance with Section 504.3.2.

Water heaters shall be installed in accordance with the manufacturer’s installation instructions. The final installation shall be approved by the Authority Having Jurisdiction.

SUBSTANTIATION:
The code section is currently written in vague language. The change cleans up the stricken language and makes it direct and addresses the intent of the current language.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 100
UPC 2024  Section: 206.0, Table 501.1(1)

SUBMITTER: Phillip H Ribbs  
PHR Consultants

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>TABLE 501.1(1) WATER HEATERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE*</td>
</tr>
<tr>
<td>Electric, Household Storage</td>
</tr>
<tr>
<td>Oil-Fired Storage Tank</td>
</tr>
<tr>
<td>Gas-Fired, 75 000 Btu/h or less, Storage</td>
</tr>
<tr>
<td>Gas, Above 75 000 Btu/h, Storage and Instantaneous</td>
</tr>
<tr>
<td>Electric, Commercial Storage</td>
</tr>
<tr>
<td>Solid Fuel-Fired</td>
</tr>
<tr>
<td>Electric Instantaneous</td>
</tr>
</tbody>
</table>

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

* Dual purpose water heaters shall be installed in accordance with this code and the manufacturer's installation instructions.

206.0 - D -

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

SUBSTANTIATION:
The code is currently silent on dual purpose type water heaters. There are types water heaters specially designed to supply both potable water fixtures and space heating systems. The addition of this language will serve as a safety measure to ensure such designs are not overlooked. Also, the addition of a definition will clarify the intent of the code.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 100 and UMC Item # 022 resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:
225.0 – W –
Water Heater, Dual Purpose. An appliance utilized as intended to be a heat source for both space heating and domestic hot water applications.

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT: The definition of “Dual Purpose Water Heater” for UPC Item # 100 is being revised to correct an oversight by replacing the phrase “utilized as” to “intended to be.”

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for the definition of “Dual Purpose Water Heater” by replacing the phrase “utilized as” to “intended to be.”
Proposals

Item #: 101
UPC 2024  Section: Chapter 5

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 54 Extract Update

RECOMMENDATION:
Revise text

CHAPTER 5
WATER HEATERS

504.3.2 Unlisted Water Heaters. Unlisted water heaters shall be installed with a clearance of 12 inches (305 mm) on all sides and rear. Combustible floors under unlisted water heaters shall be protected in an approved manner. [NFPA 54:10.27.2.2]

504.5 Temperature-Limiting Devices. A water heater installation or a hot water storage vessel installation shall be provided with overtemperature protection by means of an approved, listed device installed in accordance with the terms of its listing and the manufacturer’s installation instructions. (NFPA 54:10.26.5)

504.6 Temperature, Pressure, and Vacuum Relief Devices. Temperature, pressure, and vacuum relief devices or combinations thereof, and automatic gas shutoff devices shall be installed in accordance with the terms of their listings and the manufacturer’s installation instructions. A shutoff valve shall not be placed between the relief valve and the water heater or on discharge pipes between such valves and the atmosphere. The hourly British thermal units (Btu) (kW•h) discharge capacity or the rated steam relief capacity of the device shall be not less than the input rating of the water heater. (NFPA 54:10.26.6) Discharge piping shall be installed in accordance with Section 608.5.

506.1 General. Air for combustion, ventilation, and dilution of flue gases for appliances installed in buildings shall be obtained by application of one of the methods covered in Section 506.2 through Section 506.7.3. Where the requirements of Section 506.2 are not met, outdoor air shall be introduced in accordance with methods covered in Section 506.4 through Section 506.7.3.

Exception: This provision shall not apply to direct-vent direct vent appliances. [NFPA 54:9.3.1.1]

506.2.2 Known Air Infiltration Rate Method. Where the air infiltration rate of a structure is known, the minimum required volume shall be determined as follows [NFPA 54:9.3.2.2]:

(1) For appliances other than fan-assisted, calculate using the following Equation 506.2.2(1). [NFPA 54:9.3.2.2(1)]

\[
\text{Required Volume}_{\text{air}} \geq \frac{21 \text{ ft}^3}{\text{ACH}} \left( \frac{I_{\text{other}}}{1000 \text{ Btu/h}} \right)
\]

(2) For fan-assisted appliances, calculate using the following Equation 506.2.2(2). [NFPA 54:9.3.2.2(2)]

\[
\text{Required Volume}_{\text{fan}} \geq \frac{15 \text{ ft}^3}{\text{ACH}} \left( \frac{I_{\text{fan}}}{1000 \text{ Btu/h}} \right)
\]
For SI units: $1 \text{ cubic foot} = 0.0283 \text{ m}^3$, 1000 British thermal units per hour $= 0.293 \text{ kW}$

(3) For purposes of these calculations, an infiltration rate greater than 0.60 ACH shall not be used in the equations in Section Equation 506.2.2(1) and Section Equation 506.2.2(2). [NFPA 54:9.3.2.2(3)]

506.6 Engineered Installations. Engineered combustion air installations shall provide an adequate supply of combustion, ventilation, and dilution air and shall be approved by the Authority Having Jurisdiction determined using engineering methods. [NFPA 54:9.3.5]

507.7 Types of Gas(es). The appliance shall be connected to the fuel gas for which it was designed. No attempt shall be made to convert the appliance from the gas specified on the rating plate for use with a different gas without consulting the installation instructions, the serving gas supplier, or the appliance manufacturer for complete instructions. Listed appliances shall not be converted unless permitted by and in accordance with the manufacture's installation instructions. [NFPA 54:9.1.3]

507.8 Safety Shutoff Devices for Unlisted LP-Gas Appliance Used Indoors. Unlisted appliances for use with undiluted liquefied petroleum gases—LP-Gases and installed indoors, except attended laboratory equipment, shall be equipped with safety shutoff devices of the complete shutoff type. [NFPA 54:9.1.4]

507.18 Adequate Capacity of Piping—Addition to Existing System. When additional appliances are being connected to a gas piping system, the existing piping shall be checked to determine whether it has adequate capacity. Where the capacity of the system is determined to be inadequate for the additional appliances, the existing system shall be enlarged as necessary or required, or separate gas piping of adequate capacity shall be run from the point of delivery to the appliance provided.[NFPA 54:9.1.16-5.1.2]

507.19 Avoiding Strain on Gas Piping. Appliances shall be supported and connected to the piping so as not to exert undue strain on the connections. [NFPA 54:9.1.17-9.1.16]

507.20 Gas Appliance Pressure Regulators. Where the gas supply pressure is higher than that at which the appliance is designed to operate or varies beyond the design pressure limits of the appliance, a gas appliance pressure regulator listed in accordance with ANSI Z21.18/CSA 6.3 shall be installed. [NFPA 54:9.1.18-9.1.17]

507.21 Venting of Gas Appliance Pressure Regulators. Venting of gas appliance pressure regulators shall comply with the following requirements:

(1) Appliance pressure regulators requiring access to the atmosphere for successful operation shall be equipped with vent piping leading outdoors or, if the regulator vent is an integral part of the appliance, into the combustion chamber adjacent to a continuous pilot, unless constructed or equipped with a vent limiting means to limit the escape of gas from the vent opening in the event of diaphragm failure.

(2) Vent limiting means shall be employed on listed appliance pressure regulators only.

(3) In the case of vents leading outdoors, means shall be employed to prevent water from entering this piping and also to prevent blockage of vents by insects and foreign matter.

(4) Under no circumstances shall a regulator be vented to the appliance flue or exhaust system.

(5) In the case of vents entering the combustion chamber, the vent shall be located so the escaping gas is readily ignited by the pilot and the heat liberated thereby does not adversely affect the normal operation of the safety shutoff system. The terminus of the vent shall be securely held in a fixed position relative to the pilot. For manufactured gas, the need for a flame arrester in the vent piping shall be determined.

(6) A vent line(s) from an appliance pressure regulator and a bleed line(s) from a diaphragm-type valve shall not be connected to a common manifold terminating in a combustion chamber. Vent lines shall not terminate in positive-pressure-type combustion chambers. [NFPA 54:9.1.19]

507.22 Bleed Lines for Diaphragm-Type Valves. Bleed lines shall comply with the following requirements:

(1) Diaphragm-type valves shall be equipped to convey bleed gas to the outdoors or into the combustion chamber adjacent to a continuous pilot.

(2) In the case of bleed lines leading outdoors, means shall be employed to prevent water from entering this piping and also to prevent blockage of vents by insects and foreign matter.

(3) Bleed lines shall not terminate in the appliance flue or exhaust system.

(4) In the case of bleed lines entering the combustion chamber, the bleed line shall be located so the bleed gas is readily ignited by the pilot and the heat liberated thereby does not adversely affect the normal operation of the safety shutoff system. The terminus of the bleed line shall be securely held in a fixed position relative to the pilot. For manufactured gas, the need for a flame arrester in the bleed line piping shall be determined.
A bleed line(s) from a diaphragm-type valve and a vent line(s) from an appliance pressure regulator shall not be connected to a common manifold terminating in a combustion chamber. Bleed lines shall not terminate in positive-pressure-type combustion chambers. [NFPA 54:9.1.20-9.1.18]

**507.23 Combination of Appliances and Equipment.** Any combination of appliances, equipment, attachments, or devices used together in any manner shall comply with the standards that apply to the individual appliance and equipment. [NFPA 54:9.1.24-9.1.19]

**507.24 Installation Instructions.** The installing agency/installer shall conform to the appliance and equipment manufacturer’s recommendations in completing an installation. The installing agency/installer shall leave the manufacturer’s installation, operating, and maintenance instructions in a location on the premises where they are readily available for reference and guidance of the Authority Having Jurisdiction, service personnel, and the owner or operator. [NFPA 54:9.1.22-9.1.20]

**507.25 Protection of Outdoor Appliances.** Appliances not listed for outdoor installation but installed outdoors shall be provided with protection to the degree that the environment requires. Appliances listed for outdoor installation shall be permitted to be installed without protection in accordance with the provisions of its listing and the manufacturer’s installation instructions. [NFPA 54:9.1.21]

**508.2.2 Electrical Power.** All appliances requiring an external source of electrical power for its operation shall be installed in accordance with NFPA 70, provided with the following:

1. A readily accessible electrical disconnecting means within sight of the appliance that completely de-energizes the appliance.
2. A 120 V ac grounding-type receptacle outlet on the roof adjacent to the appliance on the supply side of the disconnect switch. [NFPA 54:9.4.2.3]

**508.4 Appliances in Attics and Under-Floor Spaces.** An attic or under-floor space in which an appliance is 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]

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

**509.1.1 Installation.** Listed chimneys and vents shall be installed in accordance with Section 509.0 and the manufacturer’s installation instructions. [NFPA 54:12.2.1]

**509.2.6 Direct-Vent Appliances.** Listed direct-vent appliances shall be installed in accordance with the manufacturer’s installation instructions and Section 509.8.2. [NFPA 54:12.3.5-12.3.5.1]

**509.2.6.1 Through-the-Wall Vent Termination.** Through-the-wall vent terminations for listed direct-vent appliances shall be in accordance with Section 509.8.1. [NFPA 54:12.3.5.2]

**509.3.3.5 Exit Terminals.** The exit terminals of mechanical draft systems shall be not less than 7 feet (2134 mm) above finished ground level where located adjacent to public walkways and shall be located as specified in Section 509.8 and Section 509.8.1 of this code. [NFPA 54:12.4.3.6]

**509.3.4 Ventilating Hoods and Exhaust Systems.** Where automatically operated appliances, other than commercial food service appliances, are vented through a ventilating hood or exhaust system equipped with a damper or with a power means of exhaust, provisions shall be made to allow the flow of gas to the main burners only when the damper is open to a position to properly vent the appliance and when the power means of exhaust is in operation. [NFPA 54:12.4.4.1]

**509.5.1 Factory-Built Chimneys.** Factory-built chimneys shall be listed in accordance with UL 103, UL 959, or UL 2561. Factory-built chimneys shall be installed in accordance with the manufacturer’s installation instructions. Factory-built chimneys used to vent appliances that operate at positive vent pressure shall be listed for such application. [NFPA 54:12.6.1.1]

**509.5.5 Size of Chimneys.** The effective area of a chimney venting system serving listed appliances with draft hoods, Category I appliances, and other appliances listed for use with Type B vents shall be in accordance with one of the following methods:

1. Those listed in Section 510.0.
2. For sizing an individual chimney venting system for a single appliance with a draft hood, the effective areas of the
vent connector and chimney flue of a venting system serving a single appliance with a draft hood shall be not less than the area of the appliance flue collar or draft hood outlet or greater than seven times the draft hood outlet area. 

(3) For sizing The effective area of the chimney flue of a chimney venting system connected to serving two appliances with draft hoods, the effective area of the chimney flue shall be not less than the area of the larger draft hood outlet plus 50 percent of the area of the smaller draft hood outlet or greater than seven times the smaller draft hood outlet area.

(4) Chimney venting systems using mechanical draft shall be sized in accordance with approved engineering methods. 

(5) Other approved engineering methods. [NFPA 54:12.6.3.1]

509.6.1 Standard. Chimneys shall be lined in accordance with NFPA 211.

Exception: Existing chimneys shall be permitted to have their use continued when an appliance is replaced by an appliance of similar type, input rating, and efficiency, where the chimney complies with Section 509.5.6 through Section 509.6.3 and the sizing of the chimney is in accordance with Section 509.5.6. [NFPA 54:12.6.4.2]

509.5.6.2 Cleanouts. Cleanouts shall be examined and where they do not remain tightly closed when not in use, they shall be repaired or replaced. [NFPA 54:12.6.4.3]

509.6.2.1 Category I Appliances. The sizing of natural draft venting systems serving one or more listed appliances equipped with a draft hood or appliances listed for use with a Type B gas vent, installed in a single story of a building, shall be in accordance with one of the following:

(1) The provisions of Section 510.0.

(2) Vents serving fan-assisted combustion system appliances, or combinations of fan-assisted combustion system and draft hood-equipped appliances, shall be sized in accordance with Section 510.0 or other approved engineering methods.

(3) For sizing an individual gas vent for a single, draft hood-equipped appliance, the effective area of the vent connector and the gas vent shall be not less than the area of the appliance draft hood outlet or greater than seven times the draft hood outlet area.

(4) For sizing a gas vent connected to two appliances with draft hoods, the effective area of the vent shall be not less than the area of the larger draft hood outlet plus 50 percent of the area of the smaller draft hood outlet or greater than seven times the smaller draft hood outlet area.

(5) Other approved engineering practices Engineering methods. [NFPA 54:12.7.4.1]

509.6.2.3 Category II, Category III, and Category IV Appliances. The sizing of gas vents for Category II, Category III, and Category IV appliances shall be in accordance with the appliance manufacturer's instructions. The sizing of plastic pipe specified by the appliance manufacturer as a venting material for Category II, III, and IV appliances shall be in accordance with the appliance manufacturer's instructions. [NFPA 54:12.7.4.3]

509.6.2.4 Sizing. Chimney venting systems using mechanical draft shall be sized in accordance with approved engineering methods. [NFPA 54:12.7.4.4]

509.6.3 Gas Vents Serving Appliances on More than One Floor. A Where a common vent shall be permitted is installed in a multistory installations to vent Category I appliances located on more than one floor level, provided the venting system is shall be designed and installed in accordance with approved engineering methods. For the purpose of this section, crawl spaces, basements, and attics shall be considered as floor levels. [NFPA 54:12.7.5.1]

509.7.4 Size of Single-Wall Metal Pipe. Single-wall metal piping shall comply with the following requirements:

(1) A venting system of a single-wall metal pipe shall be sized in accordance with one of the following methods and the appliance manufacturer's instructions:

(a) For a draft hood-equipped appliance, in accordance with Section 510.0.

(b) For a venting system for a single appliance with a draft hood, the areas of the connector and the pipe each shall not be less than the area of the appliance flue collar or draft hood outlet, whichever is smaller. The vent area shall not be greater than seven times the draft hood outlet area.

(c) Other approved engineering methods.

(2) Where a single-wall metal pipe is used and has a shape other than round, it shall have an equivalent effective area equal to the effective area of the round pipe for which it is substituted and the minimum internal dimension of the pipe shall be 2 inches (50 mm).

(3) The vent cap or a roof assembly shall have a venting capacity not less than that of the pipe to which it is attached. [NFPA 54:12.8.5]

509.8 Through-the-Wall Vent Termination. Through-the-wall vent termination shall be in accordance with Section 509.8.1 through Section 509.8.3. A mechanical draft venting system shall terminate at least 3 feet (914 mm) above any forced air inlet located within 10 feet (3048 mm) (See Figure 509.8).

Exceptions:

(1) This provision shall not apply to the combustion air intake of a direct-vent appliance.

(2) This provision shall not apply to the separation of the integral outdoor air inlet and flue gas discharge of listed
509.8.1 Mechanical Draft Venting System. A mechanical draft venting system of other than direct-vent type shall terminate at least 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from, or 1 foot (305 mm) above any door, operable window, or gravity air inlet into any building. The bottom of the vent terminal shall be located at least 12 inches (305 mm) above finished grade level. [NFPA 54:12.9.2]

509.8.2 Direct Vent Appliance.  

509.8.1 Clearance for Through-the-Wall Vent Termination. The clearances for through-the-wall direct-vent and non-direct vent terminals shall be in accordance with Table 509.8-2 and Figure 509.8-1. The bottom of the vent terminal and the air intake shall be located not less than 12 inches (305 mm) above finished grade level. Exception: The clearances in Table 509.8-1 shall not apply to the combustion air intake of a direct vent appliance. [NFPA 54:12.9.1]  

509.8.3 Category I through Category IV and Noncategorized Appliances. Through-the-wall vents for Category II and Category IV appliances and noncategorized condensing appliances shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment. Where local experience indicates that condensate is a problem with Category I and Category III appliances, this provision shall also apply. Drains for condensate shall be installed in accordance with the appliance and the vent manufacturer’s installation instructions. [NFPA 54:12.9.4]

509.8.4 Annuars Spaces. Where vents, including those for direct-vent appliances or combustion air intake pipes, penetrate outside walls of buildings, the annular spaces around such penetrations shall be permanently sealed using approved materials to prevent entry of combustion products into the building. [NFPA 54:12.9.5]

509.8.5 Vent Terminals. Vent systems for Category IV appliances that terminate through an outside wall of a building and discharge flue gases perpendicular to the adjacent wall shall be located not less than 10 feet (3048 mm) horizontally from an operable opening in an adjacent building. Exception: This shall not apply to vent terminals that are 2 feet (610 mm) or more above or 25 feet (7620 mm) or more below operable openings. [NFPA 54:12.9.6]

509.9 Condensation Drain. Provision shall be made to collect and dispose of condensate from venting systems serving Category II and Category IV appliances and noncategorized condensing appliances in accordance with Section 509.8.3. [NFPA 54:12.10.1]

509.10.1.4 Medium-Heat Appliances. Vent connectors for medium-heat appliances shall be constructed of factory-built, medium-heat chimney sections or steel of a thickness not less than that specified in Table 509.10.1.4 and shall comply with the following:  

1. A steel vent connector for an appliance with a vent gas temperature in excess of 100°F (538°C) measured at the entrance to the connector shall be lined with medium-duty fire brick or the equivalent. 

2. The lining shall be at least 2 1/2 inches (64 mm) thick for a vent connector having a diameter or greatest cross-sectional dimension of 18 inches (457 mm) or less. 

3. The lining shall be at least 4 1/2 inches (114 mm) thick laid on the 4 1/2 inches (114 mm) bed for a vent connector having a diameter or greatest cross-sectional dimension greater than 18 inches (457 mm). 

4. Where factory-built chimney sections are employed, they shall be joined together in accordance with the chimney manufacturer's instructions. [NFPA 54:12.11.2.5]

509.10.2 Size of Vent Connector. A vent connector for an appliance with a single draft hood or for a Category I fan-assisted combustion system appliance shall be sized and installed in accordance with Section 510.0 or other approved engineering methods. [NFPA 54:12.11.3.1]

509.10.2.1 Manifold. For a single appliance having more than one draft hood outlet or flue collar is installed, the manifold shall be constructed according to the instructions of the appliance manufacturer. Where there are no instructions, the manifold shall be designed and constructed in accordance with approved-engineering practices-methods. As an alternative method, the effective area of the manifold shall equal the combined area of the flue collars or draft hood outlets, and the vent connectors shall have a minimum 1 foot (305 mm) rise. [NFPA 54:12.11.3.2]  

509.10.2.2 Size. Where two or more appliances are connected to a common vent or chimney, each vent connector shall be sized in accordance with Section 510.0 or other approved engineering methods. [NFPA 54:12.11.3.3] As an alternative method applicable only where all of the appliances are draft hood-equipped, each vent connector shall have an effective area not less than the area of the draft hood outlet of the appliance to which it is connected. [NFPA 54:12.11.3.4]

509.10.2.3 Height. Where two or more appliances are vented through a common vent connector or vent manifold, the
common vent connector or vent manifold shall be located at the highest level consistent with available headroom and clearance to combustible material and sized in accordance with Section 510.0 or other approved engineering methods. [NFPA 54:12.11.3.5]

As an alternative method applicable only where there are two draft hood-equipped appliances, the effective area of the common vent connector or vent manifold and all junction fittings shall be not less than the area of the larger vent connector plus 50 percent of the area of the smaller flue collar outlet. [NFPA 54:12.11.3.6]

**509.10.6 Connector Junctions.** Where vent connectors are joined together, the connection shall be made with a manufactured tee or wye fitting. [NFPA 54:12.11.7]

(renumber remaining section)

**509.10.6 Slope.** A vent connector shall be installed without any dips or sags and shall slope upward toward the vent or chimney at least 1/4 inch per foot (20.8 mm/m).

**Exception:** Vent connectors attached to a mechanical draft system installed in accordance with appliance and the draft system manufacturer’s instructions. [NFPA 42.14.7-12.11.8]

**509.10.7.1 Single Wall Connector.** The maximum horizontal length of a single-wall connector shall be 75 percent of the height of the chimney or vent, except for engineered systems. [NFPA 42.11.8.1-12.11.9.1]

**509.10.7.2 Type B Double Wall Connector.** The maximum horizontal length of a Type B double-wall connector shall be 100 percent of the height of the chimney or vent, except for engineered systems. The maximum length of an individual connector for a chimney or vent system serving multiple appliances, from the appliance outlet to the junction with the common vent or another connector, shall be 100 percent of the height of the chimney or vent. [NFPA 42.11.8.2-12.11.9.2]

**509.10.8 Support.** A vent connector shall be supported for the design and weight of the material employed to maintain clearances and prevent physical damage and separation of joints. [NFPA 42.11.9-12.11.10]

**509.10.9 Chimney Connection.** Where entering a flue in a masonry or metal chimney, the vent connector shall be installed above the extreme bottom to avoid stoppage. [NFPA 42.11.11.1] Where a thimble or slip joint is used to facilitate removal of the connector, the connector shall be firmly attached to or inserted into the thimble or slip joint to prevent the connector from falling out. [NFPA 42.11.11.2] Means shall be employed to prevent the connector from entering so far as to restrict the space between its end and the opposite wall of the chimney flue. [NFPA 42.11.11.3-10.10 Inspection.** The entire length of a vent connector shall be readily accessible for inspection, cleaning, and replacement. [NFPA 42.11.11.12]

**509.10.11 Fireplaces.** A vent connector shall not be connected to a chimney flue serving a fireplace unless the fireplace flue opening is permanently sealed. [NFPA 42.11.12-12.11.13]

**509.10.12.1 Medium-Heat Appliances.** Vent connectors for medium-heat appliances shall not pass through walls or partitions constructed of combustible material. [NFPA 42.11.14-12.11.14.2]

**509.12 Appliances Requiring Draft Hoods and Draft Controls.** Vented appliances shall be installed with draft hoods.

**Exception:** Dual oven-type combination ranges, incinerators, direct-vent direct vent appliances, fan-assisted combustion system appliances, appliances requiring chimney draft for operation; single-firebox boilers equipped with conversion burners with inputs exceeding greater than 400 000 Btu/h (117 kW); appliances equipped with blast, power, or pressure burners that are not listed for use with draft hoods; and appliances designed for forced venting. [NFPA 54:12.13.1]

**509.12.1 Installation.** A draft hood supplied with or forming a part of a listed vented appliance shall be installed without alteration, exactly as furnished and specified by the appliance manufacturer. [NFPA 54:12.13.2]

If a draft hood is not supplied by the appliance manufacturer where one is required, a draft hood shall be installed, be of a listed or approved type, and, in the absence of other instructions, be of the same size as the appliance flue collar. Where a draft hood is required with a conversion burner, it shall be of a listed or approved type. [NFPA 54:12.13.2.1]

Where a draft hood of special design is needed or preferable, the installation shall be approved and in accordance with the recommendations of the appliance manufacturer. [NFPA 54:12.13.2.2]

**509.13 Manually Operated Dampers.** A manually operated damper shall not be placed in any appliance vent connector. Fixed baffles and balancing baffles shall not be classified as manually operated dampers. [NFPA 54:12.14.1]

Balancing baffles shall be mechanically locked in the desired position before placing the appliance in service. [NFPA 54:12.14.2] Balancing baffles shall be listed in accordance with UL 378. [NFPA 54:12.14.3]

**509.14 Automatically Operated Vent Dampers.** An automatically operated vent damper shall be of a listed type. [NFPA 54:12.15]

**509.15 Obstructions.** Devices that retard the flow of vent gases shall not be installed in a vent connector, chimney, or vent. The following shall not be considered as obstructions:

1. Draft regulators and safety controls specifically listed for installation in venting systems and installed in
in accordance with the manufacturer’s installation instructions.

(2) Approved draft regulators and safety controls designed and installed in accordance with approved engineering methods.

(3) Listed heat reclaimers and automatically operated vent dampers installed in accordance with the manufacturer’s installation instructions.

(4) Vent dampers serving listed appliances installed in accordance with Section 510.1 or Section 510.2 or other approved engineering methods.

(5) Approved economizers, heat reclaimers, and recuperators installed in venting systems of appliances not required to be equipped with draft hoods, provided the appliance manufacturer’s instructions cover the installation of such a device in the venting system and performance in accordance with Section 509.3 and Section 509.3.1 is obtained. [NFPA 54:12.16]

510.1.6 Corrugated Chimney Liner Reduction. Listed corrugated metallic chimney liner systems in masonry chimneys shall be sized by using Table 510.1.2(1) or Table 510.1.2(2) for Type B vents with the maximum capacity reduced by 20 percent (0.80 x maximum capacity) and the minimum capacity as shown in Table 510.1.2(1) or Table 510.1.2(2).

Corrugated metallic liner systems installed with bends or offsets shall have their maximum capacity further reduced in accordance with Section 510.1.2. The 20 percent reduction for corrugated metallic chimney liner systems includes an allowance for one long radius 90 degree (1.57 rad) turn at the bottom of the liner. [NFPA 54:13.1.7]

510.1.8 Vertical Vent Upsizing Using the 7 xTimes Rule. Where the vertical vent has a larger diameter than the vent connector, the vertical vent diameter shall be used to determine the minimum vent capacity, and the connector diameter shall be used to determine the maximum vent capacity. The flow area of the vertical vent shall not exceed seven times the flow area of the listed appliance categorized vent area, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods. [NFPA 54:13.1.9]

510.1.13 Single Run of Vent Multiple Vertical Vent Sizes. In a single run of vent or vent connector, more than one diameter and type shall be permitted to be used, provided that all the sizes and types are permitted by the tables. [NFPA 54:13.1.14]

510.1.16 Engineering Methods Sizing Vents Not Covered by Tables. For Where a vent heights is lower than 6 feet (1829 mm) and/or higher than shown in Table 510.1.2(1) through Table 510.2(9), an engineering methods shall be used to calculate the vent capacity capacities. [NFPA 54:13.1.17]

510.2 Multiple Appliance Vent Table 510.2(1) through Table 510.2(9) Obstructions and Vent Dampers. (remaining text unchanged) [NFPA 54:13.2.1]

510.2.12 Vent Height. For The available total height (H) for multiple appliances all locates on one the same floor, available total height (H) shall be measured from the highest draft hood outlet or flue collar up to the level of the outlet of the common vent. [NFPA 54:13.2.13]

510.2.13 Multistory Installations Vent Height. For multistory installations, Where appliances are located on more than one floor, the available total height (H) for each segment of the system shall be the vertical distance between the highest draft hood outlet or flue collar entering that segment and the centerline of the next higher interconnection tee. [NFPA 54:13.2.14]

510.2.15 Vent-Type Multistory Type B Vents Required Installations. (remaining text unchanged) [NFPA 54:13.2.16]

510.2.16 Offsets in Multistory Vent Offsets and Capacity Installations. (remaining text unchanged) [NFPA 54:13.2.17]

510.2.17 Vertical Vent Size Limitation. Where two or more appliances are connected to a vertical vent or chimney, the flow area of the largest section of vertical vent or chimney shall not exceed seven times the smallest listed appliance categorized vent areas, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods. [NFPA 54:13.2.18]

510.2.18 Multiple Input Ratings. For appliances with more than one input rate, The minimum vent connector capacity (FAN Min) of appliances with more than one input rate shall be determined from the table, and shall be less than the lowest appliance input rating, and The maximum vent connector capacity (FAN Max or NAT Max) shall be determined from the tables and shall be greater than the highest appliance input rating. [NFPA 54:13.2.19]
<table>
<thead>
<tr>
<th>APPLIANCES</th>
<th>TYPE OF VENTING SYSTEM</th>
<th>LOCATION OF REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed Category I appliances</td>
<td>Type B gas vent</td>
<td>Section 509.6</td>
</tr>
<tr>
<td>Listed appliances equipped with draft hood</td>
<td>Chimney</td>
<td>Section 509.5</td>
</tr>
<tr>
<td>Appliances listed for use with Type B gas vent</td>
<td>Single-wall metal pipe</td>
<td>Section 509.7</td>
</tr>
<tr>
<td></td>
<td>Listed chimney lining system for gas venting</td>
<td>Section 509.5.3</td>
</tr>
<tr>
<td></td>
<td>Special gas vent listed for these appliances</td>
<td>Section 509.4.3</td>
</tr>
<tr>
<td>Listed vented wall furnaces</td>
<td>Type B-W gas vent</td>
<td>Section 509.6</td>
</tr>
<tr>
<td>Category II, Category III, and Category IV appliances</td>
<td>As specified or furnished by manufacturers</td>
<td>Section 509.4.1 and Section 509.4.3</td>
</tr>
<tr>
<td>Appliances that can be converted to use solid fuel</td>
<td>Chimney</td>
<td>Section 509.5</td>
</tr>
<tr>
<td>Unlisted combination gas- and oil-burning appliances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combination gas- and solid fuel-burning appliances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appliances listed for use with chimneys only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlisted appliances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listed combination gas- and oil-burning appliances</td>
<td>Type L vent</td>
<td>Section 509.6</td>
</tr>
<tr>
<td></td>
<td>Chimney</td>
<td>Section 509.5</td>
</tr>
<tr>
<td>Decorative appliance in vented fireplace</td>
<td>Chimney</td>
<td>UMC Section 911.2</td>
</tr>
<tr>
<td>Gas-fired toilets</td>
<td>Single-wall metal pipe</td>
<td>Section 509.7</td>
</tr>
<tr>
<td>Direct-vent appliances</td>
<td>—</td>
<td>Section 509.2.6</td>
</tr>
<tr>
<td>Appliances with integral vents</td>
<td>—</td>
<td>Section 509.2.7</td>
</tr>
</tbody>
</table>
### TABLE 509.7.3.4(1)
CLEARANCES FOR CONNECTORS

<table>
<thead>
<tr>
<th>APPLIANCE</th>
<th>LISTED TYPE B GAS VENT MATERIAL</th>
<th>LISTED TYPE L VENT MATERIAL</th>
<th>SINGLE-WALL METAL PIPE</th>
<th>FACTORY-BUILT CHIMNEY SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed appliances with draft hoods and appliances listed for use with Type B gas vents</td>
<td>As listed</td>
<td>As listed</td>
<td>6</td>
<td>As listed</td>
</tr>
<tr>
<td>Residential boilers and furnaces with listed gas conversion burner and with draft hood</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>As listed</td>
</tr>
<tr>
<td>Residential appliances listed for use with Type L vents</td>
<td>Not permitted</td>
<td>As listed</td>
<td>9</td>
<td>As listed</td>
</tr>
<tr>
<td>Unlisted residential appliances with draft hood</td>
<td>Not permitted</td>
<td>6</td>
<td>9</td>
<td>As listed</td>
</tr>
<tr>
<td>Residential and low-heat appliances other than those above</td>
<td>Not permitted</td>
<td>9</td>
<td>18</td>
<td>As listed</td>
</tr>
<tr>
<td>Medium-heat appliances</td>
<td>Not permitted</td>
<td>Not permitted</td>
<td>36</td>
<td>As listed</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm
* These clearances shall apply unless the installation instructions of a listed appliance or connector specify different clearances, in which case the listed clearances shall apply.

![Figure 509.7.3.4(1)](image)

**Notes:**

1. A – Equals the clearance with no protection specified in Table 509.7.3.4(1) and Table 509.7.3.4(2) and in the sections applying to various types of equipment.
2. B – Equals the reduced clearance permitted in accordance with Table 509.7.3.4(2).
3. The protection applied to the construction using combustible material shall extend far enough in each direction to make C equal to A.
Masonry walls shall be attached to combustible walls using wall ties. Spacers shall not be used directly behind appliance or connector.

**FIGURE 509.7.3.4(2)**
WALL PROTECTOR CLEARANCE REDUCTION SYSTEM
[NFPA 54: FIGURE 10.3.2.3(b)-10.3.3.3(b)]

For SI units: 1 inch = 25.4 mm

**Note:** Do not place masonry wall ties directly behind appliance or connector.

**FIGURE 509.7.3.4(3)**
MASSORY CLEARANCE REDUCTION SYSTEM
[NFPA 54: FIGURE 10.3.2.3(e)-10.3.3.3(c)]

For SI units: 1 inch = 25.4 mm
### TABLE 509.7.3.4(2)
REDUCTION OF CLEARANCES WITH SPECIFIED FORMS OF PROTECTION

#### [NFPA 54: TABLE 40.2.310.2.4](#)

<table>
<thead>
<tr>
<th>Type of Protection Applied to and Covering All Surfaces of Combustible Material Within the Distance Specified as the Required Clearance With No Protection [See Figure 509.7.3.4(1) Through Figure 509.7.3.4(3)]</th>
<th>Where the Required Clearance With No Protection From Appliance, Vent Connector, or Single-Wall Metal Pipe Is:</th>
<th>Allowable Clearances With Specified Protection (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>36 (inches)</td>
<td>18 (inches)</td>
</tr>
<tr>
<td><strong>Above Column 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above Column 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sides and Rear Column 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) 3 1/2 inch thick masonry wall without ventilated air space</td>
<td>—</td>
<td>24</td>
</tr>
<tr>
<td>(2) 1/2 inch insulation board over 1 inch glass fiber or mineral wool batts</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>(3) 0.024 inch (nominal 24 gauge) sheet metal over 1 inch glass fiber or mineral wool batts reinforced with wire on rear face with ventilated air space</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>(4) 3 1/2 inch thick masonry wall with ventilated air space</td>
<td>—</td>
<td>12</td>
</tr>
<tr>
<td>(5) 0.024 inch (nominal 24 gauge) sheet metal with ventilated air space</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>(6) 1/2 inch insulation board with ventilated air space</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>(7) 0.024 inch (nominal 24 gauge) sheet metal with ventilated air space over 0.024 inch (nominal 24 gauge) sheet metal with ventilated air space</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>(8) 1 inch glass fiber or mineral wool batts sandwiched between two sheets 0.024 inch (nominal 24 gauge) sheet metal with ventilated air space</td>
<td>18</td>
<td>12</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, **°C = (°F - 32)/1.8**

**Notes:**
1. Reduction of clearances from combustible materials shall not interfere with combustion air, draft hood clearance and relief, and accessibility of servicing.
2. All clearances shall be measured from the outer surface of the combustible material to the nearest point on the surface of the appliance, disregarding any intervening protection applied to the combustible material.
3. Spacers and ties shall be of noncombustible material. No spacer or tie shall be used directly opposite the
Where all clearance reduction systems use a ventilated air space, adequate provision for air circulation shall be provided as described. [See Figure 509.7.3.4(2) and Figure 509.7.3.4(3)] At least 1 inch (25.4 mm) shall be between clearance reduction systems and combustible walls and ceilings for reduction systems using a ventilated air space.

Where a wall protector is mounted-installed on a single flat wall away from corners, it shall have a minimum 1 inch (25.4 mm) air gap. To provide adequate air circulation, the bottom and top edges, or only the side and top edges, or all edges shall be left open.

Mineral wool batts (blanket or board) shall have a minimum density of 8 pounds per cubic foot (lb/ft³) (128 kg/m³) and a minimum melting point of 1500°F (816°C).

Insulation material used as part of a clearance reduction system shall have a thermal conductivity of 0.1 Btu•in/(h•ft²•°F) [0.1 W/(m•K)] or less.

At least 1 inch (25.4 mm) shall be between the appliance and the protector. In no case shall the clearance between the appliance and the combustible surface be reduced below that allowed in this table.

10 All clearances and thicknesses are minimum; larger clearances and thicknesses are acceptable.
11 Listed single-wall connectors shall be installed in accordance with the terms of their listing and the manufacturer’s installation instructions.

### TABLE 509.8.2 509.8.1 THROUGH-THE-WALL DIRECT-VENT TERMINATION CLEARANCES

<table>
<thead>
<tr>
<th>DIRECT-VENT APPLIANCE INPUT RATING</th>
<th>THROUGH-THE-WALL VENT TERMINAL CLEARANCE FROM ANY AIR OPENING INTO A BUILDING (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 000 Btu/h and less</td>
<td>6</td>
</tr>
<tr>
<td>Greater than 10 000 Btu/h and not exceeding 50 000 Btu/h</td>
<td>9</td>
</tr>
<tr>
<td>Greater than 50 000 Btu/h and not exceeding 150 000 Btu/h</td>
<td>12</td>
</tr>
<tr>
<td>&gt; 150 000 Btu/h</td>
<td>In accordance with the appliance manufacturer’s instructions and in no case less than the clearances specified in Section 509.8.1.</td>
</tr>
</tbody>
</table>

### FIGURE CLEARANCE LOCATION

<table>
<thead>
<tr>
<th>FIGURE CLEARANCE</th>
<th>CLEARANCE LOCATION</th>
<th>MINIMUM CLEARANCES FOR DIRECT VENT TERMINALS</th>
<th>MINIMUM CLEARANCES FOR NON-DIRECT VENT TERMINALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Clearance above finished grade level, veranda, porch, deck, or balcony</td>
<td>12 inches</td>
<td>12 inches</td>
</tr>
<tr>
<td>B</td>
<td>Clearance to window or door that is openable</td>
<td>6 inches for appliances &lt;= 10 000 Btu/hr 9 inches for appliances &gt; 10 000 Btu/hr 12 inches for appliances &gt; 50 000 Btu/hr 150 000 Btu/hr Appliances &gt; 150 000 Btu/hr, in accordance with the appliance manufacturer’s instructions and not less than the clearances specified for non-direct vent terminals in row B</td>
<td>4 feet below or to side of opening or 1 foot above opening</td>
</tr>
<tr>
<td>C</td>
<td>Clearance to non-openable window</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610 mm) from the center line of the terminal</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Clearance</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Clearance to unventilated soffit</td>
<td>None unless otherwise specified by the appliance manufacture</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Clearance to outside corner of building</td>
<td>None unless otherwise specified by the appliance manufacture</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Clearance to inside corner of building</td>
<td>None unless otherwise specified by the appliance manufacture</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Clearance to non-mechanical air supply inlet to building and the combustion air inlet to any other appliance</td>
<td>Same clearance as specified for row B</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Clearance to a mechanical air supply inlet</td>
<td>10 feet horizontally from inlet or 3 feet above inlet</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>Clearance above paved sidewalk or paved driveway located on public property or other areas where condensate or vapor can cause a nuisance or hazard</td>
<td>7 feet and not located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Clearance to underside of veranda, porch, deck, or balcony</td>
<td>12 inches where the area beneath the veranda, porch, deck, or balcony is open on not less than two sides. The vent terminal is prohibited in this location where only one side is open.</td>
<td></td>
</tr>
</tbody>
</table>

For SI Units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW
The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item #101, Section 508.4 (Appliances in Attics and Under-Floor Spaces) and UMC Item #056, Section 304.4 (Appliances in Attics and Under-Floor Spaces) resulted in conflicting language within the code. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

**508.4 Appliances in Attics and Under-Floor Spaces.** An attic or under-floor space in which an appliance is installed shall be accessible through an opening and passageway at least as large as larger than 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](#))

**TCC ACTION:** ACCEPT AS SUBMITTED

**TCC STATEMENT:**
The language in UPC Item #101, Section 508.4 (Appliances in Attics and Under-Floor Spaces) is being revised to correlate with the action taken by the UMC TC Item #056, Section 304.4 (Appliances in Attics and Under-Floor Spaces) regarding the phrase "or under-floor space."

Additionally, the TCC further modified UPC Item #101 to change the phrase "at least as large as" to "larger than" as the TCC felt such revision of text was necessary to correct an error in the original text as sufficient accessibility through an opening is required.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 508.4 regarding adding the phrase "or under-floor space" and a change from the phrase "at least as large as" to "larger than."
The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordace with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 101, Section 509.2.6 (Direct-Vent Appliances) and UMC Item # 174, Section 802.2.6 (Direct Vent Appliances) resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

509.2.6 Direct-Vent Appliances. Listed direct vent appliances shall be installed in accordance with the manufacturer’s installation instructions. [{NFPA 54;12.3.5.1}]

**TCC ACTION:** ACCEPT AS SUBMITTED

**TCC STATEMENT:**
The language in UPC Item # 101, Section 509.2.6 (Direct-Vent Appliances) is being revised to correlate with the action taken by the UMC TC for Item # 174, Section 802.2.6 (Direct Vent Appliances) by adding the term “instructions” to the end of the section.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 509.2.6 regarding the addition of the term “instructions” to the end of the section.
Proposals

Item #: 102
UPC 2024  Section: 504.3.2

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

504.0 Water Heater Requirements.

504.3 Clearance. (remaining text unchanged)

504.3.2 Unlisted Water Heaters. Unlisted water heaters shall be installed with a clearance of 12 inches (305 mm) on all sides and rear. Combustible floors under unlisted water heaters shall be protected in an approved manner. [NFPA 54:10.27.2.2]

504.3.2 Unlisted Water Heaters. Except as otherwise permitted in this code, unlisted water heaters shall be approved by the Authority Having Jurisdiction prior to being installed. Clearance for unlisted water heaters shall be not less than 12 inches (305 mm) on all sides. Combustible floors under unlisted water heaters shall be protected in an approved manner. [NFPA 54-2018:10.27.2.2]

SUBSTANTIATION:
New Section 504.3.2 is being proposed to replace the existing language. As currently written, there is no direction for the approval that is required of the AHJ. These provisions are important and required for the installation of unlisted water heaters such as boilers. This new section will address that issue and rewrites the provisions in a more concise and clear manner.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

COMMITTEE STATEMENT:
The Technical Committee requested that the extract reference brackets and identification be added to the definition.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 103
UPC 2024  Section: 504.4

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Revise text

504.0 Water Heater Requirements.

504.4 Pressure Limiting Devices. A water heater installation shall be provided with overpressure protection using an approved, listed device installed in accordance with the terms of its listing and the manufacturer's installation instructions. Pressure relief devices shall have a pressure setting greater than the water service pressure and not exceed 150 psi (1034 kPa) as required in Section 608.4.

(below shown for reference only)

608.4 Pressure Relief Valves. Each pressure relief valve shall be an approved automatic type with drain, and each such relief valve shall be set at a pressure of not more than 150 psi (1034 kPa). No shutoff valve shall be installed between the relief valve and the system.

SUBSTANTIATION:
The proposed language is being added for clarity and safety of the end user. The UPC requires the plumbing water supply to be limited to 80 psi. While manufacturers usually install a pressure relief valve rated at 150 psi, there are over the counter relief valves rated at 75 psi which will cause the pressure to release. To prevent such incidences, the language will ensure the P&T valve is above the water supply pressure.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 21  NEGATIVE: 4  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: I would agree with Chuck White that this change does not add any clarity to the code. It may add confusion.

GORSUCH: Agree with Charles White. In addition, the maximum 150 psi may not be correct all the time. For example, for high-rise buildings, if I have a water heater in the basement the working pressure may exceed 150 psi.

KREITENBERG: Water Service is a term of art with a specific definition. The piping system within a building is not necessarily related to the pressure of the water service.

WHITE: This does not necessarily clarify the situation. The proposal is looking for a problem that does not exist and adds confusion. There is a difference between service pressure and pressure after a pressure reducing valve. It may be confusing to users as to which pressure to reference. Also, the rating of the relief valve should depend on the rating of the appliance being protected, the manufacturer's instructions should be followed.
Proposals

Item #: 104
UPC 2024 Section: 507.5

SUBMITTER: Bob Adler
Self

RECOMMENDATION:
Revise text

507.0 Appliance and Equipment Installation Requirements.

507.5 Drainage Pan. Where a water heater is located in an attic, in or on an attic ceiling assembly, floor-ceiling assembly, or floor-subfloor assembly where damage results from a leaking water heater, a watertight pan of corrosion-resistant materials shall be installed beneath the water heater in accordance with the following:

(1) The drainage pan shall be provided with not less than 3/4 of an inch (20 mm) diameter drain to an approved location.
(2) Such The drainage pan shall be not less than 1 1/2 inches (38 mm) in depth.
(3) Where a drain pan pipe is installed, the material of the piping shall be rated for the temperature rating of the water heater and shall be approved for use with the liquid being discharged.

SUBSTANTIATION:
The new text will add provisions which clarify that piping used on hot water applications shall be rated for such temperatures as there are drain line to be used for cold water applications only. Additionally, the provisions for the drainage pan are being placed in a list which makes the provisions easy to find.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

507.0 Appliance and Equipment Installation Requirements.

507.5 Drainage Pan. Where a water heater is located in an attic, in or on an attic ceiling assembly, floor-ceiling assembly, or floor-subfloor assembly or where damage results from a leaking water heater, a watertight pan of corrosion-resistant materials shall be installed beneath the water heater in accordance with the following:

(1) The drainage pan shall be provided with not less than 3/4 of an inch (20 mm) diameter drain to an approved location. The terminating end of the drainpipe shall be readily visible.
(2) The drainage pan shall be not less than 1 1/2 inches (38 mm) in depth.
(3) Where a drainage pan pipe is installed, the material of the piping shall be rated for the temperature rating of the water heater and shall be approved for use with the liquid being discharged.
(4) Discharge from a relief valve into a drainage pan shall be prohibited.

COMMITTEE STATEMENT:
The modification adds parts of Item #105, Item #106, and Item #107.

The modification clarifies that Section 507.5 is applicable to all locations where a leaking water heater can cause damage and not only the locations indicated in the section. The intent of the section is to prevent damage from occurring in the surrounding vicinity of the water heater should a leak occur. Additionally, the terminating end of the drain pipe shall be visible to alert the owner or inspector that the water heater is leaking.

This modification also adds (4) as the same prohibition of not allowing discharging the relief valve into a water heater pan that is in Section 608.5(7). It is a common mistake and needs to be stated in both sections.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

BALLANCO: I believe the modification of Item (4) is incorrect. It appears that the proponent was attempting to regulate the drainage piping from the pan, not from the relief valve. While I am voting affirmative, I believe a correction is necessary.

EXPLANATION OF NEGATIVE:

WHITE: The proposal should direct the piping to be installed in the manner of relief valves and direct the user to Section 608.5 (Discharge Piping) where all of this is discussed. Adding the discharge of relief valves is already in Section 608.5 and is duplicative in this section. Having the end of the pipe readily visible, while proper, is not the same language used in Section 608.5 where it is "readily observable". The code should strive for consistent language.
507.0 Appliance and Equipment Installation Requirements.

507.5 Drainage Pan. Where a water heater is located in an attic, in or on an attic ceiling assembly, floor-ceiling assembly or floor-subfloor assembly or where damage results from a leaking water heater, a watertight pan of corrosion-resistant materials shall be installed beneath the water heater with not less than \( \frac{3}{4} \) of an inch (20 mm) diameter drain to an approved location. The terminating end of the drainpipe shall be readily visible. Such pan shall be not less than 1\( \frac{1}{2} \) inches (38 mm) in depth.

SUBSTANTIATION:
The proposed change will clarify that Section 507.5 is applicable to all locations where a leaking water heater can cause damage and not only the locations indicated in the section. The intent of the section is to prevent damage from occurring in the surrounding vicinity of the water heater should a leak occur. Additionally, the terminating end of the drain pipe shall be visible to alert the owner or inspector that the water heater is leaking.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the changes pertaining to the terminating end of the drainpipe being readily visible in this proposal are already being addressed in Item # 104.
Proposals

Item #: 106
UPC 2024  Section: 507.5

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

507.0 Appliance and Equipment Installation Requirements.

507.5 Drainage Pan. Where a water heater is located in an attic, in or on an attic ceiling assembly, floor-ceiling assembly, or floor-subfloor assembly or where structural damage could results from a leaking water heater, a watertight pan of corrosion-resistant materials not less than 1-1/2 inches (38 mm) in depth shall be installed beneath the water heater with a drain not less than 3/4 inch (20 mm) and diameter drain of materials shown in Table 701.2, to an approved location. Discharge from a relief valve into a water heater pan shall be prohibited. Such pan shall be not less than 1-1/2 inches (38 mm) in depth.

SUBSTANTIATION:
The proposed changed defines why the drainage pan is required. It’s not for any or every kind of damage, it is there to mitigate structural damage. The change moves the last sentence to where it belongs but also defines what material is required for the drain by referencing Table 701.2 (Materials for Drain, Waste, Vent Pipe and Fittings). The prohibition in Section 608.5(7) is that you cannot drain the pressure relief into the drainage pan and is shown here for clarity. This is a common mistake and needs to be stated in both sections.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the changes pertaining to the "discharge from a relief valve into a water heater pan shall be prohibited" is already being addressed in Item # 104. Additionally, structural damage is not needed as the section covers more than just the structure. Also, the reference to Section 701.2 for piping material does not cover all pipe materials used in the field.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
507.5 Drainage Pan. Where a water heater is located in an attic, in or on an attic ceiling assembly, floor-ceiling assembly, or floor-subfloor assembly or where structural damage could result from a leaking water heater, a watertight pan of corrosion-resistant materials, not less than 1½ inches (38 mm) in depth, shall be installed beneath the water heater with a drain not less than ¾ of an inch (20 mm) diameter drain to an approved location. Discharge from a relief valve into a water heater pan shall be prohibited. Such pan shall be not less than 1½ inches (38 mm) in depth.

SUBSTANTIATION:
This change clarifies the intent of why the pan is required. It’s not any or every kind of damage, it is there to mitigate structural damage. Also, the same prohibition of not allowing discharging the relief valve into a water heater pan is in Section 608.5(7). It is a common mistake and needs to be stated in both sections.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the changes pertaining to the "discharge from a relief valve into a water heater pan shall be prohibited" is already being addressed in Item # 104. Additionally, "structural damage" is not needed as the section covers more than just structural.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 108
UPC 2024  Section: 507.13

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

507.0 Appliance and Equipment Installation Requirements.

507.13 Installation in Residential Garages. Appliances in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit shall be installed so that all heating elements, switches, burners, and burner-ignition devices are located not less than 18 inches (457 mm) above the floor unless listed as flammable vapor ignition resistant. \{NFPA 54:9.1.10.1\}

SUBSTANTIATION:
Requirements for electric water heaters have been missing since the 2003 UPC. The reasons for this may no longer exist and are perhaps unimportant. The fact is that electric water heaters are still installed by plumbers and still need inspections. What document do plumbers and inspectors seek for these installation requirements?

Elements and switches (thermostats) are just as dangerous as burners and burner ignition devices, perhaps more so with the advent of FVIR for gas burning water heaters.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 108, Section 507.13 (Installation in Residential Garages) and UMC Item # 061, Section 305.1 (Installation in Residential Garages) resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

507.0 Appliance and Equipment Installation Requirements.

507.13 Installation in Residential Garages. Appliances in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit shall be installed so that all heating elements, switches, burners, and burner-ignition devices are located not less than 18 inches (457 mm) above the floor, unless Exception: Listed as flammable vapor ignition resistant (FVIR) appliances,\{NFPA 54:9.1.10.1\}

TCC ACTION: ACCEPT AS SUBMITTED
TCC STATEMENT:
The language in UPC Item # 108, Section 507.13 (Installation in Residential Garages) is being revised to correlate with the action taken by the UMC TC for Item # 061, Section 305.1 (Installation in Residential Garages) to relocate the phrase “listed flammable vapor ignition resistant appliances” to an Exception.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 507.13 to relocate the phrase “listed flammable vapor ignition resistant appliances” to an exception.
Proposals

Item #: 109
UPC 2024  Section: 507.26

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

507.0 Appliance and Equipment Installation Requirements.

507.26 Accessibility for Service. All appliances shall be located with respect to building construction and other equipment so as to permit access to the appliance. Sufficient clearance shall be maintained to permit cleaning of heating surfaces; the replacement of filters, blowers, motors, burners, controls, and vent connections; the lubrication of moving parts where necessary; the adjustment and cleaning of burners and pilots; and the proper functioning of explosion vents, if provided. For attic installation, the passageway and servicing area adjacent to the appliance shall be floored. [(NFPA 54:9.2.1)]

SUBSTANTIATION:
The change is a cleanup of the language to improve Section 507.26. The term “sufficient” is being removed as it is ambiguous code language.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is being rejected as the intent for access to appliances is better addressed in Item #110.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
507.26 Accessibility for Service. All appliances shall be located with respect to building construction and other equipment so as to permit access to the appliance for repair or replacement of the appliance. Sufficient clearance shall be maintained to permit removal of the appliance; cleaning of heating surfaces; the replacement of filters, blowers, motors, burners, controls, and vent connections; the lubrication of moving parts where necessary; the adjustment and cleaning of burners and pilots; and the proper functioning of explosion vents, if provided. For attic installation, the passageway and servicing area adjacent to the appliance shall be floored. ([NFPA 54:9.2.1])

SUBSTANTIATION:
The Code requires access for the repair of appliances in Section 507.26, but does not require access for the removal of appliances without the need to remove building construction or other appliances.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
reference to Section 508.4, and adding clearances for working space.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 507.26 regarding striking the term "sufficient," adding the reference to Section 508.4, and adding clearances for working space.
Proposals

Item #: 111
UPC 2024  Section: 508.2.1.1, Table 1701.1

SUBMITTER: Lauren Bauerschmidt
ASSP

RECOMMENDATION:
Revise text

508.2.1.1 Guards and Rails. Guards or rails shall be required where the following exist:
(1) The clearance between the appliance and a roof edge or open end of an equipment platform is less than 6 feet (1829 mm).
(2) The open end of the equipment platform is located more than 30 inches (762 mm) above the roof, floor, or grade below.
   Where guards or rails are installed, they shall be constructed so as to prevent the passage of a 21 inch (533 mm) diameter ball, resist the imposed loading conditions, and shall extend not less than 30 inches (762 mm) beyond each side of the equipment or appliance.
   Exception: Guards shall not be required where a permanent fall arrest anchorage connector system in accordance with ASSP Z359.1 is installed.

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<tr>
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<td>Miscellaneous</td>
<td>508.2.1.1</td>
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( порions of table not shown remain unchanged)

Note: ASSP Z359.1 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revisions reflect the latest updates to the ASSP standard that is referenced in Table 1701.1. The promulgator standard has changed names from "ASSE" to "ASSP" and has also been updated in Section 508.2.1.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 112
UPC 2024  Section: 508.0, 508.4.1

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

508.0 Appliances on Roofs, in Attics or Under-Floor Spaces.

508.4 Appliances in Attics and Under-Floor Spaces. (remaining text unchanged)

508.4.1 Length of Passageway. Where the height of the passageway is less than 6 feet (1829 mm), the distance from the passageway access to the appliance shall not exceed 20 feet (6096 mm) measured along the centerline of the passageway. [NFPA 54:9.5.1.1] Where the height of the passageway is 6 feet (1829 mm) or more, the distance from the passageway access to the appliance shall not exceed 50 feet (15 240 mm) measured along the centerline of the passageway.

SUBSTANTIATION:
This code change would limit the length of a passageway that is 6 feet high or more to a maximum length of 50 feet to remove the conflict between the building/residential code. There is currently no limit or provisions for a distance for a passageway greater than 6 feet in height.

Additionally, provisions under Section 508.0 cover more than just “appliances on roofs.” In addition to roofs, it covers appliances in attics and in under-floor spaces (Section 508.4). Updating the main title will assist in clarifying the intent of the section and all its sub-sections.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 21  NEGATIVE: 4  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: In commercial buildings, appliances are often more than 50 feet from the entry when located in an attic. When there is adequate height of the passageway, often more than 8 feet, there is no justification for limiting the distance to the appliance. While I recognize that other codes list a 50-foot distance, I don’t agree with the limitation in the other codes.

GORSUCH: Agree with Charles White.

KREITENBERG: Multiple applications require an "appliance" to be more than 50-feet away. Assuming access is provided, which is required regardless of this Code, the 50-foot limitation provides no benefit and is overly restrictive.

WHITE: While I agree with the editorial change to the section title, I do not agree with the change to passageway distances for passageways 6 feet or more in height. It is stated there is a conflict in the codes but no sections are listed to justify this statement. The effect would be to limit hallway lengths in attics or below floor spaces (basements?) to 50 feet, there is no justification for the 50-foot limit other than it seems like a good idea to the proponent.
Item #: 113
UPC 2024  Section: 509.2, 509.3

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Add new text

509.0 Venting of Appliances.

509.2 Venting of Gas Appliances. Low-heat and medium-heat gas appliances shall be vented in accordance with this chapter. Other gas appliances shall be vented in accordance with NFPA 211 or other applicable standards.

509.3 Appliances Fueled by Other Fuels. Appliances fueled by fuels other than gas shall be vented in accordance with NFPA 211 and the appliance manufacturer's instructions.

(renumber remaining sections)

Note: NFPA 211 meets the requirements for a mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The UPC only addresses low and medium heat appliances. The new language will guide the user of the code to the appropriate standard NFPA 211 for other gas appliances. NFPA 211 (Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances) applies to the design, installation, maintenance, and inspection of all chimneys, fireplaces, venting systems, and solid fuel-burning appliances. The standard covers the removal of waste gases; the reduction of fire hazards associated with the construction and installation of chimneys, fireplaces, and venting systems for residential, commercial, and industrial appliances; and the installation of solid fuel-burning appliances.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as there is a concern that there may be other standards that apply to appliances fueled by other fuels.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 114

UPC 2024  Section: 509.6.1.1

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

509.0 Venting of Appliances.

509.6.1.1 Insulation Protection Shield. Where a vent passes through an insulated assembly, an approved metal shield constructed of steel having a thickness of not less than 26 gauge shall be installed between the vent and insulation. The shield shall extend not less than 2 inches (51 mm) above the insulation and be secured to the structure in accordance with the manufacturer’s installation instructions.

SUBSTANTIATION:
The existing language does not contain guidance regarding the minimum gauge required for insulation shield passing through insulated areas such as attics. The proposed language will add the minimum shield thickness. The proposed 26 gauge minimum thickness is found in other manufacturer requirements.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 115
UPC 2024  Section: 509.10.5

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

509.10 Vent Connectors for Category I Appliances.

509.10.5 Joints. Joints between sections of connector piping and connections to flue collars or draft hood outlets shall be fastened in accordance with one of the following methods:

1. Sheet-metal screws. Mechanically fastened by means of not less than three sheet-metal screws equally spaced around the joint.

2. Vent connectors of listed vent material assembled and connected to flue collars or draft hood outlets in accordance with the manufacturer’s instructions.

3. Other approved means. [[NFPA 54:12.11.6]]

SUBSTANTIATION:
One: There is a potential conflict with the 2021 UMC Section 603.9: "UMC - 603.9 Joints and Seams of Ducts. Joints and seams for duct systems shall comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible. Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gasketing, or other means. Crimp joints for round ducts shall have a contact lap of not less than 1-1/2 inches (38 mm) and shall be mechanically fastened by means of not less than three sheet-metal screws equally spaced around the joint, or an equivalent fastening method."

Two: A common practice is to use one or two screws which can allow the vent to swivel and become dislodges and leak carbon monoxide and other exhaust gases.

Three: Some installers use an aluminum tape typically used for HVAC plenums. This product cannot take the heat and will fall off many times again exhausting gas into the space.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 116
UPC 2024  Section: 509.10.10

SUBMITTER: Phillip H Ribbs  
PHR Consultants

RECOMMENDATION:  
Revise text

509.0 Venting of Appliances.

509.10 Vent Connectors for Category I Appliances. (remaining text unchanged)

509.10.12 Passage through Ceilings, Floors, or Walls. A vent connector shall not pass through a ceiling, floor, or fire-resistance-rated wall. A single-wall metal pipe connector shall not pass through an interior wall.

Exceptions:
(1) Vent connectors made of listed Type B or Type L vent material and serving listed appliances with draft hoods and other appliances listed for use with Type B gas vents that pass through walls or partitions constructed of combustible material shall be installed with not less than the listed clearance to combustible material.
(2) Vent connectors shall be permitted to be installed in accordance with Section 509.7.3.1 and Section 509.7.3.5.

(The below sections are shown for information only)

509.7.3.1 Limitations. Single-wall metal pipe shall be used only for runs directly from the space in which the appliance is located through the roof or exterior wall to the outer air. A pipe passing through a roof shall extend without interruption through the roof flashing, roof jacket, or roof thimble. [NFPA 54:12.8.4.2]

509.7.3.5 Combustible Exterior Wall. Single wall metal pipe shall not pass through a combustible exterior wall unless guarded at the point of passage by a ventilated metal thimble not smaller than the following:
(1) For listed appliances with draft hoods and appliances listed for use with Type B gas vents, the thimble shall be a minimum of 4 inches (100 mm) larger in diameter than the metal pipe. Where there is a run of not less than 6 feet (1829 mm) of metal pipe in the opening between the draft hood outlet and the thimble, the thimble shall be a minimum of 2 inches (50 mm) larger in diameter than the metal pipe.
(2) For unlisted appliances having draft hoods, the thimble shall be a minimum of 6 inches (150 mm) larger in diameter than the metal pipe.
(3) For residential and low-heat appliances, the thimble shall be a minimum of 12 inches (300 mm) larger in diameter than the metal pipe.

Exception: In lieu of thimble protection, all combustible material in the wall shall be removed a sufficient distance from the metal pipe to provide the specified clearance from such metal pipe to combustible material. Any material used to close up such opening shall be noncombustible. [NFPA 54:12.8.4.6]

SUBSTANTIATION:
The intent of the exception to Section 509.10.12 is further clarified by directing the end user to Section 509.7.3.1 and Section 509.7.3.5 which permit connectors to pass through ceilings, floors, or wall and are specified in the indicated sections. This change will clarify the intent of Section 509.10.12 and avoid any confusion between the sections.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 116, Section 509.10.12 (Passage Through Ceilings, Floors, or Walls) and UMC Item # 175, Section 802.10.12 (Passage Through Ceilings, Floors, or Walls) resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

509.10.12 Passage Through Ceilings, Floors, or Walls. A vent connector shall not pass through a ceiling, floor, or fire-resistance-rated wall. A single-wall metal pipe connector shall not pass through an interior wall.

Exceptions:
(1) Vent connectors made of listed Type B or Type L vent material and serving listed appliances with draft hoods and other appliances listed for use with Type B gas vents that pass through walls or partitions constructed of combustible material shall be installed with not less than the listed clearance to combustible material.
(2) Vent connectors shall be permitted to be installed pass through ceilings, floors, or walls in accordance with Section 509.7.3.1 and Section 509.7.3.5.

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT:
The language in UPC Item # 116, Section 509.10.12 (Passage Through Ceilings, Floors, or Walls) is being revised to correlate with the action taken by the UMC TC for Item # 175, Section 802.10.12 (Passage Through Ceilings, Floors, or Walls) by changing the phrase “be installed” to “pass through ceilings, floors, or walls” in Exception (2).

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 509.10.12 to update the phrase from “be installed” to “pass through ceilings, floors, or walls” in Exception (2).
Proposals

Item #: 117
UPC 2024  Section: 510.2.11

SUBMITTER: Shane Peters  
City of Santa Monica

RECOMMENDATION:  
Revise text

510.0 Sizing of Category I Venting Systems.

510.2 Multiple Appliance Vent Table 510.2(1) through Table 510.2(9). (remaining text unchanged)

510.2.11 Vent Connector Rise. The connector rise \( R \) for each appliance a vent connector shall be measured from the draft hood outlet or flue collar to the centerline where the vent gas streams come together. (NFPA 54:13.2.12)

SUBSTANTIATION: 
This is about the vent connector, not the appliance it connects to so eliminates unnecessary wording and focuses on the vent connector.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 117, Section 510.2.11 (Vent Connector Rise) and UMC Item # 178, Section 803.2.11 (Vent Connector Rise) resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

510.0 Sizing of Category I Venting Systems.

510.2 Multiple Appliance Vent Table 510.2(1) through Table 510.2(9). (remaining text unchanged)

510.2.11 Vent Connector Rise. The vent connector rise \( R \) for a vent connector each appliance shall be measured from the draft hood outlet or flue collar to the centerline where the vent gas streams come together. (NFPA 54:13.2.12)

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT:  
The language in UPC Item # 117, Section 510.2.11 (Vent Connector Rise) is being revised to correlate with the action taken by the UMC TC for Item # 178, Section 803.2.11 (Vent Connector Rise) to clarify the term “vent connector rise” and its application to “each appliance.”

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for
actions taken for Section 510.2.11 regarding clarification of the term “vent connector rise” and its application to “each appliance.”
Proposals

Item #: 118

UPC 2024  Section: 603.2

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Revise text

603.0 Cross-Connection Control.

603.2 Approval of Devices or Assemblies. Before a device or an assembly is installed for the prevention of backflow, it shall have first been approved by the Authority Having Jurisdiction. Devices or assemblies shall be tested in accordance with recognized standards or other standards acceptable to the Authority Having Jurisdiction. Backflow prevention devices and assemblies shall comply with Table 603.2, except for specific applications and provisions as stated in Section 603.5.1 through Section 603.5.21.

Devices or assemblies installed in a potable water supply system for protection against backflow shall be maintained in good working condition by the person or persons having control of such devices or assemblies. Such devices or assemblies shall be tested at the time of installation, repair, or relocation and not less than on an annual schedule thereafter, or more often where required by the Authority Having Jurisdiction. Where found to be defective or inoperative, the device or assembly shall be repaired or replaced. No device or assembly shall be removed from use or relocated or other device or assembly substituted, without the approval of the Authority Having Jurisdiction.

Testing or maintenance shall be performed by a certified backflow assembly tester or repairer certified in accordance with ASSE Series 5000 or otherwise any other additional certification approved by the Authority Having Jurisdiction.

SUBSTANTIATION:
The proposed change defines and clarifies that ASSE 5000 is a certification standard. The removal of "otherwise" strengthens this requirement by defining and clarifying another certification is needed that is acceptable to the Authority Having Jurisdiction.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
Proposals

Item #: 119

UPC 2024  Section: Table 603.2

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Revise text

| TABLE 603.2 |
| BACKFLOW PREVENTION DEVICES, ASSEMBLIES, AND METHODS |
| DEGREE OF HAZARD |
| DEVICE, ASSEMBLY, OR METHOD | APPLICABLE STANDARDS | POLLUTION (LOW HAZARD) | CONTAMINATION (HIGH HAZARD) | INSTALLATION |
| Chemical Dispenser with integral backflow protection | ASSE 1055 | X | | |

(portion of table not shown remain unchanged)

Note: ASSE 1055 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
ASSE 1055 Standard is commonly used in the industry and should be added to Table 603.2 like other commonly installed backflow devices listed in this table.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 120
UPC 2024  Section: Table 603.2

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>TABLE 603.2 BACKFLOW PREVENTION DEVICES, ASSEMBLIES, AND METHODS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DEGREE OF HAZARD</strong></td>
</tr>
<tr>
<td><strong>DEVICE, ASSEMBLY, OR METHOD</strong></td>
</tr>
<tr>
<td><strong>APPLICABLE STANDARDS</strong></td>
</tr>
<tr>
<td><strong>POLLUTION (LOW HAZARD)</strong></td>
</tr>
<tr>
<td><strong>CONTAMINATION (HIGH HAZARD)</strong></td>
</tr>
<tr>
<td><strong>INSTALLATION</strong></td>
</tr>
<tr>
<td><strong>BACK-SIPHONAGE</strong></td>
</tr>
<tr>
<td><strong>BACK-PRESSURE</strong></td>
</tr>
<tr>
<td><strong>BACK-SIPHONAGE</strong></td>
</tr>
<tr>
<td><strong>BACK-PRESSURE</strong></td>
</tr>
<tr>
<td>Hose connection backflow preventers</td>
</tr>
<tr>
<td>Such devices are not for use under continuous pressure conditions.</td>
</tr>
<tr>
<td>Laboratory faucet back-flow preventer</td>
</tr>
<tr>
<td>Installation includes laboratory faucets. Such devices are not for use under continuous pressure conditions. No valve downstream.</td>
</tr>
</tbody>
</table>

(portion of table not shown remain unchanged)

(row with ASSE 1052 is shown for informational purposes only)

SUBSTANTIATION:
Both ASSE 1052 and ASSE 1035 standards contain the same protection, two checks, and an atmospheric port. The protection level should be the same. They are both also rated for low pressure backpressure (10 feet of head or 4.33 psi).

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 121
UPC 2024  Section: Table 603.2, Table 1701.1, Table 1701.2

SUBMITTER: Cameron Rapoport
Watts Water Technologies

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>DEVICE, ASSEMBLY, OR METHOD¹</th>
<th>APPLICABLE STANDARDS</th>
<th>POLLUTION (LOW HAZARD)</th>
<th>CONTAMINATION (HIGH HAZARD)</th>
<th>INSTALLATION²,³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Check Detector Fire Protection Backflow Prevention Assembly (two independent check valves with a parallel detector assembly consisting of a water meter and either a double check valve backflow prevention assembly or a single check for a Type II assembly, and means for field testing)</td>
<td>ASSE 1048</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Reduced Pressure Detector Fire Protection Backflow Prevention Assembly (two independently)</td>
<td>ASSE 1047</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
acting loaded check valves, a differential pressure relief valve, with a parallel detector assembly consisting of a water meter and either a reduced-pressure principle backflow prevention assembly or a single check for a Type II assembly, and means for field testing)

| Dual Check Valve Type Backflow Preventers for Carbonated Beverage Dispensers, Post Mix Type | ASSE 1032 | X | X | - | - | Installation includes carbonated beverage machines or dispensers but is also suitable for other beverage dispensers such as coffee machines, as well as ice machines. These devices operate under intermittent or continuous pressure conditions.

(portions of table not shown remain unchanged)

**TABLE 1701.1**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSE 1032-2004 (R2021)</td>
<td>Dual Check Valve Type Backflow Preventers for Carbonated Beverage Dispensers, Post Mix Type</td>
<td>Backflow Protection</td>
<td>Table 603.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

**Note:** ASSE 1032 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

**TABLE 1701.2**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSE-1032-2004 (R2011)</td>
<td>Dual Check Valve Type Backflow Preventers for Carbonated Beverage Dispensers, Post Mix Type</td>
<td>Backflow Protection</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)
**SUBSTANTIATION:**
The type-II bypass is approved for use in DCDA and RPDA devices (ASSE 1048 and ASSE 1047, respectively) by the two major standard-writing organizations for backflow preventers, ASSE and USCFCCCHR. The type-II bypass has been part of these standards for over 10 years. The type II bypass consists of a water meter, and a single check, as it bypasses only the 2nd check of main DC/RP. This currently conflicts with language in Section 603.3.8 and Section 603.3.9, as well as Table 603.2.

ASSE 1032 devices are not currently included in the body of 2021 UPC. I have added the ASSE 1032 devices along with common and reasonable applications.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
There is confusion regarding the single and double check valves and how they are applied. Additionally, is it not clear how ASSE 1032 applies to carbonated beverage dispensers. The TC requests the change to be clarified and submitted as a public comment.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 122

UPC 2024  Section: TIA UPC Table 603.2

SUBMITTER: Joel F. Hipp
Hobart, Div. ITW Food Equipment Group

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>DEGREE OF HAZARD</th>
<th>DEVICE, ASSEMBLY, OR METHOD</th>
<th>APPLICABLE STANDARDS</th>
<th>POLLUTION (LOW HAZARD)</th>
<th>CONTAMINATION (HIGH HAZARD)</th>
<th>INSTALLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ASSE 1001 or CSA B64.1.1</td>
<td>X</td>
<td>X</td>
<td>Upright position. Ne-valve downstream. Have outlet open to atmosphere. Minimum of 6 inches or listed distance above all downstream piping and flood level rim of receptor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(portions of the table not shown remain unchanged)

SUBSTANTIATION:

Technical Merit: The 2021 UPC has a conflict regarding the installation requirements for atmospheric vacuum breakers (AVB). Table 603.2 states that there shall be “No valve downstream”. However, ASSE 1001 was updated in 2017 to remove the wording “no valve downstream” and add, "have its outlet open to atmosphere" (Attachment 1 of TIA 001-21). Table 1701.1 in the 2021 UPC for Reference Standards includes the 2017 edition of ASSE 1001 (Attachment 2 of TIA 001-21).

Therefore, the installation requirements for atmospheric vacuum breakers in Table 603.2 must be updated as shown above to correct this conflict with the 2017 edition of ASSE 1001. Allowing a valve downstream from an AVB that does not create backpressure on the device is not a public health hazard.

Historically, a valve in the outlet to the AVB would create backpressure if it were considered a control valve and completely stopped the flow of water exiting the AVB. However, if the valve is not a shutoff or control valve, and is located in a branch of a TEE that does not block the outlet of the AVB to atmosphere, the intent of the requirement is met. Prohibiting any downstream valve is design restrictive and does not represent current certified designs that meet the intent of the code, which is to prevent backpressure on the AVB.

The validity of applications with a valve downstream from an AVB can be confirmed by the UPC 18-101 Request for Clarification issued by Bruce Pfeiffer, Chair of the UPC Answers and Analysis Committee (attachment 3 of TIA 001-21).
Updates to nationally recognized standards referenced in the UPC must always be taken into consideration so that the public can fully benefit from advancements in technology. Otherwise there would be confusion for anyone enforcing the UPC or applying the standards.

Emergency nature:
1) Hardship on Owners/Users of Equipment - There are currently many commercial dishwashing machines on the market with an auxiliary valve downstream of an AVB. The valve is in a branch of a TEE that cannot prevent the AVB from being open to atmosphere. However, since it does not meet the literal interpretation of the wording in Table 603.2 of the UPC, some AHJ’s have required these customers to replace the AVB with an RPZ or Spill Resistant Pressure Vacuum Breaker. Results of these nonconformance citations:
   - Delays in receiving a final CO
   - Plumbing modification fees from $1,200 to $2,000 per site
   - Loss of manufacturer warranty due to non-standard part replacements
   - Voiding the third-party sanitation certification
2) Loss of NSF Certification – When an NSF Certified commercial dishwashing machine is modified to replace the AVB with an untested device, that NSF Certification is rendered null and void. As such, the customer is susceptible to a possible public health citation for using a noncertified dishmachine. An even more significant ramification is a possible reduction in the sanitizing efficacy of the dishmachine which is a potential public health concern.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 123

UPC 2024  Section: Table 603.2

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>DEVICE, ASSEMBLY, OR METHOD</th>
<th>APPLICABLE STANDARDS</th>
<th>POLLUTION (LOW HAZARD)</th>
<th>CONTAMINATION (HIGH HAZARD)</th>
<th>INSTALLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backflow preventer for Carbonated Beverage Dispensers (two independent check valves with a vent to the atmosphere)</td>
<td>ASSE 1022</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(portions of table not shown remain unchanged)</td>
<td></td>
<td>(X)</td>
<td>(X)</td>
<td>(X)</td>
</tr>
<tr>
<td>SUBSTANTIATION: ASSE 1022 it is currently listed as approved only for low hazard backsiphonage. It should be listed at a minimum for both low hazard backsiphonage and low hazard backpressure. Also, since it is installed on what is a high hazard cross-connection it should be listed for high hazard backsiphonage and high hazard backpressure.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMMITTEE ACTION: ACCEPT AS SUBMITTED</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL ELIGIBLE TO VOTE: 26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Item #: 124

UPC 2024  Section: 603.3.8

SUBMITTER: Cameron Rapoport
Watts Water Technologies

RECOMMENDATION:
Revise text

603.0 Cross-Connection Control.

603.3 Backflow Prevention Devices, Assemblies, and Methods. (remaining text unchanged)

603.3.8 Double Check Detector Fire Protection Backflow Prevention Assembly. A double check valve backflow prevention assembly with a parallel detector assembly consisting that either bypasses both checks in the double check valve backflow prevention assembly (DC) and consists of a water meter and a double check valve backflow prevention assembly (DC), or bypasses the second check of the double check valve backflow prevention assembly and consists of a water meter and a single check.

SUBSTANTIATION:
The type-II bypass is approved for use in DCDA and RPDA devices (ASSE 1048 and ASSE 1047, respectively) by the two major standard-writing organizations for backflow preventers, ASSE and USCFCCCHR. The type-II bypass has been part of these standards for over 10 years. The type II bypass consists of a water meter, and a single check, as it bypasses only the 2nd check of main DC/RP. This currently conflicts with language in Section 603.3.8, Section 603.3.9, and Table 603.2.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The added verbiage is not necessary and the current language addresses the intent of the section.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 125
UPC 2024  Section: 603.3.9

SUBMITTER: Cameron Rapoport
Watts Water Technologies

RECOMMENDATION:
Revise text

603.0 Cross-Connection Control.

603.3 Backflow Prevention Devices, Assemblies, and Methods. (remaining text unchanged)

603.3.9 Reduced Pressure Detector Fire Protection Backflow Prevention Assembly. A reduced-pressure principle backflow prevention assembly with a parallel detector assembly consisting either bypassing both checks of the reduced pressure principle backflow preventer and consisting of a water meter and a reduced-pressure principle backflow prevention assembly (RP), or bypassing the second check of the reduced pressure principle backflow preventer and consisting of a water meter and a single check.

SUBSTANTIATION:
The type-II bypass is approved for use in DCDA and RPDA devices (ASSE 1048 and ASSE 1047, respectively) by the two major standard-writing organizations for backflow preventers, ASSE and USCFCCCHR. The type-II bypass has been part of these standards for over 10 years. The type II bypass consists of a water meter, and a single check, as it bypasses only the 2nd check of main DC/RP. This currently conflicts with language in Section 603.3.8 and Section 603.3.9, as well as Table 603.2.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is difficult to follow and can cause confusion to the end user. The TC requests that the verbiage be clarified and submitted as a public comment.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
Proposals

Item #: 126

UPC 2024 Section: 603.4.7

SUBMITTER: Cameron Rapoport
Watts Water Technologies

RECOMMENDATION:
Revise text

603.0 Cross-Connection Control.

603.4 General Requirements. (remaining text unchanged)

603.4.7 Freeze Protection. In cold climate areas, backflow assemblies and devices shall be protected from freezing with an outdoor enclosure that complies with ASSE 1060 or by a method acceptable to the Authority Having Jurisdiction. For indoor installations where freezing conditions may occur and heat, insulation, or both may be inadequate, digital monitoring of temperature with low temperature alerts shall be required.

SUBSTANTIATION:
In areas subjected to outdoor freezing temperatures, backflow preventer failure can occur in indoor mechanical rooms when not adequately heated, which is often the case. This is particularly true for fire sprinkler system backflow assemblies, as there is no flow of water to prevent freezing. In these cases, removal of the valve would not be possible, and insulation may be tampered with, lost, or inadequate due to both low water and ambient temperature. In such cases, digital monitoring systems with either a separate alarm or connection to a Building Management System (BMS) will alert users to take action to prevent damage to the backflow preventer.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is unnecessary, vague, and unenforceable as to "where freezing conditions may occur" and what is meant by "may be inadequate." The current language in Section 603.4.7 clearly states the intent of the section.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 127
UPC 2024  Section: 603.5.6, Table 1701.1, Table 1701.2

SUBMITTER: Tim Collings
self

RECOMMENDATION:
Revise text

603.0 Cross-Connection Control.

603.5 Specific Requirements. (remaining text unchanged)

603.5.6 Protection from Lawn Sprinklers and Irrigation Systems. Potable water supplies to systems having no pumps or connections for pumping equipment, and no chemical injection or provisions for chemical injection, shall be protected by a valve complying with IAPMO PS 72, or protected from backflow by one of the following devices:
(1) Atmospheric vacuum breaker (AVB)
(2) Pressure vacuum breaker backflow prevention assembly (PVB)
(3) Spill-resistant pressure vacuum breaker (SVB)
(4) Reduced-pressure principle backflow prevention assembly (RP)

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO PS 72-2019</td>
<td>Valves with Atmospheric Vacuum Breakers</td>
<td>Valves</td>
<td>603.5.6</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: IAPMO PS 72 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO-PS-72-2007+</td>
<td>Valves with Atmospheric Vacuum Breakers</td>
<td>Valves</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
Valves covered by this standard are intended for cold water installations requiring an integral anti-siphon device to prevent house water contamination when installed per the manufacturer's instructions.
COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

603.0 Cross-Connection Control.

603.5 Specific Requirements. (remaining text unchanged)

603.5.6 Protection from Lawn Sprinklers and Irrigation Systems. Potable water supplies to systems having no pumps or connections for pumping equipment, and no chemical injection or provisions for chemical injection, shall be protected by a valve complying with IAPMO PS 72, or protected from backflow by one of the following devices:

1. Atmospheric vacuum breaker (AVB)
2. Pressure vacuum breaker backflow prevention assembly (PVB)
3. Spill-resistant pressure vacuum breaker (SVB)
4. Reduced-pressure principle backflow prevention assembly (RP)
5. A valve complying with IAPMO PS 72

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO PS 72-2019</td>
<td>Valves with Atmospheric Vacuum Breakers</td>
<td>Valves</td>
<td>603.5.6</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

COMMITTEE STATEMENT:
The modification relocates the IAPMO PS 72 standard to the list to avoid confusion. Placing it in the list clarifies that the device will also serve as a backflow protection device.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 128

UPC 2024  Section: 603.5.12, Table 1701.1, Table 1701.2

SUBMITTER: Cameron Rapoport
Watts Water Technologies

RECOMMENDATION:
Revise text

603.0 Cross-Connection Control.

603.5 Specific Requirements. (remaining text unchanged)

603.5.12 Beverage Dispensers. Potable water supply to beverage dispensers, carbonated beverage dispensers, or coffee machines shall be protected by an air gap or vented backflow preventer that complies with ASSE 1022. For carbonated beverage dispensers, piping material installed downstream of the backflow preventer shall not be affected by carbon dioxide gas. Non-carbonated beverage dispensers, such as ice makers and coffee machines, shall be protected by an air gap or dual check backflow preventer that comply with ASSE 1032 or ASSE 1024.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STANDARD NUMBER</strong></td>
</tr>
<tr>
<td>ASSE 1032-2004 (R2021)</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASSE 1032 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

<table>
<thead>
<tr>
<th>TABLE 1701.2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DOCUMENT NUMBER</strong></td>
</tr>
<tr>
<td>ASSE 1032-2004 (R2011)</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASSE 1032 and ASSE 1024 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
Post-mix type carbonated beverage dispensers present a higher hazard than non-carbonated beverage dispensers, and therefore the added protection of an atmospheric vent in an ASSE 1022 compliant device is appropriate. However, non-carbonated beverage dispensers present less of a hazard as they do not produce carbonic acid, and therefore a dual check would be an appropriate device. There are two ASSE standards for dual checks, ASSE 1032 and ASSE 1024.
Though ASSE 1032 states it is specifically for carbonated beverage, examination of the standard leaves no reason it would not be appropriate for non-carbonated beverage. Additionally, ASSE 1032 are more commonly available in appropriate sizes (1/4", 3/8") than ASSE 1024 devices, and with more appropriate end connections given that their intended application is for beverage dispensing.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is confusing as the change is pertaining non-carbonated beverage dispensers, however, the standard title indicates it is for "carbonated" beverage dispensers. The TC requests the scope of the standard to be clarified and resubmitted as a public comment.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
603.5.14 Protection from Fire Systems. (remaining text unchanged)

603.5.14.3 One- or Two-Family, or Townhouse Residential Sprinkler Systems. Except as provided in Section 603.5.14.1 and Section 603.5.14.2, potable water supplies to one- or two-family or townhouse residential sprinkler systems that are normally under pressure shall be protected from backpressure and backsiphonage by a backflow preventer in accordance with ASSE 1024.

(renumber remaining sections)

(below shown for reference only)

603.5.14.1 Fire Department Connection. Where fire protection systems supplied from a potable water system include a fire department (siamese) connection that is located less than 1700 feet (518.2 m) from a nonpotable water source that is capable of being used by the fire department as a secondary water supply, the potable water supply shall be protected by one of the following:
(1) Reduced pressure principle backflow prevention assembly (RP)
(2) Reduced pressure detector fire protection backflow prevention assembly Nonpotable water sources include fire department vehicles carrying water of questionable quality or water that is treated with antifreeze, corrosion inhibitors, or extinguishing agents.

603.5.14.2 Chemicals. Where antifreeze, corrosion inhibitors, or other chemicals are added to a fire protection system supplied from a potable water supply, the potable water system shall be protected by one of the following:
(1) Reduced pressure principle backflow prevention assembly (RP)
(2) Reduced pressure detector fire protection backflow prevention assembly

Note: ASSE 1024 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.
SUBSTANTIATION:
Residential fire sprinkler systems in one- or two-family homes or townhouses are becoming more common, and the contents of those fire sprinklers should be protected against backsiphonage and backpressure. This is because common fire sprinkler system materials are often not lead free or otherwise appropriate for potable use, as well as the risk of legionella growth in stagnant systems. There are several ASSE 1024 compliant devices that also meet typical fire standards (UL) that do not put an unreasonable burden on the homeowner due to their lower cost and lack of testing requirements.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The term "normally" is not enforceable. The change is not clear as to what systems are "normally under pressure."

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 130
UPC 2024  Section: 206.0, 603.5.17

SUBMITTER: Herb Hoeptner  
Hoeptner Perfected Products

RECOMMENDATION:
Revise text

603.0 Cross Connection Control.

603.5.17 Potable Water Outlets and Valves. Potable water outlets, freeze-proof yard hydrants, combination stop-and-waste valves, freeze resistant drinking fountains or other fixtures that incorporate a stop and waste feature that drains into the ground shall not be installed underground.  
Exception: Drinking fountain freeze resistant sanitary shall be permitted to be installed underground.

206.0 -D- 
Drinking Fountain Freeze Resistant. An outdoor point of use valve used for potable water systems that uses a stop and waste below the frost line to protect against freezing. The device is normally installed in a vertical position extending from below the frost line to above grade.
Drinking Fountain Freeze Resistant Sanitary. An outdoor point of use valve used for potable water systems that drains back into an internal reservoir below the frost line to protect against freezing. The device is normally installed in a vertical position extending from below the frost line to above grade.

SUBSTANTIATION:
An outside frost free drinking fountain are most common at parks, sports complexes, hiking trails, bike trails, dog parks and anywhere the public will need drinking water. The latest trend is to include bottle fillers and dog waterers. To prevent them from freezing they incorporate a stop and waste vale to drain the system into the soil. Standard yard hydrants(weep hole hydrants) that drain into the ground to prevent freezing, and all stop and waste valves are prohibited from being buried underground. An outside frost free drinking fountain drains into the soil the same as a weep hole hydrant or stop and waste and is currently not addressed as such in the UPC code. One can argue whether or not someone can get cross contamination from a stop and waste claiming the use is for filling bucket, but one cannot argue that the only purpose for a drinking fountain is to drink from it. Therefore it is imperative that we guarantee the quality of the water coming from a drinking fountain.

Definitions: There is no current definition of Drinking Fountain Freeze Resistant or the subcategory, Drinking Fountain Freeze Resistant Sanitary. These are generally accepted definitions.

Section 603.5.17 currently does not include outside frost free drinking fountains that use a stop and waste to protect from freezing. To prevent this text from being misinterpreted to read that all frost free drinking fountains including Sanitary frost free drinking fountains cannot be installed underground an exception needs to be added. Sanitary drinking fountains have been specifically designed to be installed below the frost line and supply potable drinking water.

Currently there are three manufacturers that manufacture a Sanitary Drinking Fountain that does not drain into the soil to prevent freezing. For more information on Drinking fountains please see attached

Is your outside drinking fountain safe for drinking?
If you use or install outside drinking fountains or yard hydrants you might want to concern yourself with the
inevitable possibility that your potable water can become contaminated with harmful bacteria located in the soil. Sure you hire the best contractors and you assume that you meet all the state and local requirements, but sometimes that is not enough. Some code authorities adopt codes but don’t necessarily enforce them, leaving you liable for any problems that develop. Some code authorities are slow to adopt the most current standards available, thus newly adopt an old standard after you have completed your project again leaving you liable. In this litigious society, sometimes you need to do more to ensure you do not become entangled in the litigation process.

How contaminated ground water can enter your potable water supply:
Typical outside drinking fountains and yard hydrants prevent freeze-ups by draining out of a “weep hole” deep in the ground. They generally consist of a bubbler, or in the case of a yard hydrant, a head for attaching a hose, a riser pipe, and a shut-off valve deep below the frost level. The term “weep hole” is derived from the fact that, when the weep hole drinking fountain or yard hydrant is shut off, a hole in the side of the valve opens to drain all the water from the riser into the soil below the frost line. These are sometimes referred to as Stop & Waste valves. A typical problem for these “weep hole” devices is that, when the ground water level fluctuates, especially during the summer months, or the device is used repeatedly so drain water does not have a chance to percolate into the ground, the ground water level will rise above the weep hole filling the riser with soiled ground water that will be consumed by the public. Each time the device is shut off (Fig. 1) and the weep hole opens, ground water will migrate into the drinking fountain or yard hydrant. Each time the drinking fountain or hydrant is turned on (Fig. 2), that contaminated migrated water enters the potable water supply system and exits the bubbler. That first drink of water can be nothing but soiled, most likely contaminated water.

A secondary, and more serious, problem occurs when the rubber seal in the shutoff valve or air valve deteriorates over time and begins to leak. When the valve on the kitchen sink leaks it is very noticeable as it will drip incessantly forcing you to replace the rubber seal. Unfortunately when your drinking fountain or yard hydrant leaks, it usually leaks out the weep hole deep in the ground undetected. From the surface no one is aware the device is leaking. When a back siphonage condition occurs (Fig.3), that leak out will become a leak in, sucking contaminated muddy water into the supply line. If the hydrant is located in a horse arena or cow barn, animal by-products will leach into the potable water supply.
In the first scenario the end user can consume contaminated water. In the second scenario, it is far more serious because the entire water supply can become contaminated which the public consumes. This means that possible contamination from one drinking fountain or yard hydrant, in one area, could cross contaminate the public in other areas or other commercial or private dwellings. Anyone connected to that water supply potentially can become contaminated.

Lately, due to the deaths associated with e-coli outbreaks and other pathogens that have contaminated our water supplies, there has been great concern regarding cross contamination between the soil, which carries animal by-products, fertilizers and other waste, and the water supply.

The liability toward each state became such a concern that many states created their own drinking fountain and yard hydrant requirements. Initially, states implemented requirements to isolate weep hole devices from the potable water supply. These requirements included installing a testable RPP backflow preventer upstream of the hydrant and then tagging the hydrant “danger unsafe water”. This solved two major concerns. First, it protected the potable water supply from siphoning contaminated water into the public water system, and secondly, it attempted to notify the public not to use the hydrant for any potable source. Naturally the obvious downside to this approach was that drinking fountains and yard hydrants had to be used as a potable source. Drinking fountains are only used for drinking, and yard hydrants are used for RV parks and campgrounds. A secondary downside is the cost associated with the purchase and installation of a testable RPP backflow preventer, the difficulty in finding a location for the backflow preventer to keep it from freezing and the added cost in annual inspection and testing of the backflow preventer.

Innovative manufacturers soon developed a new breed of drinking fountains and yard hydrants to solve the problems associated with the new requirements imposed on weep hole devices. These new devices are called Sanitary Drinking Fountains (Fig. 4) and Sanitary Yard Hydrants.

These Sanitary devices work much the same way as a Weep Hole device in that when they are shut off the water in the riser drains down and out a hole located below the frost line to prevent freezing. However, instead of draining out a hole and into the soil, the Sanitary Hydrant, or Sanitary Drinking Fountain (Fig. 4), drains into a sealed tank. When the hydrant is turned on again the water in the tank is expelled leaving the tank empty to repeat the cycle when the device is again shut off. Because the Sanitary drinking fountain and yard hydrant drain into a tank there is no cross contamination with the soil. Because the soil is not required for drainage the drinking fountain or yard hydrant can be placed in any soil condition, even clay.
With the advent of the Sanitary Drinking Fountain and Sanitary Yard Hydrant, states were able to meet the needs and safety requirements of the public. The problem for the state or local code officials was the cost, manpower and liability in having to develop their own approval process and testing each manufacturer’s device for approval. In turn, the varying requirements by each state made it difficult for manufacturers to make one product for all states.

ASSE (American Society of Sanitary Engineers) realized the need to develop a national standard to help states avoid this liability and give manufacturers the ability to meet one set of requirements. After six years of debate and research by code officials, manufacturers, engineers, consultants, and the public, ASSE Sanitary Yard Hydrant Standard 1057 was completed. This standard requires that the hydrant not drain directly into the ground and it must have a back flow preventer if a hose is capable of attachment. It stipulates required pressure and flow capabilities and ensures proper freeze protection.

It's obvious that over the past few years the sanitary issue for drinking fountains and yard hydrants has become an important issue for public safety, and although the 1057 Sanitary Yard Hydrant Standard has not yet specifically addressed drinking fountains, it is important to realize one's potential risk of cross contamination and possible liability when installing or specifying drinking fountains and yard hydrants. For yard hydrants, make sure they have been tested by an approved test lab and listed by a third party certifier to the ASSE 1057 standard. For drinking fountains make sure they are Sanitary drinking fountains where the freeze protection draining does not drain directly into the ground.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
There has been a long standing agreement to not install drinking fountain piping underground. There is no guidance regarding the depth requirements in the proposed change. The term "sanitary" may conflict with the way it is used in the code. Furthermore, nothing in this code prohibits the use of such installation, therefore, the change is not needed.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**
- **AFFIRMATIVE:** 25
- **NOT RETURNED:** 1 Daniels
Proposals

Item #: 131

UPC 2024  Section: 227.0, 603.5.17

SUBMITTER: Herb Hoeptner  
Hoeptner Perfected Products

RECOMMENDATION:  
Revise text

603.0 Cross Connection Control.

603.5.17 Potable Water Outlets and Valves. Potable water outlets, freeze-proof non-sanitary yard hydrants, combination stop-and-waste valves, or other fixtures that incorporate a stop and waste feature that drains into the ground shall not be installed underground.

Exception: Freeze-resistant sanitary yard hydrants that meet the requirements of ASSE 1057 shall be permitted to be installed underground.

227.0 -Y-

Yard Hydrant. A point-of-use valve used for nonpotable water systems that is protected against freezing by draining residual water onto the soil (which can be a source of cross-contamination). The device is normally installed in a vertical position extending from below the frost line to above grade.

Yard Hydrant, Sanitary. A point-of-use valve used for potable water systems that drains back into an internal reservoir below the frost line to protect against freezing. The device incorporates a backflow prevention device with hose connection outlet for potable water application. The device is normally installed in a vertical position extending from below the frost line to above grade.

Note: ASSE 1057 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
Standard yard hydrants (weep hole hydrants) that drain into the ground to prevent freezing, are normally used for irrigation but are typically attached to a potable water supply. It has been determined that weep hole yard hydrants can cross contaminate to the potable water supply lines, contaminating homes and buildings upstream of the hydrant. Those same hydrants are also being used for potable water supply for campsites, Recreational Vehicles (RV) and trailer parks, creating more cross contamination problems for the end user’s potable water. Please see additional information

An ASSE 1057 Sanitary Yard Hydrant approved device protects the water supply from cross contamination with the soil. These devices do not behave as a weep hole hydrant (such as a stop and waste device) as they do not have an opening into the soil to drain the excess water from the device. Devices capture water in an internal reservoir below the frost line to prevent cross contamination from the soil. They could be buried in a septic tank and still deliver clean potable water as they are totally isolated from the surrounding soil conditions. This is why they have been deemed Sanitary.

The purpose of this proposed change is to clarify the definition and installation of freeze resistant sanitary yard hydrants which is currently not addressed in the UPC code

Definitions: There is no current definition of Yard Hydrant or the subcategory, Sanitary Yard Hydrant. These are generally accepted definitions.
Section 603.5.17 can currently be misinterpreted to read that all yard hydrants including Sanitary yard hydrants cannot be installed underground, when in fact the product is specifically designed to be installed below the frost line and supply potable water. Currently there are three manufacturers that are listed to ASSE 1057 Sanitary Yard Hydrant standard.

In summary:
Most states have taken it upon themselves to require Sanitary Yard Hydrants to meet the ASSE 1057 Standard. Any engineer who is familiar with ASSE 1057 will make it a requirement, even if the state does not, because they are concerned for their own liability. The UPC code currently does not address Sanitary Yard Hydrants. This verbiage, including the requirement to meet ASSE 1057, is currently used by most states. Any engineer who specifies a yard hydrant will always specify a 1057 approved device for their own liability. This Sanitary Yard Hydrant addition has been sorely neglected in the UPC codes.

Serious Cross Contamination In Yard Hydrants:
Due to the deaths associated with e-coli outbreaks and other pathogens that have contaminated our water supplies, there has been great concern regarding cross contamination between the potable water supply and the soil, which carries animal by-products, fertilizers and other hazardous materials. Most of us are familiar with a standard “weep hole” Yard Hydrant as they have been around for years. Hundreds of thousands of them are sold each year. They are used in campgrounds, RV parks, ranches, farms, gardens and anywhere water is needed away from a building. However, most of us are unaware of the serious cross contamination potential associated with the weep hole at the base of the hydrant. The common weep hole yard hydrant consists of a head for attaching a hose, a riser pipe, and a shutoff valve deep below the frost level. The term “weep hole” is derived from the fact that, when the weep hole hydrant is shut off, a hole in the side of the valve opens up to drain all the water from the riser into the soil below the frost line, much like a Stop and Waste Valve. Some are placed in a backfill of gravel to aid in draining. Most states agencies recognize the cross contamination potential anytime a hose is connected to a hydrant. Hoses have the ability to be placed in high hazard environments, such as stock tanks, pesticide tanks or even lying on the ground in mud puddles. Back Siphonage will cause these hazardous materials to be sucked back into the water supply. Back siphonage can occur whenever a supply line is broken or drained for repair. In addition, yard hydrants create a back siphonage each and every time they are shut off, as the mere act of draining the riser, creates a siphon at the hose bib. Because of this, many states have required vacuum breakers to be attached to all hydrants where a hose could be attached. Naturally this prevents cross contamination during back siphonage should the hose be placed in a contaminated environment.

What many agencies are starting to realize is, that there still exists a severe cross contamination potential associated with the weep hole being in contact with the soil. Because these weep hole hydrants function much the same way as a Stop and Waste Valve, they suffer the same cross contamination issues. For example, if the stopper in a standard "weep hole" hydrant ever leaks, it is undetectable at ground level as it is leaking out the weep hole deep into the ground. The hydrant weep hole drips continuously throughout the day and night, and from the surface no one is aware the hydrant is leaking.

When a back siphonage condition occurs, that leak out will become a leak in, sucking contaminated muddy water into the supply line. If the hydrant is located in a horse or cow barn, animal by-products will leach into the potable water supply.
Even when the hydrant is working properly, in states where the ground water level fluctuates, this problem is exacerbated by the fact that when the water table rises above the weep hole, like when it rains, the backfill of gravel gets full of water. Any water higher that the weep hole will migrate contaminated water into the riser. Now every time one turns on the hydrant they will get a slug of contaminated water entering the potable water of an RV or camper. Each time the hydrant is shut off and the weep hole opens, permitting contaminated water to migrate into the hydrant. Each time the hydrant is turned on, that contaminated water enters the potable water supply system. Outside drinking fountains operate the same way. Each time the fountain is turned on, the first drink of water is nothing but soiled, possibly contaminated, water.

The liability toward each state became such a concern that many states created their own yard hydrant requirements. Initially, states implemented requirements to isolate weep hole hydrants from the potable water supply. These requirements included installing a testable RPP backflow preventer upstream of the hydrant and then tagging the hydrant “danger unsafe water”. This solved two major concerns. First, it protected the potable water supply from siphoning contaminated water into the public water system, and secondly, it attempted to notify the public not to use the hydrant for any potable source. The downside to this approach was the cost associated with the purchase and installation of a testable RPP backflow preventer, the difficulty in finding a location for the RPP device to keep it from freezing, the added cost in annual inspection and testing of the RPP device, and the fact that the weep hole yard hydrant is not fit for potable water. RV parks and campgrounds were especially hard hit, as they required potable water from their hydrants.

Manufacturers soon developed a new breed of yard hydrants to solve the problems associated with the new requirements imposed on weep hole hydrants. These new hydrants are called Sanitary Yard Hydrants.

A Sanitary Yard Hydrant works much the same way as a Weep Hole Hydrant in that when they are shut off, the water in the riser drains down and out a hole located below the frost line to prevent freezing. However, instead of draining out a hole and into the soil, the Sanitary Hydrant drains into a sealed tank. When the hydrant is turned on again, the water in the tank is expelled leaving the tank empty to repeat the cycle when the hydrant is again shut off. Because the sanitary hydrant drains into a tank there is no cross contamination with the soil. Because the soil is not required for drainage the hydrant can be placed in any soil condition, even clay. With the addition of a vacuum breaker at the hose connection, the Sanitary Yard Hydrant protects the potable water supply and public from cross contamination from the soil and from the hose.

The problem for the state and local code officials was the cost, manpower, and liability in having to develop their own approval process and testing each manufacturer’s device for approval. In turn, the varying requirements by each state made it difficult for manufacturers to make one product for all states.

ASSE realized the need to develop a national standard to help states avoid this liability and give manufacturers the ability to meet one set of requirements. After six years of debate and research by code officials, manufacturers, engineers, consultants, and the public, ASSE’s Sanitary Yard Hydrant Standard 1057 was completed. This standard requires that the yard hydrant not drain directly into the ground and that it must have a back flow preventer if a hose
is capable of attachment. In addition, it stipulates minimum required pressure and flow capabilities and ensures proper freeze protection and that all serviceable parts can be accomplished without the need to excavate. It also stipulates, the manufacturers must test their hydrants at an approved and regulated test lab.

This standard reduces the liability, manpower, and costs for the state agencies to ensure proper protection of the water supply and the public. At the same time it helps manufacturers to have a base line from which to develop and improve yard hydrants in general.

With the continued efforts by states for clean, safe, potable water and the high liability associated with cross contamination, greater concern must be given to the proper selection, installation and use of yard hydrants.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The term "sanitary" may conflict with the way it is used in other parts of the code. There should be a separation between the potable and nonpotable requirements. Furthermore, nothing in this code prohibits the use of such installation and therefore not needed.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
603.5 Specific Requirements. (remaining text unchanged)

603.5.21 Chemical Dispensers. The water supply to chemical dispensers shall be protected against backflow. The chemical dispenser shall comply with ASSE 1055 or the water supply shall be protected by one of the following methods:
(1) Air gap
(2) Atmospheric vacuum breaker (AVB)
(3) Pressure vacuum breaker backflow prevention assembly (PVB)
(4) Spill-resistant pressure vacuum breaker (SVB)
(5) Reduced-pressure principle backflow prevention assembly (RP)

603.5.21.1 Pressure Relief Device. Chemical dispensers receiving their water supply from a service or mop basin faucet or fixture fitting, shall be provided with a pressure relief device attached to the hose threads of the faucet or fixture fitting prior to the connection of the chemical dispenser. The pressure relief device shall comply with IAPMO PS 104 and shall have a constant bleed of water when the service or mop sink faucet is in use. An individual water supply to the chemical dispenser shall be permitted to be used to supply water to the chemical dispenser.

603.5.21.2 Water Connection. Chemical dispensers used to supply cleaning or sanitizing chemicals to commercial kitchen sinks and dishwashers shall have an individual water connection to the potable water system. Alteration of listed faucets or fixture fittings to supply water to a chemical dispenser or other dispensing devices shall be prohibited.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
<th>REFERENCED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
<td>STANDARD TITLE</td>
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<tr>
<td>IAPMO PS 104-2019</td>
<td>Pressure Relief Connection for Dispensing Equipment</td>
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(portions of table not shown remains unchanged)

Note: IAPMO PS 104 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

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<th>TABLE 1701.2</th>
<th>STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES</th>
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<tbody>
<tr>
<td>DOCUMENT NUMBER</td>
<td>DOCUMENT TITLE</td>
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<tr>
<td>IAPMO PS 104-1997</td>
<td>Pressure Relief Connection for Dispensing Equipment</td>
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</tbody>
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(portions of table not shown remains unchanged)
SUBSTANTIATION:
Currently, it is a common practice by many of the chemical dispenser companies to supply water to their devices by connecting their product to the hose threads on a mop sink faucet using a wye connection. By closing the stop on the other half of the wye connection, constant pressure would be applied to atmospheric vacuum breaker on the faucet. Atmospheric vacuum breakers may not have down stream valves or constant pressure per Table 603.2 of the 2021 UPC. This device provides a continuous flow of water through the "bleed tee" when the faucet is on, thereby eliminating the issue with downstream valving, as well as reminds the user to shut the water off to the fixture.

Currently, many chemical dispenser companies will install a brass tee in the faucet spout of a commercial kitchen sink to supply water to their device. Section 301.2 of the 2021 UPC requires all plumbing fixture fittings and faucets to be tested to applicable standards and listed by an accredited third party listing agency. A listed faucet or fixture fitting that has been altered with the insertion of a tee voids the listing for the faucet or fixture fitting. An individual water supply to the chemical dispenser would be needed to comply with the requirements found in the UPC.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is being rejected as the wording is confusing and the intent is not clear. The proposal should be reworded and submitted as a public comment.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 133
UPC 2024  Section: 604.1

SUBMITTER: Pennie Feehan
Pennie L Feehan Consulting
Rep. Copper Development Association

RECOMMENDATION:
Revise text

604.0 Materials.

604.1 Pipe, Tube, and Fittings. Pipe, tube, fittings, solvent cement, thread sealants, solders, and flux used in potable water systems intended to supply drinking water shall comply with NSF 61. Where copper alloys pipe, fittings and valves made from copper alloys containing more than 15 percent zinc by weight and are used in plastic piping systems, they shall be resistant to dezincification and stress corrosion cracking in compliance with NSF 14.

Materials used in the water supply system, except valves and similar devices, shall be of a like material, except where otherwise approved by the Authority Having Jurisdiction.

Materials for building water piping and building supply piping shall comply with the applicable standards referenced in Table 604.1.

SUBSTANTIATION:
The original sentence is confusing and wordy. This code section was created because of a manufacturing issue that has been corrected in NSF 14 - Plastics Piping System Components and Related Materials, Section 5.8.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The Technical Committee is aware that the dezincification provisions are covered in NSF 14, but feel it is important to reference it in the text; no reason was provided to remove the language. The existing language assists the end user by indicating the dezincification requirements without having to look at the standard.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 134
UPC 2024  Section: Table 604.1, Table 1701.1

SUBMITTER: Chang Ki Lee
PlumbPlus Corp.

RECOMMENDATION:
Revise text

TABLE 604.1
MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>BUILDING SUPPLY PIPE AND FITTINGS</th>
<th>WATER DISTRIBUTION PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
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<tr>
<td>Ductile-Iron</td>
<td>X</td>
<td>X</td>
<td>AWWA C151</td>
<td>ASME B16.4, AWWA C110, AWWA C153, IAPMO IGC 360</td>
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(portions of table not shown remains unchanged)

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>IAPMO IGC 360-2020a</td>
<td>Compression Fittings for Water Supply and Gas Piping Applications</td>
<td>Fittings</td>
<td>Table 604.1</td>
</tr>
</tbody>
</table>

Note: IAPMO IGC 360 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The proposed standard covers compression type fitting for ductile iron water supply pipe. This type of compression fitting is currently not covered by any standard.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The IAPMO IGC 360 standard does not address ductile iron fittings, therefore, being rejected.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
**Proposals**

**Item #: 135**

UPC 2024  Section: Table 604.1, Table 1701.1, Table 1701.2

**SUBMITTER:** Bruce A Pfeiffer  
Retired - City of Topeka

**RECOMMENDATION:**  
Revise text

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### TABLE 604.1
MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>BUILDING SUPPLY PIPE AND FITTINGS</th>
<th>WATER DISTRIBUTION PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ductile-Iron</td>
<td>X</td>
<td>X</td>
<td>AWWA C151</td>
<td>ASME B16.4, AWWA C110, AWWA C153, AWWA C606, CSA B242, IAPMO PS 53</td>
</tr>
<tr>
<td>Galvanized Steel</td>
<td>X</td>
<td>X</td>
<td>ASTM A53</td>
<td>AWWA C606, CSA B242, IAPMO PS 53</td>
</tr>
<tr>
<td>Malleable Iron</td>
<td>X</td>
<td>X</td>
<td>—</td>
<td>ASME B16.3, AWWA C606, IAPMO PS 53</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>X</td>
<td>X</td>
<td>ASTM A269, ASTM A312, ASTM A554, ASTM A778</td>
<td>ASTM F3226, CSA B242, IAPMO PS 53, IAPMO PS 117</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)
### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWWA C606-2015</td>
<td>Grooved and Shouldered Joints</td>
<td>Joints</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>CSA B242-2005</td>
<td>Groove- and Shoulder-Type Mechanical Pipe Couplings</td>
<td>Fittings</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>IAPMO PS 53-2020</td>
<td>Grooved Mechanical Pipe Couplings and Grooved Fittings</td>
<td>Fittings</td>
<td>Table 604.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

**Note:** AWWA C606, CSA B242, and IAPMO PS 53 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

### TABLE 1701.2
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
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<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Grooved and Shouldered Joints</td>
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</tr>
<tr>
<td>CSA B242-2005</td>
<td>Groove- and Shoulder-Type Mechanical Pipe Couplings</td>
<td>Fittings</td>
</tr>
<tr>
<td>IAPMO PS 53-2016</td>
<td>Grooved Mechanical Pipe Couplings and Grooved Fittings</td>
<td>Joints</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

**SUBSTANTIATION:**
These fitting standards cover grooved mechanical pipe couplings and grooved fittings for pressure applications. These types of fittings are not currently covered in the codes, but are widely used in the industry for water distribution applications.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1 Daniels
Proposals

Item #: 136

UPC 2024  Section: Table 604.1, Table 1701.1, Table 1701.2

SUBMITTER: Mr John Wilson
Taylor Kerr Engineering Ltd (Teekay Couplings)

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>TABLE 604.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIAL</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Ductile-Iron</td>
</tr>
<tr>
<td>Galvanized Steel</td>
</tr>
<tr>
<td>PE</td>
</tr>
<tr>
<td>PP</td>
</tr>
</tbody>
</table>
Notes:
1 For building supply or exterior cold-water applications, not for water distribution piping.
2 For brazed fittings only

(portions of table not shown remains unchanged)

### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
</table>

(portions of table not shown remains unchanged)

**Note:** ASTM F1476 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

### TABLE 1701.2
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F1476-2007 (R2013)</td>
<td>Performance of Gasketed Mechanical Couplings for Use in Piping Applications</td>
<td>Joints</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

**SUBSTANTIATION:**
The ASTM F1476 specification provides the performance characteristics and qualification tests required for gasketed mechanical couplings (GMC) including groove-type mechanical couplings for grooved end pipe, mechanical restraint couplings for plain end pipe and mechanical compression couplings for plain end pipe. These couplings are for use at temperatures within the recommended temperature range of their respective gaskets.

Couplings manufactured to perform to this standard are utilized around the world for many pipework systems for civils, water, oil & gas, marine, plumbing and mechanical installations with a wide range of pipe materials. Gasketed mechanical pipe couplings allow pipes to be permanently joined without the need for welding, soldering or brazing, eliminating the need for on-site hot work. No pipe threading, grooving, or alternative preparation is required. This gives the system designer and contractor access to a widely used and accepted modern construction method in today’s industry.

Health and safety benefits come from the simple tools required and the use of plain end pipe. There is no heating, welding or manipulation of material on site, so handling is easy and safe. The coupling is light in weight, has no loose parts and all materials are REACH and RoHS compliant and manufactured under an ISO 9001 quality programme. Gaskets are NSF 61 compliant.

The high-level performance of GMCs allows gravity systems to be uprated. For example, where CISPI 310 states that thrust restraint systems are required, a GMC can fulfil the regulation. Global manufacturers of hubless cast iron utilize GMCs in sensitive locations as part of their overall systems.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The change is being rejected as it is mixing gaskets with mechanical joints, which is not appropriate for this section.
<table>
<thead>
<tr>
<th>TOTAL ELIGIBLE TO VOTE: 26</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels</td>
</tr>
</tbody>
</table>
Proposals

Item #: 137
UPC 2024  Section: Table 604.1, Table 1701.1

SUBMITTER: Mark Fasel  
Viega LLC

RECOMMENDATION:
Revise text

**TABLE 604.1**
MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>BUILDING SUPPLY PIPE AND FITTINGS</th>
<th>WATER DISTRIBUTION PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Stainless Steel</td>
<td>X</td>
<td>X</td>
<td>ASTM A269, ASTM A312, ASTM A554, ASTM A778</td>
<td>ASTM F3226, IAPMO IGC 353, IAPMO PS 117</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

**TABLE 1701.1**
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 353-2019</td>
<td>Branch Connectors</td>
<td>Connectors</td>
<td>Table 604.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: IAPMO IGC 353 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**SUBSTANTIATION:**
The IAPMO IGC 353 Branch Connectors standard was developed for branch connectors NPS 1 1/2" - 6 inches.

Branch connectors are defined within the standard as a permanent fitting or connection that allows a NPT threaded branch connection to be added to existing piping.

Branch connectors covered by IAPMO IGC 353 shall include:
(a) Saddle like permanent connection mechanically fixed in place to the host pipe; and
(b) leak tight seal realized through the compression of a sealing element between the outer surface of the pipe and body or flange of the branch connector.

Note: One method of mechanically fixing the branch connection is via a swaging action which secures the fitting by mechanically deforming a flange of metal attached to the branch connector so that it matches the contour of the inside surface of a host pipe as indicated in Section 1.1.2 of IAPMO IGC 353.

Section 4.2.1 of the standard requires that materials and components of a branch connector intended to convey or dispense water for human consumption through drinking or cooking shall comply with the applicable requirements of NSF/61 and the applicable low-lead requirements.
The addition of this standard to the Materials for building supply and water distribution piping and fittings table provides a consensus developed standard branch connector fittings can be listed to for use in potable water applications with stainless steel pipe.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The proposed standard, IAPMO IGC 353, is being rejected as it is not applicable to potable water systems, therefore, not appropriate for such reference.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposal

Item #: 138
UPC 2024 Section: Table 604.1, Table 1701.1

SUBMITTER: Michael Cudahy
PPFA

RECOMMENDATION:
Revise text

### TABLE 604.1
MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>BUILDING SUPPLY PIPE AND FITTINGS</th>
<th>WATER DISTRIBUTION PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE-RT</td>
<td>X</td>
<td>X</td>
<td>ASTM F2769, CSA B137.18</td>
<td>ASSE 1061, ASTM D3261, ASTM F1055, ASTM F1807, ASTM F2098, ASTM F2159, ASTM F2735, ASTM F2769, ASTM F3347, ASTM F3348, CSA B137.18</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

### TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F3347-2020a</td>
<td>Metal Press Insert Fittings with Factory Assembled Stainless Steel Press Sleeve for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing</td>
<td>Fittings</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>ASTM F3348-2020b</td>
<td>Plastic Press Insert Fittings with Factory Assembled Stainless Steel Press Sleeve for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing</td>
<td>Fittings</td>
<td>Table 604.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)
Note: ASTM F3347 and ASTM F3348 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The scopes of ASTM F3347 and ASTM F3348 cover water distribution fittings but do not address building supply pipe and fittings. The change needs clarification to show that the standards are only applying to water distribution pipe and fittings.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 20  NEGATIVE: 5  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:
BALLANCO: This change should have been accepted. The substantiation justifies the proposed change.

BROWN, GORSUCH: Agree with Michael Cadahy.

CUDAHY: The rejection misses the fact that not all of the fittings listed are intended for direct burial, which is important. Fittings for hot and cold distribution are tested to more rigorous conditions than service only type fittings.

NIELSEN: There was nothing wrong with this proposal.
604.0 Materials. The maximum allowable lead content in pipes, pipe fittings, plumbing fittings, and fixtures intended to convey or dispense water for human consumption shall be not more than a weighted average of 0.25 percent with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures. For solder and flux, the lead content shall be not more than 0.2 percent where used in piping systems that convey or dispense water for human consumption. Exceptions:

(1) Pipes, pipe fittings, plumbing fittings, or fixtures or back-flow preventers used for nonpotable services such as manufacturing, industrial processing, irrigation, outdoor watering, or any other uses where the water is not used for human consumption.

(2) Flush valves, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are 2 inches (50 mm) in diameter or larger.

SUBSTANTIATION:
Backflow preventers that are intended to convey water for use in non-potable services are in contact with potable water on the upstream side. Authorities Having Jurisdiction are increasingly requiring lead free backflow preventers in these applications (i.e. irrigation, fire) for this reason. This language would align with inspectors and increase water safety with respect to lead contact.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is being rejected as it will require backflow preventers to be lead free, however, federal regulations allow the exception.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:

GORSUCH: Backflow preventers should be lead-free since there are parts of the bodies that may be in direct contact with potable water system.
Proposals

Item #: 140

UPC 2024  Section: 604.5, 604.12

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

604.0 Materials.

604.5 Flexible Connectors. Flexible water connectors shall be installed in readily accessible locations, and where under continuous pressure shall comply with ASME A112.18.6/CSA B125.6. Flexible water connectors with an excess flow shutoff device shall comply with CSA B125.5/IAPMO Z600.

604.12 Flexible Corrugated Connectors. Flexible corrugated connectors of copper, copper alloy, or stainless steel water connectors shall be installed in readily accessible locations and shall comply with ASME A112.18.6/CSA B125.6. Flexible water connectors with an excess flow shutoff device shall comply with CSA B125.5/IAPMO Z600. Such connectors shall be limited to the following connector lengths:
(1) Fixture Connectors – 30 inches (762 mm)
(2) Washing Machine Connectors – 72 inches (1829 mm)
(3) Dishwasher and Icemaker Connectors – 120 inches (3048 mm)
(4) Other Connections – 48 inches (1220 mm)

SUBSTANTIATION:
The change deletes Section 604.5 and relocates the language to Section 604.12. The existing language of Section 604.12 was added in 2000 (see original proposal and reason statement in at the end of the substantiation) while the field of flexible water connectors was still developing. The term “corrugated” still used in the section title now seems archaic for the current application described.

Corrugated connectors (see images below) are distinctive in appearance, were a very small portion of the market (perhaps is even smaller now) and were primarily developed for larger diameter connections. Certainly not for the relatively small and flexible diameters that serve fixture connectors, dishwasher and icemaker connections. They are not well suited for close radius change of directions like the 180° change required for most clothes washer connections.

All the Flexible Corrugated Connectors are listed to ASME A112.18.6/CSA B125.6.

Explanation:
1. Removes the specific materials section included and opens it to any material meeting the standard.
2. Removes the dubious statement “where under continuous pressure shall comply with…” They should comply with the standard whether under pressure or not.
3 Water Heater Connectors are still in the following section
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
There is no technical justification given for adding (4) to limit all "other connections" to 48 inches in length. The change is generalizing corrugated connectors, however, such provisions may not be applicable to all connectors.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25    NOT RETURNED: 1   Daniels
Proposals

Item #: 141
UPC 2024 Section: 604.13

SUBMITTER: Lance MacNevin  
Plastics Pipe Institute

RECOMMENDATION:
Revise text

604.0 Materials.

604.13 Water Heater Connectors. Flexible metallic (copper and stainless steel), reinforced flexible, braided stainless steel, or polymer braided with EPDM core connectors that connect a water heater to the piping system shall comply with ASME A112.18.6/CSA B125.6. Copper, copper alloy, or stainless steel flexible connectors shall not exceed 24 inches (610 mm). PEX, PEX-AL-PEX, PE-AL-PE, or PE-RT tubing shall not be installed within the first 18 inches (457 mm) of piping connected to a water heater. 

**Exception:** PEX, PEX-AL-PEX, PE-AL-PE, or PE-RT tubing shall be permitted to be connected directly to tankless water heaters intended for domestic water applications.

SUBSTANTIATION:
PPI has conducted significant research on the topic of direct connection of plastic piping materials to tankless water heaters. The findings of the research were published in 2020 as "PPI Recommendation H: Direct Connection of Plastic Piping Materials to Tankless Water Heaters for Domestic (i.e. residential) Applications" published at https://plasticpipe.org/pdf/recommendation-h-direct-connection-tankless.pdf

The core findings are summarized in this paragraph: "Piping systems using the materials CPVC, PE-RT, PEX, and PP, which carry a pressure/ temperature rating of 100 psi at 180°F (690 kPa @ 82°C), and which are intended and certified for hot and cold potable water distribution systems according to industry standards and relevant codes, may be connected directly to tankless water heaters which are intended for domestic (i.e. residential) applications, unless prohibited by local plumbing code or the specific water heater manufacture."

Therefore, there is no reason to prohibit direction connection of these piping materials to tankless water heaters intended for domestic water applications. The proposed Exception will bring the UPC into harmonization with current industry practices which are supported in PPI Recommendation H.

The term "domestic" is well-established within this code. See definition for "Water Heater" in Chapter 2, Section 414.1, Section 609.12, and Table 610.3 as examples.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
There is a health and safety concern when allowing plastic materials to directly connect to a tankless water heater, therefore, the change is being rejected.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
605.0 Joints and Connections.
605.1 Copper or Copper Alloy Pipe, Tubing, and Joints. (remaining text unchanged)

605.1.3 Mechanical Joints. Mechanical joints shall include, but are not limited to, compression, flanged, grooved, pressed, and push fit fittings.

   Mechanical joints for copper or copper alloy piping shall be made with a mechanical coupling with groove end piping, or ASTM F1476 Type II Class 2 flexible and restrained, or approved joint designed for the specific application.

605.2 CPVC Plastic Pipe and Joints. (remaining text unchanged)
605.2.1 Mechanical Joints. Mechanical joints shall include compression, flanged, grooved and push fit fittings.

   A mechanical joint shielded coupling for CPVC plastic shall have a metallic shield that complies with ASTM F1476 Type II Class 2 flexible and restrained or Type II Class 3 flexible and unstrained. The elastomeric seal shall comply with NSF/ANSI/CAN 61 or other suitable material that will cater for the effluent within the pipework system. The coupling shall be installed in accordance with manufacturer’s installation instructions. The mechanical joint shall be treated as a permanent pipe seal.

605.3 CPVC/AL/CPVC Plastic Pipe and Joints. (remaining text unchanged)
605.3.1 Solvent Cement. (remaining text unchanged)
605.3.2 Mechanical Joints. Mechanical joints shall include flanged, grooved, flexible and restrained couplings and push fit fittings.

605.4 Ductile Iron Pipe and Joints. (remaining text unchanged)
605.4.1 Mechanical Joints. Mechanical joints for ductile iron pipe and fittings shall consist of a bell that is cast integrally with the pipe or fitting and provided with an exterior flange having bolt holes and a socket with annular recesses for the sealing gasket and the plain end of the pipe or fitting. The elastomeric gasket shall comply with AWWA C111. Lubricant recommended for potable water application by the pipe manufacturer shall be applied to the gasket and plain end of the pipe.

   A mechanical joint shielded coupling for jointing ductile iron pipe should conform to ASTM F1476 Type II Class 2 flexible and restrained or Type II Class 3 flexible and unstrained, or AWWA C227 bolted split-sleeve coupling. Mechanical shields shall comply with either 304 or 316L stainless steel with alloy steel coated or 316 / 316L stainless steel fasteners. The elastomeric gasket shall comply with NSF/ANSI/CAN 61. The coupling shall be installed in accordance with manufacturer’s installation instructions.

605.5 Galvanized Steel Pipe and Joints. (remaining text unchanged)
605.5.1 Mechanical Joints. Mechanical joints shall be made with an approved and listed elastomeric gasket.

   Mechanical Joints shall be made with an elastomeric gasket or to ASTM F1476 Type II Class 2 flexible and restrained or Type II Class 3 flexible and unstrained. The elastomeric seal shall comply or shall comply with NSF/ANSI/CAN 61.
605.6 PE Plastic Pipe/Tubing and 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 injoining 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.

Mechanical joints shall be made with an elastomeric gasket or to ASTM F1476 Type II Class 2 flexible and restrained or Type II Class 3 flexible and unrestrained. The elastomeric seal shall comply with NSF/ANSI/CAN 61. The coupling shall be installed in accordance with manufacturer’s installation instructions.

605.11 Polypropylene (PP) Piping and Joints. Mechanical and compression sleeve joints shall be installed in accordance with the manufacturer’s installation instructions.

Mechanical Joints shall be made with an elastomeric gasket or to ASTM F1476 Type II Class 2 flexible and restrained or Type II Class 3 flexible and unrestrained. The elastomeric seal shall comply with NSF/ANSI/CAN 61. The coupling should be installed in accordance with manufacturer’s installation instructions.

605.12 PVC Plastic Pipe and 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 socket after assembly to provide a positive seal.

Mechanical gasketed couplings with stainless steel casing shield and elastomer gasket ASTM F1476 Type II Class 2 flexible and restrained or Type II Class 3 flexible and unrestrained, shall be designed for its intended use.

605.13 Stainless Steel Pipe and Joints. Mechanical joints shall be designed for their intended use. Such joints shall include compression, flanged, grooved, press-connect, and threaded.

Mechanical joints between stainless steel pipe and fittings shall be of the compression, grooved coupling, hydraulic press-connect fittings, flanged or ASTM F1476 Type II Class 2 flexible and restrained or Type II Class 3 flexible and unrestrained for plain ended pipes and fittings.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWWA C227-2017</td>
<td>Bolted, Split-Sleeve Couplings</td>
<td>Joints</td>
<td>605.4.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)
Note: ASTM F1476, AWWA C227, and NSF/ANSI/CAN 61 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

### TABLE 1701.2

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
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<td>ASTM F1476-2007(R2013)</td>
<td>Performance of Gasketed Mechanical Couplings for Use in Piping Applications</td>
<td>Joints</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

**SUBSTANTIATION:**

The ASTM F1476 specification provides the performance characteristics and qualification tests required for gasketed mechanical couplings (GMC) including groove-type mechanical couplings for grooved end pipe, mechanical restraint couplings for plain end pipe and mechanical compression couplings for plain end pipe.

These couplings are for use at temperatures within the recommended temperature range of their respective gaskets.

Couplings manufactured to perform to this standard are utilized around the world for many pipework systems for civils, water, oil & gas, marine, plumbing and mechanical installations with a wide range of pipe materials. Gasketed mechanical pipe couplings allow pipes to be permanently joined without the need for welding, soldering or brazing, eliminating the need for on-site hot work. No pipe threading, grooving, or alternative preparation is required. This gives the system designer and contractor access to a widely used and accepted modern construction method in today’s industry.

Health and safety benefits come from the simple tools required and the use of plain end pipe. There is no heating, welding or manipulation of material on site, so handling is easy and safe. The coupling is light in weight, has no loose parts and all materials are REACH and RoHS compliant and manufactured under an ISO 9001 quality programme. Gaskets are NSF 61 compliant.

The high-level performance of GMCs allows gravity systems to be uprated. For example, where CISPI 310 states that thrust restraint systems are required, a GMC can fulfill the regulation. Global manufacturers of hubless cast iron utilize GMCs in sensitive locations as part of their overall systems.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**

The proposal is being rejected as ASTM F1476 is a performance standard, not a fitting standard. The standard does not include dimensions or sizing requirements, nor provisions for a center-stop. Additionally, the standard contains permissive language that can lead to confusion for the end user.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  
- **AFFIRMATIVE:** 25  
- **NOT RETURNED:** 1 Daniels
Proposals

Item #: 143
UPC 2024  Section: 605.1.3.3

SUBMITTER: Tyler Leighton
Watts Water Technologies

RECOMMENDATION:
Revise text

605.0 Joints and Connections.

605.1.3 Mechanical Joints. (remaining text unchanged)

605.1.3.3 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 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. Fittings used in potable water systems intended to supply drinking water shall comply with NSF 61.

SUBSTANTIATION:
The purpose of requiring NSF 61 and NSF 372 is to ensure the health and safety of everyone using these fittings in potable water applications. The provisions are consistent with those found in Section 604.1.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
This requirement is being rejected and the intend of the proposal regarding "fittings used in water systems intended to supply drinking water" is already addressed in Section 604.1.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
PROPOSALS

Item #: 144
UPC 2024 Section: 605.2.2

SUBMITTER: Forest Hampton
Lubrizol, Inc.

RECOMMENDATION:
Revise text

605.0 Joints and Connections.

605.2 CPVC Plastic Pipe and Joints. (remaining text unchanged)

605.2.2 Solvent Cement Joints. Solvent cement joints for CPVC pipe and fittings shall be clean from dirt and moisture. Solvent cements shall comply with ASTM F493, requiring the use of a primer shall be orange in color. The primer shall be colored and shall comply with ASTM F656. Listed solvent cement that complies with ASTM F493 and that does not require the use of primers, yellow, green, or red in color, shall be permitted for pipe and fittings 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.

SUBSTANTIATION:
Currently, it can be difficult to see the yellow solvent cement ring on a tan CTS CPVC joint during inspection. A high contrast cement has been asked for from the field to aid in the inspection of CPVC joints. The color green was chosen because of its high contrast against the tan pipe and fittings and green is not currently used to identify any other type of cement.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 145

UPC 2024  Section: 605.2.2, 605.3.1, Table 1701.1, Table 1701.2

SUBMITTER: Michael Cudahy
PPFA

RECOMMENDATION:
Revise text

605.0 Joints and Connections.

605.2 CPVC Plastic Pipe and Joints. (remaining text unchanged)

605.2.2 Solvent Cement Joints. Solvent cement joints for CPVC pipe and fittings shall be clean from dirt and moisture. Solvent cements shall comply with ASTM F493, requiring the use of a primer shall be orange in color. The primer shall be colored and shall comply with ASTM F656. Listed solvent cement 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 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. Follow ASTM D2855 for two-step joining and ASTM F3328 for one-step joining. Place pipe inside fitting to forcefully bottom the pipe in the socket and hold together until joint is set.

605.3 CPVC/AL/CPVC Plastic Pipe and Joints. (remaining text unchanged)

605.3.1 Solvent Cement Joints. Solvent cement joints for CPVC/AL/CPVC pipe and fittings shall be clean from dirt and moisture. Solvent cements that comply with ASTM F493, requiring the use of a primer shall be orange in color. The primer shall be colored and shall comply with ASTM F656. Listed solvent cement that complies with ASTM F493 and that does not require the use of primers, yellow in color, shall be permitted to join pipe that comply with ASTM F2855 and fittings that comply with ASTM D2846, 1/2 of an inch (15 mm) through 2 inches (50 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. Follow ASTM D2855 for two-step joining and ASTM F3328 for one-step joining. Place pipe inside fitting to forcefully bottom the pipe in the socket and hold together until joint is set.
### TABLE 1701.1
### REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM D2855-2020</td>
<td>The Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets</td>
<td>Joints</td>
<td>605.2.2, 605.3.1</td>
</tr>
<tr>
<td>ASTM F3328-2018</td>
<td>The One-Step (Solvent Cement Only) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets</td>
<td>Joints</td>
<td>605.2.2, 605.3.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: ASTM D2855 and ASTM F3328 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

### TABLE 1701.2
### STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM D2855-2015</td>
<td>Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets</td>
<td>Joints</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
There are two standards for solvent cement joining; ASTM D2855-15 is, “Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets” ASTM F3328-18 is, “Standard Practice for the One-Step (Solvent Cement Only) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.”

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the current code language provides the needed requirements regarding joining methods of CPVC and CPVC/AL/CPVC plastic pipe and joints.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 21 NEGATIVE: 4 NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:
BALLANCO: This change should have been accepted. The substantiation justifies the acceptance of this proposal.

CUDAHY: These are useful and extensive joining instructions.

GORSUCH: Agree with Charles White.

WHITE: The two methods should be accepted and standards included.
Proposals

Item #: 146
UPC 2024  Section: 605.12

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

605.0 Joints and Connections.

605.12 PVC Plastic Pipe and Joints. PVC plastic pipe and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.12.1 through Section 605.12.3. PVC piping shall not be exposed to direct sunlight.

Exception: Piping that is exposed to sunlight shall be 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.

SUBSTANTIATION: As written, the section on UV protection of PVC pipe and fittings is very confusing. The portion is being separated into its own section and re-written for clarity. There is no need to put a 24 inch limit as any exposed PVC pipe shall be protected. This change will clarify the intent of the section.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change will require all PVC piping that is exposed to sunlight to be wrapped, regardless of the length of pipe. Furthermore, there was no technical justification given to warrant such change.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 147
UPC 2024  Section: 605.12.2, Table 1701.1

SUBMITTER: Michael Cudahy
PPFA

RECOMMENDATION:
Revise text

605.0 Joints and Connections.

605.12 PVC Plastic Pipe and Joints. (remaining text unchanged)

605.12.2 Solvent Cement Joints. Solvent cement joints for PVC pipe and fittings shall be clean from dirt and moisture. Pipe shall be cut square and pipe shall be deburred. Where surfaces to be joined are cleaned and free of dirt, moisture, oil, and other foreign material, apply primer purple in color that complies with ASTM F656. Primer shall be applied to the surface of the pipe and fitting is softened. Solvent cement that complies with ASTM D2564 shall be applied to all joint surfaces. Joints shall be made while both the inside socket surface and outside surface of pipe are wet with solvent cement. Two-step joining methods shall be in accordance with ASTM D2855. Hold joint in place and undisturbed for 1 minute after assembly.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>REFERENCED STANDARDS</td>
</tr>
<tr>
<td>STANDARD NUMBER</td>
</tr>
<tr>
<td>ASTM D2855-2020</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASTM D2855 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The standard for solvent cement joining is ASTM D2855, “Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets”

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the current code language provides the needed requirements regarding joining methods of PVC pipe and joints.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 20  NEGATIVE: 5  NOT RETURNED: 1  Daniels
EXPLANATION OF NEGATIVE:

**BALLANCO:** This change should have been accepted. The substantiation justifies the acceptance of the standard reference.

**CUDAHY:** These are useful and extensive joining instructions.

**GORSUCH:** Same as Item # 145, the substantiation justifies the change.

**KREITENBERG:** This modification provides better clarity of the requirement; should be accepted.

**WHITE:** This should be accepted based on the justification.
Proposals

Item #: 148
UPC 2024  Section: 605.16.1, 705.10.2

SUBMITTER: Pennie Feehan
Pennie L Feehan Consulting
Rep. Copper Development Association

RECOMMENDATION:
Revise text

605.0 Joints and Connections.

605.16 Joints Between Various Materials. (remaining text unchanged)

605.16.1 Copper or Copper Alloy Pipe or Tubing to Threaded Pipe Joints. Joints from copper or copper alloy pipe or tubing to threaded pipe that is not copper, or copper alloy shall be made using copper alloy adapter, copper alloy nipple [minimum 6 inches (152 mm)], dielectric fitting, or dielectric union in accordance with ASSE 1079. The joint between the copper or copper alloy pipe or tubing and the fitting shall be a soldered, brazed, flared, or press-connect joint and the connection between the threaded pipe and the fitting shall be made with a standard pipe size threaded joint.

705.0 Joints and Connections.

705.10 Joints Between Various Materials. (remaining text unchanged)

705.10.2 Copper or Copper Alloy Pipe to Threaded Pipe Joints. Joints from copper or copper alloy pipe or tubing to threaded pipe that is not copper, or copper alloy shall be made by the use of a listed copper alloy adapter or dielectric fitting. The joint between the copper or copper alloy pipe and the fitting shall be a soldered or brazed, and the connection between the threaded and the fittings shall be made with a standard pipe size threaded joint.

SUBSTANTIATION:
The original sentence of Section 605.16.1 and Section 705.10.2 is not clear and does not specify that the connection is from copper alloy pipe or tubing to threaded pipe of a different material. This proposal does not change the intent of the code section.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The language is not clear on its intent. It is requested that proponent come back with public comment to clarify what was intended in this proposal.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 149
UPC 2024  Section: 605.15, 605.16.1, 605.16.3, Table 1701.1, Table 1701.2

SUBMITTER: Ronald Rice
self

RECOMMENDATION:
Revise text

605.0 Joints and Connections.

605.15 Dielectric Unions. Dielectric unions where installed at points of connection where there is a dissimilarity of metals shall be in accordance with ASSE 1079 or IAPMO PS 66.

605.16 Joints Between Various Materials. (remaining text unchanged)

605.16.1 Copper or Copper Alloy Pipe or Tubing to Threaded Pipe Joints. Joints from copper or copper alloy pipe or tubing to threaded pipe shall be made using copper alloy adapter, copper alloy nipple [minimum 6 inches (152 mm)], dielectric fitting, or dielectric union in accordance with ASSE 1079 or IAPMO PS 66. The joint between the copper or copper alloy pipe or tubing and the fitting shall be a soldered, brazed, flared, or press-connect joint and the connection between the threaded pipe and the fitting shall be made with a standard pipe size threaded joint.

605.16.3 Stainless Steel to Other Materials. Where connecting stainless steel pipe to other types of piping, mechanical joints of the compression type, dielectric fitting, or dielectric union in accordance with ASSE 1079 or IAPMO PS 66 and designed for the specific transition intended shall be used.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO PS 66-2015</td>
<td>Dielectric Fittings</td>
<td>Fittings</td>
<td>605.15, 605.16.1, 605.16.3</td>
</tr>
</tbody>
</table>

Note: IAPMO PS 66 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO PS 66-2015</td>
<td>Dielectric Fittings</td>
<td>Fittings</td>
</tr>
</tbody>
</table>

SUBSTANTIATION:
This standard covers insulated, dielectric fittings with male threads, grooved ends, or plain ends, intended to reduce galvanic corrosion in plumbing systems by isolating dissimilar metal piping sections, and specifies requirements for materials, physical characteristics, performance testing, and markings. IAPMO PS 66 covers larger diameter piping.
COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 150
UPC 2024  Section: 605.16.2, 605.16.3

SUBMITTER: Mr John Wilson
Taylor Kerr Engineering Ltd (Teekay Couplings)

RECOMMENDATION:
Revise text

605.0 Joints and Connections.

605.16 Joints Between Various Materials. (remaining text unchanged)

605.16.2 Plastic Pipe to Other Materials. Where connecting plastic pipe to other types of piping, approved types of adapter or transition fittings designed for the specific transition intended shall be used including stepped gasketed mechanical couplings.

605.16.3 Stainless Steel to Other Materials. Where connecting stainless steel pipe to other types of piping, mechanical joints couplings of the compression type, gasketed mechanical coupling dielectric fitting, or dielectric union in accordance with ASSE 1079 and designed for the specific transition intended shall be used.

SUBSTANTIATION:
The ASTM F1476 specification provides the performance characteristics and qualification tests required for gasketed mechanical couplings (GMC) including groove-type mechanical couplings for grooved end pipe, mechanical restraint couplings for plain end pipe and mechanical compression couplings for plain end pipe.

These couplings are for use at temperatures within the recommended temperature range of their respective gaskets.

Couplings manufactured to perform to this standard are utilized around the world for many pipework systems for civils, water, oil & gas, marine, plumbing and mechanical installations with a wide range of pipe materials. Gasketed mechanical pipe couplings allow pipes to be permanently joined without the need for welding, soldering or brazing, eliminating the need for on-site hot work. No pipe threading, grooving, or alternative preparation is required. This gives the system designer and contractor access to a widely used and accepted modern construction method in today’s industry.

Health and safety benefits come from the simple tools required and the use of plain end pipe. There is no heating, welding or manipulation of material on site, so handling is easy and safe. The coupling is light in weight, has no loose parts and all materials are REACH and RoHS compliant and manufactured under an ISO 9001 quality programme. Gaskets are NSF 61 compliant.

The high-level performance of GMCs allows gravity systems to be uprated. For example, where CISPI 310 states that thrust restraint systems are required, a GMC can fulfil the regulation. Global manufacturers of hubless cast iron utilize GMCs in sensitive locations as part of their overall systems.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is being rejected as it is mixing gaskets with mechanical joints, which is not appropriate for this section.
<table>
<thead>
<tr>
<th>TOTAL ELIGIBLE TO VOTE:</th>
<th>26</th>
</tr>
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<tbody>
<tr>
<td>VOTING RESULTS:</td>
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<tr>
<td>NOT RETURNED:</td>
<td>1</td>
</tr>
<tr>
<td>Daniels</td>
<td></td>
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</table>
Proposals

Item #: 151

UPC 2024  Section: 218.0, 221.0, 605.17, Table 1701.1

SUBMITTER: Erin Coffman
Water Systems Council

RECOMMENDATION:
Add new text

605.0 Joints and Connections.

605.17 Pitless Adapters, Pitless Units, and Sanitary Well Caps for Potable Water Supply. Pitless adapters, pitless units, and sanitary well caps shall be installed in accordance with the manufacturer's installation instructions and supported in accordance with the building code. Pitless adapters, pitless units, and sanitary well caps intended to supply drinking water shall comply with ASSE 1093/WSC PAS-97.

218.0  -P-

Pitless Adapter. A device designed to attach to one or more openings through a well casing. It shall be constructed so as to prevent the entrance of contaminants or pollutants into the well or potable water supply through such opening(s) to conduct water from the well, to protect the water from freezing or extremes of temperature, and to provide access to water system parts within the well.

Pitless Unit. An assembly that extends the upper end of the well casing from below the frostline to a minimum of 12 in (305 mm) above grade. It shall be constructed to prevent the entrance of contaminants or pollutants into the well or potable water supply, to conduct water from the well, to protect the water from freezing or extremes of temperature, and to provide full access to the well and to water system parts within the well. It shall provide a sanitary well cap for the top terminal of the well.

221.0  -S-

Sanitary Well Cap. A device that covers and encloses the upper termination of a pitless unit or the well casing and provides protection to the top, exposed portion of the well casing by being tamper resistant, forming a protective cover from the elements, that allows for atmospheric venting of the well, and being resistant to the entry of vermin or contaminants or pollutants.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
<th>REFERENCED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
<td>STANDARD TITLE</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: ASSE 1093/WSC PAS 97 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.
SUBSTANTIATION:
The current code language does not provide requirements for pitless adapters, pitless units, and sanitary well caps. These are components that are critical to water well supply systems. Requirements are necessary for safety aspects and dependable performance standards.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The provisions involve capping of wells, which is not necessarily related to the scope of the plumbing code. Those regulations are specified by the health department.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 152
UPC 2024  Section: 606.1, Table 1701.1

SUBMITTER: Garry Sato
Greensmart Sustainable Concepts

RECOMMENDATION:
Revise text

606.0 Valves.

606.1 General. Valves up to and including 2 inches (50 mm) in size shall be copper alloy or other approved material. Sizes exceeding 2 inches (50 mm) shall be permitted to have cast iron or copper alloy bodies or other approved materials. Each gate or ball valve shall be a fullway or full-port type with working parts of the noncorrosive material. Valves carrying water used in potable water systems intended to supply drinking water shall comply with the requirements of NSF 61 and ASME A112.4.14, ASME B16.34, ASTM F1970, ASTM F2389, AWWA C500, AWWA C504, AWWA C507, IAPMO IGC 312, IAPMO Z1157, MSS SP-67, MSS SP-70, MSS SP-71, MSS SP-72, MSS SP-78, MSS SP-80, MSS SP-110, MSS SP-122, or NSF 359. Valves carrying water intended to supply drinking water shall also comply with NSF 61.

TABLE 1701.1
REFERRED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 312-2018a</td>
<td>Gate, Globe, Angle, and Check Valves</td>
<td>Valves</td>
<td>606.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: IAPMO IGC 312 and NSF 61 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The proposed text cleans up the language by adding "or other approved materials" for sizes exceeding 2" as indicated in the first sentence. NSF 61 is moved after the valve standards as NSF 61 is an additional standard required for drinking water purposes. Furthermore, IAPMO IGC 312 is being added as it is an approved standard which covers ball, gate, and globe valves that are fullway/full-port type valves.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is being rejected as it references "other approved materials" without identifying those materials.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 153
UPC 2024  Section: 606.1

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Revise text

606.0 Valves.
606.1 General. Valves up to and including 2 inches (50 mm) in size shall be copper alloy or other approved material. Sizes exceeding 2 inches (50 mm) shall be permitted to have cast iron or copper alloy bodies. Each gate or ball valve shall be a fullway or full-port type with working parts of the noncorrosive material. Valves carrying water used in potable water systems intended to supply drinking water shall comply with the requirements of NSF 61 and ASME A112.4.14, ASME B16.34, ASTM F1970, ASTM F2389, AWWA C500, AWWA C504, AWWA C507, IAPMO Z1157, MSS SP-67, MSS SP-70, MSS SP-71, MSS SP-72, MSS SP-78, MSS SP-80, MSS SP-110, MSS SP-122, or NSF 359. Valves intended to supply drinking water shall also comply with the requirements of NSF 61.

Note: NFPA 61 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The revised text clarifies the intent of NSF 61 as only being required when the valves are used when the water is intended for drinking. All the other standards are required in potable water systems.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 154
UPC 2024  Section: 606.5.1, Table 1701.1, Table 1701.2

SUBMITTER: Ronald Rice
self

RECOMMENDATION:
Add new text

606.0 Valves.

606.5 Control Valve. (remaining text unchanged)

606.5.1 Manifolds. Field installed manifolds for water distribution shall conform with the applicable requirements for valves, pipes, and fittings as referenced in this code. Manufactured water distribution manifolds shall be in accordance with IAPMO IGC 109.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
<th>REFERENCED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
<td>STANDARD TITLE</td>
</tr>
<tr>
<td>IAPMO IGC 109-2019</td>
<td>Water Distribution Manifolds</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: IAPMO IGC 109 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

<table>
<thead>
<tr>
<th>TABLE 1701.2</th>
<th>STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCUMENT NUMBER</td>
<td>DOCUMENT TITLE</td>
</tr>
<tr>
<td>IAPMO-IGC-109-2017</td>
<td>Water-Distribution-Manifolds</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
Manifolds are utilized in water distribution systems. The addition of a section for manifolds will provide guidance to the end user and ensure that all components of field installed manifolds conform to that applicable material standards for water distribution. Furthermore, IAPMO IGC 109 is being added as the standard covers water distribution manifolds for residential and commercial, hot and cold, water distribution systems, and specifies requirements for materials, physical characteristics, performance testing, and markings.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
Item #: 155

UPC 2024  Section: 606.9, Table 1701.1

SUBMITTER: Cameron Rapoport
Watts Water Technologies

RECOMMENDATION:
Revise text

606.0 Valves.

606.9 Leak Detection Devices. Where digital leak detection devices for water supply and distribution are installed, they shall comply with IAPMO IGC 115 or IAPMO IGC 349 IAPMO Z1349.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO Z1349-2021</td>
<td>Devices for Detection, Monitoring or Control of Plumbing Systems</td>
<td>Miscellaneous</td>
<td>606.9</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: IAPMO Z1349 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The IAPMO IGC 115 and the IAPMO IGC 349 standards have been incorporated into one standard (IAPMO Z1349) which now incorporates digital technology.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is being rejected as the IAPMO Z1349 standard addresses more than just digital leak detection devices.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 156

UPC 2024  Section: 606.9, L 405.1, Table 1701.1

SUBMITTER: Rich Houle
Reliance Worldwide Corporation

RECOMMENDATION:
Revise text

606.0 Valves.

606.9 Leak Detection Devices. Where leak detection devices for water supply and distribution are installed, they shall comply with IAPMO IGC 115 or IAPMO IGC 349 or IAPMO Z1349.

L 405.0 Leak Detection and Control.
L 405.1 General. Where installed, leak detection and control devices shall comply with IAPMO IGC 115 or IAPMO IGC 349 or IAPMO Z1349. Leak detection and control devices help protect property from water damage and also conserve water by shutting off the flow when leaks are detected.

TABLE 1701.1
REFERRED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
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<td>Miscellaneous</td>
<td>606.9</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: IAPMO Z1349 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The standard IAPMO IGC 115 and IGC 349 have been updated and have gone through the ANSI process. Both IGC 115 and IGC 349 have been combined into one standard; ANSI/CAN/IAPMO Z1349.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 157
UPC 2024  Section: 607.2, 607.2.1, 607.2.2, Table 1701.1

SUBMITTER: Erin Coffman
Water Systems Council

RECOMMENDATION:
Revise text

607.0 Potable Water Supply Tanks.

607.2 Potable Water Tanks. Potable water supply tanks, with and without bladders/diaphragms, interior tank coatings, or tank liners intended to supply drinking water shall comply with NSF 61.

607.2.1 Non-Pressurized Potable Water Tanks. Non-pressurized potable water tanks. Tanks used for potable water shall be tightly covered and vented in accordance with the manufacturer’s installation instructions. Such vent shall be screened with a corrosion-resistant material of not less than number 24 mesh. 607.4

Overflow. Tanks shall have an overflow not less than a 16 square inch (0.01 m²) overflow that is screened with a corrosion-resistant material of not less than number 24 mesh.

607.2.2 Pressurized Potable Water Tanks. Pressurized tanks shall be provided with a pressure-relief valve installed in accordance with the manufacturer’s installation instructions. The relief valve shall be discharged in accordance with Section 608.0. Where a potable water supply tank is located above the fixtures, appliances, or system components it serves, it shall be equipped with a vacuum relief valve that complies with CSA Z21.22.

SUBSTANTIATION:
The current code language does not provide requirements for pressurized potable water tanks. These are pressurized tanks are critical to water well supply systems. Requirements are necessary for safety aspects and dependable performance standards.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The text addresses one type of pressurized tank but does not address other types of pressured tanks that exist.
TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  
AFFIRMATIVE: 25  
NOT RETURNED: 1  

Daniels
Proposals

Item #: 158

UPC 2024  Section: 608.2

SUBMITTER: Bob Gardner
Watts Water Technologies

RECOMMENDATION:
Revise text

608.0 Water Pressure, Pressure Regulators, Pressure Relief Valves, and Vacuum Relief Valves.

608.2 Excessive Water Pressure. Where static water pressure in the water supply piping is exceeding 80 psi (552 kPa), an approved-type pressure regulator preceded by an adequate strainer shall be installed and the static pressure reduced to 80 psi (552 kPa) or less. Pressure regulators for potable water distribution systems shall comply with ASSE 1003 and NSF 61. Pressure regulator(s) equal to or exceeding 1 1/2 inches (40 mm) shall not require a strainer. For line sizes greater than 3 inches (80 mm), an automatic control (pressure regulating) valve shall be utilized. Such regulator(s) shall control the pressure to water outlets in the building unless otherwise approved by the Authority Having Jurisdiction. Each such regulator and strainer shall be accessibly located aboveground or in a vault equipped with a properly sized and sloped boresighted drain to daylight, shall be protected from freezing, and shall have the strainer readily accessible for cleaning without removing the regulator or strainer body or disconnecting the supply piping.

Pipe size determinations shall be based on 80 percent of the reduced pressure where using Table 610.4.

An approved expansion tank shall be installed in the cold water distribution piping downstream of each such regulator to prevent excessive pressure from developing due to thermal expansion and to maintain the pressure setting of the regulator. Expansion tanks used in potable water systems intended to supply drinking water shall comply with NSF 61. The expansion tank shall be properly sized and installed in accordance with the manufacturer’s installation instructions and listing. Systems designed by registered design professionals shall be permitted to use approved pressure relief valves in lieu of expansion tanks provided such relief valves have a maximum pressure relief setting of 100 psi (689 kPa) or less.

Note: NSF 61 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
Adding of “and NSF 61” - For consistency purposes when stating the requirements for components being used in potable water distribution systems. Examples of this is Section 607.2 “Potable water supply tanks, interior tank coatings, or tank liners intended to supply drinking water shall comply with NSF 61” and “Expansion tanks used in potable water systems intended to supply drinking water shall comply with NSF 61,” also in Section 608.2.

Adding of “For line sizes greater than 3 inches, an automatic control (pressure regulating) valve shall be utilized.” – For line sizes 3 inches or larger, direct acting valves are not cost conducive nor the optimized device for this application. Where direct acting regulators will have volume losses and introduce a turbulent flow path, ACV’s will sustain volume more efficiently.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as it is overly restrictive by allowing pressure regulators larger than 3 inches. The requirements of ASSE 1003 and NSF 61 only apply to sizes up to 3 inches. There is a concern that the proposed language may conflict with the standards used for compliance.
TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

SIGLER: Additional reasons why this proposed change should be rejected:
  • There are direct-acting pressure regulating valves for supply lines larger than 3 inches that are currently being used successfully today. This change would eliminate that option.
  • The justification that direct-acting pressure regulating valves are not cost-effective is wrong. The automatic control pressure regulating valves are more expensive than direct-acting pressure regulating valves.
  • ASSE 1003 allows for direct-acting pressure regulating valves up to 4 inches in size.
608.0 Water Pressure, Pressure Regulators, Pressure Relief Valves, and Vacuum Relief Valves.

608.2 Excessive Water Pressure. Where static water pressure in the potable or nonpotable water supply piping is exceeding 80 psi (552 kPa), an approved-type pressure regulator preceded by an adequate strainer shall be installed and the downstream static pressure reduced to 80 psi (552 kPa) or less. Pressure regulators for potable water distribution systems shall comply with ASSE 1003. Pressure regulator(s) equal to or exceeding 1 ½ inches (40 mm) or more shall not require a strainer. Such regulator(s) shall control the pressure to water outlets in the building unless otherwise approved by the Authority Having Jurisdiction. Each such regulator and strainer shall be accessibly located aboveground or in a vault equipped with a properly sized and sloped boresighted drain to daylight, shall be protected from freezing, and shall have the strainer readily accessible for cleaning without removing the regulator or strainer body or disconnecting the supply piping.

Pipe size determinations shall be based on 80 percent of the reduced pressure where using Table 610.4.

608.2.1 Developed Length and Pressure Adjustments. When using Table 610.4, and a pressure regulator valve is required in the building supply, the developed length of supply piping shall be computed from the building side of that valve.

Available pressure determinations shall be based on 80 percent of the reduced pressure.

608.2.2 Expansion Tanks. An approved expansion tank shall be installed in the cold water distribution piping downstream of each such regulator to prevent excessive pressure from developing due to thermal expansion and to maintain the pressure setting of the regulator. Expansion tanks used in potable water systems intended to supply drinking water shall comply with NSF 61. The expansion tank shall be properly sized, and installed, and supported in accordance with the manufacturer’s installation instructions and listing.

Exception: Systems designed by a licensed plumbing contractor or registered design professionals shall be permitted to use approved pressure relief valves in lieu of expansion tanks provided such relief valves have a maximum pressure relief setting of 100 psi (689 kPa) or less.

(below shown for reference only)

| TABLE 610.4 |
| FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES |
| (portions of table not shown remain unchanged) |

SUBSTANTIATION:
The proposed change reconfigured the existing Section 608.2 to group requirements together. Currently there is no specific requirement to control water pressure for non potable water supply piping. It seems that if it is required for potable water applications it should also be required for nonpotable use in Chapter 15 and 16.
Simplify, to make the section more readable; ‘1-1/2 inch or larger’ is simpler language.

The section on regulators is being stricken: Impossible in most installations. The pressure regulator can only 'control' the pressure of the water it discharges. Other factors such as thermal expansion can/will affect the water pressure downstream of the regulator. If the regulator was able to control the pressure to the water outlets, an expansion tank would not be required.

“Boresighted” is a term related to the optical alignment of a firearm, in this application it is practically impossible and is unnecessary language.

New section 608.2.1 replaces the previous one sentence paragraph. Adds language existing in Appendix A 107.2 while maintaining the 80% multiplier.

Further substantiation for new section 608.2.1 comes from UPC A & A Committee:
Q: To determine the building supply line using Table 610.4, the pressure range, max. length, and WSFU’s are used to determine pipe size.
For this question, the data is: over 60, 100 feet, and 24 WSFU's demand.
A 3/4" meter with a 1" building supply is required.
If the supply line pressure is 110 psi and a pressure regulator is installed 40 feet from the meter and 60 feet from the "furthest outlet", and reduced to 70 psi;

How does the language in section 608.2 (Pipe size determinations shall be based on 80 percent of the reduced pressure where using Table 610.4 apply?)

Where is the 20% reduction applied?
On the WSFU’s?
On the supply line prior to the regulator?
After the regulator?

A: Per Section 608.2 of the 2012 UPC, “pipe size determinations shall be based on 80 percent of the reduced pressure when using Table 610.4”. If the reduced pressure at the pressure reducing valve is 70 psi the downstream piping from the PRV would be sized using Table 610.4 at 56 psi with “60 feet developed length to the furthest outlet.”

Then new section 608.2.2 (Expansion Tanks) breaks this portion into what is required, adding support language for expansion tanks and what is excepted.

The last change separates what is an exception to the previous languages, as an exception.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language is confusing because it integrates provisions for both potable and non-potable water. Additionally, the provided substantiation is insufficient in technical merit.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
608.0 Water Pressure, Pressure Regulators, Pressure Relief Valves, and Vacuum Relief Valves.

608.2 Excessive Water Pressure. Where static water pressure in the water supply piping is exceeding 80 psi (552 kPa), an approved-type pressure regulator preceded by an adequate strainer shall be installed and the static pressure reduced to 80 psi (552 kPa) or less. Pressure regulators for potable water distribution systems shall comply with ASSE 1003. Pressure regulator(s) equal to or exceeding 11/2 inches (40 mm) shall not require a strainer. Such regulator(s) shall control the pressure to water outlets in the building unless otherwise approved by the Authority Having Jurisdiction. Each such regulator and strainer shall be accessibly located aboveground or in a vault equipped with a properly sized and sloped boresighted drain to daylight, shall be protected from freezing, and shall have the strainer readily accessible for cleaning without removing the regulator or strainer body or disconnecting the supply piping.

Pipe size determinations shall be based on 80 percent of the reduced pressure where using Table 610.4. An approved expansion tank shall be installed in the cold water distribution piping downstream of each such regulator to prevent excessive pressure from developing due to thermal expansion and to maintain the pressure setting of the regulator. Expansion tanks used in potable water systems intended to supply drinking water shall comply with NSF 61. The expansion tank shall be properly sized, securely fastened to the structure, and installed in accordance with the manufacturer’s installation instructions and listing. Systems designed by registered design professionals shall be permitted to use approved pressure relief valves in lieu of expansion tanks provided such relief valves have a maximum pressure relief setting of 100 psi (689 kPa) or less.

608.3 Expansion Tanks, and Combination Temperature and Pressure-Relief Valves. A water system provided with a check valve, backflow preventer, or other normally closed device that prevents dissipation of building pressure back into the water main, independent of the type of water heater used, shall be provided with an approved, listed, and adequately sized expansion tank or other approved device having a similar function to control thermal expansion. Prepressurized water expansion tanks shall comply with IAPMO Z1088. Such expansion tank or other approved device shall be installed on the building side of the check valve, backflow preventer, or other device and shall be sized, securely fastened to the structure, and installed in accordance with the manufacturer’s installation instructions.

A water system containing storage water heating equipment shall be provided with an approved, listed, adequately sized combination temperature and pressure-relief valve, except for listed nonstorage instantaneous heaters having an inside diameter of not more than 3 inches (80 mm). Each such approved combination temperature and pressure-relief valve shall be installed on the water-heating device in an approved location based on its listing requirements and the manufacturer’s installation instructions. Each such combination temperature and pressure-relief valve shall be provided with a drain in accordance with Section 608.5.

SUBSTANTIATION:
Expansion tanks range in sizes and types. Many tanks are being left to be supported by the piping onto which it is mounted, however this is a concern as piping is not meant to be a supporting device, actually piping is required to be supported, not the other way around. The addition of this language will require that all expansion tanks be supported where the installation instructions fail to mention this.

COMMITTEE ACTION: ACCEPT AS SUBMITTED
TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 161

UPC 2024  Section: 608.3

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

608.3 Expansion Tanks, and Combination Temperature and Pressure-Relief Valves. A water system provided with a check valve, backflow preventer, or other normally closed device that prevents dissipation of building pressure back into the water main, independent of the type of water heater used, shall be provided with an approved, listed, and adequately sized expansion tank or other approved device having a similar function to control thermal expansion. Prepressurized water expansion tanks shall comply with IAPMO Z1088. Such expansion tank or other approved device shall be installed on the building side of the check valve, backflow preventer, or other device and shall be sized and installed in accordance with the manufacturer's installation instructions.

A water system containing storage water heating equipment shall be provided with an approved, listed, adequately sized combination temperature and pressure-relief valve, except for listed nonstorage instantaneous heaters having an inside diameter of not more than 3 inches (80 mm). Each such approved combination temperature and pressure-relief valve shall be installed on the water-heating device in an approved location based on its listing requirements and the manufacturer's installation instructions. Each such combination temperature and pressure-relief valve shall be provided with a drain in accordance with Section 608.5.

Exception: An expansion tank shall not be required for an instantaneous non-storage water heater.

SUBSTANTIATION:
Water does not compress so when it is heated and it expands it can create damaging pressure. Expansion tanks are designed to compensate for this. Instantaneous water heaters do not store water so there is no water to expand and create the excess pressure. Water is heated on demand only so there is no issue of the water heating, expanding and building pressure as the water is flowing out by the demand.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 160, Section 608.3 (Expansion Tanks, and Combination Temperature and Pressure-Relief Valves) and UPC Item # 161, Section 608.3 (Expansion Tanks, and Combination Temperature and Pressure-Relief Valves) resulted in conflicting language within the code. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

608.3 Expansion Tanks, and Combination Temperature and Pressure-Relief Valves. A water system provided with a check valve, backflow preventer, or other normally closed device that prevents dissipation of building pressure back into the water main, independent of the type of water heater used, shall be provided with an approved, listed, and adequately sized expansion tank or other approved device having a similar function to control thermal expansion. Prepressurized water expansion tanks shall comply with IAPMO Z1088. Such expansion tank or other approved device...
shall be installed on the building side of the check valve, backflow preventer, or other device and shall be sized, securely fastened to the structure, and installed in accordance with the manufacturer's installation instructions.

A water system containing storage water heating equipment shall be provided with an approved, listed, adequately sized combination temperature and pressure-relief valve, except for listed nonstorage instantaneous heaters having an inside diameter of not more than 3 inches (80 mm). Each such approved combination temperature and pressure-relief valve shall be installed on the water-heating device in an approved location based on its listing requirements and the manufacturer's installation instructions. Each such combination temperature and pressure-relief valve shall be provided with a drain in accordance with Section 608.5.

**Exception:** An expansion tank shall not be required for an instantaneous non-storage water heater.

**TCC ACTION:** ACCEPT AS SUBMITTED

**TCC STATEMENT:**
The language in UPC Item # 161, Section 608.3 (Expansion Tanks, and Combination Temperature and Pressure-Relief Valves) is being revised to correlate with the action taken by the UPC TC for Item # 160, Section 608.3 (Expansion Tanks, and Combination Temperature and Pressure-Relief Valves) regarding expansion tanks being “securely fastened to the structure.”

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 608.3 regarding expansion tanks being “securely fastened to the structure.”
Proposals

Item #: 162

UPC 2024  Section: 608.7

SUBMITTER: Karan Kapila
          Self

RECOMMENDATION:
          Revise text

608.0 Water Pressure, Pressure Regulators, Pressure Relief Valves, and Vacuum Relief Valves.

608.7 Vacuum Relief Valves. Where the elevation of an entire a hot-water storage tank or an indirect water heater is located at an elevation above the fixture outlets in the hot-water system, a vacuum relief valve that complies with CSA Z21.22 shall be installed on the storage tank or heater.

Exception: Storage tanks which have an internal anti-siphon port in their fill tube shall not be required to install a vacuum relief valve.

SUBSTANTIATION:
Introducing air to the interior of a dip tube will "break" a siphon in all cases. Water heaters with anti-siphon ports in the top of their dip tubes are not subject to siphonage. Storage tanks which have an indirect heat source (a heat exchanger within the storage tank, or hot water circulated from the heat source to the storage tank) may or may not have an internal means of preventing siphonage. Those which are not designed or installed in a manner which specifically prevents siphonage shall be provided with a vacuum relief valve to provide the necessary anti-siphon protection. When any configuration of piping or tank design and installation could result in potential siphoning of the tanks contents, an appropriate vacuum relief valve must be installed as instructed by the manufacturer.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language on vacuum relief valves is confusing and not clear as to when the exception would apply. Additionally, the reference to the "elevation of the entire water heater" above the fixture outlets is confusing and not technically justified.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 163
UPC 2024  Section: 609.8.3

SUBMITTER: David D Dexter, P.E.
3D Engineering Consultants, LLC

RECOMMENDATION:
Revise text

609.8 Pumps. Pumps shall be installed in accordance with the manufacturer's installation instructions.
609.8.1 Access. Pumps shall be accessible for repairs.
609.8.2 Potable Water Pumps. Pumps intended to supply drinking water shall be in accordance with NSF 61.
609.8.3 Hot-Water Recirculating Pumps. For hospitals, custodial care facilities, hotels, or motels, devices that automatically turn off the recirculation pump(s) shall not be utilized.

SUBSTANTIATION:
• Given the concern for Legionella risk mitigation in facilities where there are higher potentials to immuno-compromised person or persons with pre-existing condition, the current health care design advice is to maintain circulation along with a temperature above the growth range for pathogen growth.
• ASHRAE 188 recommends continuous circulation of the water system as part of a good water management program.
• OSHA Technical Manual, Section III, Chapter 7, V. Controls, 3, c states: Domestic hot-water recirculation pumps should run continuously. They should be excluded from energy conservation measures.
• JCAHO (Joint Commission on Accreditation of Healthcare Organizations) mandate that covered organizations follow the OSHA requirements
• VA (Veterans Administration) provides similar mandates to minimize Legionella risks.
• CMS (Centers for Medicare & Medicaid Services) provides similar mandates to minimize Legionella risks. Therefore, it is in the best interest of public health, safety and welfare to provide this revision to the minimum requirements of the code as a way to comply with the requirements of other authorities and in the interest of mitigating the risk of Legionella as well as other potential pathogens within the water system.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Hotel and motel occupancies should not be included in the proposed section as the infirm do not always occupy these locations. The proposed language is not enforceable as there is no means of monitoring this after initial inspection. These requirements should be left to the local jurisdictions. Additionally, this change will eliminate the use of circulating pumps with timers that are currently in use.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 21  NEGATIVE: 4  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: I think this is an important issue that has been supported by the healthcare profession. The change should have been accepted to prevent any growth in hot water piping in healthcare facilities. Similar health concerns are also present in hotels and motels. Experience has shown extensive growth on the interior of hot water piping in hotels and motels when the recirculation is permitted to shut down during periods of low use.

GORSUCH: Agree with all the comments from negative votes. Hotels and motels perhaps are more problematic due to lack of regulations. The first Legionella outbreak happened in a hotel and many others to follow.
**MATA:** The proponent has provided adequate justification as to why this proposal is needed. However, any needed revisions will be made at public comment.

**WHITE:** The proponent's substantiation justifies adopting this change.
Proposals

Item #: 164
UPC 2024  Section: 610.2, 611.4 – 611.4.2, Table 611.4

SUBMITTER: Jason Montgomery
JASONS WATER SYSTEMS MFG. INC.

RECOMMENDATION:
Revise text

610.0 Size of Potable Water Piping.

610.2 Pressure Loss. Where a water filter, point of entry (POE) equipment (such as water softeners, iron filters, and chlorinators), backflow prevention device, tankless water heater, or similar device is installed in a water supply line, the pressure loss through such devices shall be included in the pressure loss calculations of the system, and the water supply pipe and meter shall be adequately sized to provide for such a pressure loss. Pressure loss for residential point of entry (POE) equipment shall be determined in accordance with Section 611.4 or other approved methods.

No water filter, water softener, backflow prevention device, or similar device regulated by this code shall be installed in a potable water supply piping where the installation of such device produces an excessive pressure drop in such water supply piping. In the absence of specific pressure drop information, the diameter of the inlet or outlet of such device or its connecting piping shall be not less than the diameter of such water distribution piping to the fixtures served by the device.

Such devices shall be of a type approved by the Authority Having Jurisdiction and shall be tested for flow rating and pressure loss by an approved laboratory or recognized testing agency to standards consistent with the intent of this chapter.

611.0 Drinking Water Treatment Units.

611.4 Sizing of Residential Point of Entry Equipment Softeners. Residential-use point of entry (POE) water treatment equipment pressure drop and connection sizing water softeners shall be sized in accordance with Table 611.4, with the following:

611.4.1 Residential Point of Entry Equipment Pressure Drop. The flow rate (gpm) of the fixtures served by the POE equipment shall be used to establish the pressure drop (psi) for pipe sizing calculations. The pressure drop shall be determined as follows:

1. Acquire manufacture specification sheet showing pressure drop (psi) versus flow rate (gpm).
2. Determine flow rate (gpm) for residential fixture groups from Table 611.4.
3. Determine pressure drop (psi) from the manufacturer’s specification sheet using the acquired flow rate (gpm). The pressure drop for a water softener shall not be greater than 15 psi.

611.4.2 Residential Point of Entry Equipment Connection Sizing. The pressure drop from Section 611.4.1 shall be included with Section 610.0 to size the equipment piping.

<table>
<thead>
<tr>
<th>FIXTURE GROUPS</th>
<th>FLOW RATE (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One half bathroom plus other fixtures</td>
<td>9</td>
</tr>
<tr>
<td>One bathroom group plus other fixtures</td>
<td>9</td>
</tr>
<tr>
<td>Two to four bathroom groups plus other fixtures</td>
<td>11</td>
</tr>
</tbody>
</table>
Notes:
(1) Other fixtures may include: kitchen sink, dishwasher, clothes washer, and laundry sink.
(2) Table 611.4 does not include hose bibb, high flow fixtures, or hydrant flow rates.
(3) For alternate methods of calculating the flow rate (gpm), see also Appendix A, Recommended Rules for Sizing the Water Supply System, Appendix C, Alternate Plumbing Systems, and Appendix M, Peak Water Demand Calculator for alternate methods of sizing water supply systems.

<table>
<thead>
<tr>
<th>TABLE 611.4 SIZING OF RESIDENTIAL WATER SOFTENERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>REQUIRED SIZE OF SOFTENER CONNECTION (inches)</td>
</tr>
<tr>
<td>3/4</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm

Notes:
1. Installation of a kitchen sink and dishwasher, laundry tray, and automatic clothes washer permitted without additional size increase.
2. An additional water closet and lavatory permitted.
3. Over four bathroom groups, the softener size shall be engineered for the specific installation.

4. See also Appendix A, Recommended Rules for Sizing the Water Supply System, and Appendix C, Alternate Plumbing Systems, for alternate methods of sizing water supply systems.

SUBSTANTIATION:
Using this Table 611.4 and the current method of sizing water distribution piping found in Chapter 6 (Not including the Appendices as it is not always adopted by the AHJ), it was able to be determined that Table 611.4 alone, cannot be used when determining the pipe size.

Supporting document(s) has been provided to the Technical Committee for review.

Residential Sizing for Point of Entry (POE) Water Treatment Equipment (WTE)
In order to determine pipe size, the code requires determining the pressure loss through the water treatment equipment. The following table values were generated based on the fixtures associated with UPC Table 611.4 and the Water Demand Calculator. This new table allows the end user to use GPM that will be required by the manufacturer to determine pressure loss.

![Flow Rate Table](image)

Notes:
(1) Other fixtures may include: kitchen sink, dishwasher, clothes washer, and laundry sink.
(2) Table 611.4 does not include hose bibb, high flow fixtures, or hydrant flow rates.
(3) For alternate methods of calculating the flow rate (gpm), see also Appendix A, Recommended Rules for Sizing the Water Supply System, Appendix C, Alternate Plumbing Systems, and Appendix M, Peak Water Demand Calculator for alternate methods of sizing water supply systems.

Available water pressure, elevation, developed length, meter size, service size, and pressure loss through the water treatment devices “must be considered” to properly size the system when using the table method in Chapter 6. To do this, the designer must have the gallon per minute (gpm) flow rate of the fixtures flowing through the device. The gpm can then be compared against the manufacturer’s device or assemblies pressure loss information. This pressure must then be subtracted from the available pressure to determine pipe sizes. Now that the ASSE 1087 standard is included in the UPC, it can be used to determine the pressure drop vs. flow rate information for all water filtration systems, residential and commercial.
If we stayed in line with the basic concept of Table 611.4, we could conclude that for residential applications, the code addresses homes with 1 – 4 bathroom groups. More than 4 bathroom groups, Note 3 of Table 611.4, indicates that more than 4 bathroom groups shall be an engineered system.

Note 1 – Indicates that the following fixtures can be included without increasing pipe sizes when using this table:
• Kitchen Sink
• Dishwasher
• Laundry Tray
• Automatic Clothes Washer

Note 2 – Indicates that the following fixtures may also be included when using this table for sizing:
• Water Closet
• Lavatory
> (These fixtures combined are often referred to a ½ Bath)

The IAPMO Water Demand Calculator (WDC) was used to determine the gallons per minute (GPM) for Single Family Residential and Multi-Family Dwellings. Using the IAPMO – WDC, the following was determined: (Note: WDC does not require the input of Fixture Units to determine GPM)

<table>
<thead>
<tr>
<th>FIXTURE GROUPS</th>
<th>FIXTURE</th>
<th>ENTER TOTAL NUMBER OF FIXTURES</th>
<th>PROBABILITY OF USE (%)</th>
<th>ENTER FIXTURE FLOW RATE (GPM)</th>
<th>MAXIMUM RECOMMENDED FIXTURE FLOW RATE (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathroom Fixtures</td>
<td>1 Bath Tub (no Shower)</td>
<td>0</td>
<td>1.6</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>2 Shower</td>
<td>0</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>3 Combination Bath/Shower</td>
<td>0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>4 Faucet, Lavatory</td>
<td>0</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>5 Shower, per head (no Bath Tub)</td>
<td>0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>6 Main Drain, 1/2 Bath Gravity Tank</td>
<td>0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>7 Comm. Wash.</td>
<td>0</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>8 Faucet, Kitchen Sink</td>
<td>0</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>9 Clothes Washer</td>
<td>0</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>10 Faucet, Bar Sink</td>
<td>0</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>11 Fixture 1</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>12 Fixture 2</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>13 Fixture 3</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Bathroom Groups**

<table>
<thead>
<tr>
<th>Fixture Units</th>
<th>GPM/WDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Single Bath)</td>
<td>7.0 gpm</td>
</tr>
<tr>
<td>(Bath and ½)</td>
<td>8.5 gpm</td>
</tr>
<tr>
<td>(2 Bath)</td>
<td>11.0 gpm</td>
</tr>
<tr>
<td>(2.5 Bath)</td>
<td>11.0 gpm</td>
</tr>
<tr>
<td>(3 bath)</td>
<td>11.0 gpm</td>
</tr>
<tr>
<td>(4 Bath)</td>
<td>11.0 gpm</td>
</tr>
</tbody>
</table>

*All Group Water Supply Fixture Unit (WSFU) loads determined based on 1.6 GPF WC
*Bathroom Groups include: 1-Lavatory, 1-Water Closet, 1-Bath/Shower

<table>
<thead>
<tr>
<th>Other Fixtures</th>
<th>GPM/WDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitchen Sink</td>
<td>2.2 gpm (Indiv.)</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>1.3 gpm (Indiv.)</td>
</tr>
<tr>
<td>Clothes Washer</td>
<td>3.5 gpm (Indiv.)</td>
</tr>
<tr>
<td>Laundry Sink</td>
<td>2.0 gpm (Indiv.)</td>
</tr>
</tbody>
</table>

Total 7.5 5.7 gpm (Combined)

It can then be concluded that if we “combined the fixtures” together, as the notes currently permit per Table 611.4, the following would apply:
As you can see in the list above, the gallons per minute (GPM) fall within either 9 gpm or 11 gpm which are the values stated in the new Table 611.4.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
This change is a redesign based on the “water demand calculator” which may not apply to all jurisdictions.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

<table>
<thead>
<tr>
<th>Combined Fixtures</th>
<th>Fixture Units</th>
<th>GPM/WDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Bath/Other Fixtures</td>
<td>14.5</td>
<td>9.0 gpm</td>
</tr>
<tr>
<td>Bath and ½ /Other Fixtures</td>
<td>18</td>
<td>9.0 gpm</td>
</tr>
<tr>
<td>2 Bath/Other Fixtures</td>
<td>22</td>
<td>11.0 gpm</td>
</tr>
<tr>
<td>2.5 Bath/Other Fixtures</td>
<td>25.5</td>
<td>11.0 gpm</td>
</tr>
<tr>
<td>3 Bath/Other Fixtures</td>
<td>29.5</td>
<td>11.0 gpm</td>
</tr>
<tr>
<td>4 Bath/Other Fixtures</td>
<td>37.5</td>
<td>11.0 gpm</td>
</tr>
</tbody>
</table>
TABLE 610.3
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES

<table>
<thead>
<tr>
<th>APPLIANCES, APPURTEANCES OR FIXTURES²</th>
<th>MINIMUM FIXTURE BRANCH PIPE SIZE¹,₄ (inches)</th>
<th>PRIVATE</th>
<th>PUBLIC</th>
<th>ASSEMBLY⁶</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathtub or Combination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bath/Shower (fill) ¹</td>
<td>1/2</td>
<td>4.0</td>
<td>4.0</td>
<td>—</td>
</tr>
<tr>
<td>3/4 inch Bathtub Fill Valve</td>
<td>3/4</td>
<td>10.0</td>
<td>10.0</td>
<td>—</td>
</tr>
<tr>
<td>Bidet</td>
<td>1/2</td>
<td>1.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Clothes Washer</td>
<td>1/2</td>
<td>4.0</td>
<td>4.0</td>
<td>—</td>
</tr>
<tr>
<td>Dental Unit, cuspidor</td>
<td>1/2</td>
<td>—</td>
<td>1.0</td>
<td>—</td>
</tr>
<tr>
<td>Dishwasher, domestic</td>
<td>1/2</td>
<td>1.5</td>
<td>1.5</td>
<td>—</td>
</tr>
<tr>
<td>Drinking Fountain or Water Cooler</td>
<td>1/2</td>
<td>0.5</td>
<td>0.5</td>
<td>0.75</td>
</tr>
<tr>
<td>Hose Bibb</td>
<td>1/2</td>
<td>2.5</td>
<td>2.5</td>
<td>—</td>
</tr>
<tr>
<td>Hose Bibb, each additional</td>
<td>1/2</td>
<td>1.0</td>
<td>1.0</td>
<td>—</td>
</tr>
<tr>
<td>Lavatory</td>
<td>1/2</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Lawn Sprinkler, each head</td>
<td>—</td>
<td>1.0</td>
<td>1.0</td>
<td>—</td>
</tr>
<tr>
<td>Mobile Home, each (minimum)</td>
<td>—</td>
<td>12.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Sinks</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Bar</td>
<td>1/2</td>
<td>1.0</td>
<td>2.0</td>
<td>—</td>
</tr>
<tr>
<td>Clinical Faucet</td>
<td>1/2</td>
<td>—</td>
<td>3.0</td>
<td>—</td>
</tr>
<tr>
<td>Clinical Flushometer Valve with or without faucet</td>
<td>1</td>
<td>—</td>
<td>8.0</td>
<td>—</td>
</tr>
<tr>
<td>Kitchen, domestic with or without dishwasher</td>
<td>1/2</td>
<td>1.5</td>
<td>1.5</td>
<td>—</td>
</tr>
<tr>
<td>Laundry</td>
<td>1/2</td>
<td>1.5</td>
<td>1.5</td>
<td>—</td>
</tr>
<tr>
<td>Service or Mop Basin</td>
<td>1/2</td>
<td>1.5</td>
<td>3.0</td>
<td>—</td>
</tr>
<tr>
<td>Washup, each set of faucets</td>
<td>1/2</td>
<td>—</td>
<td>2.0</td>
<td>—</td>
</tr>
<tr>
<td>Shower, per head</td>
<td>1/2</td>
<td>2.0</td>
<td>2.0</td>
<td>—</td>
</tr>
<tr>
<td>Urinal, 1.0 GPF Flushometer</td>
<td>3/4</td>
<td>See Footnote⁷</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
### Notes:

1. Size of the cold branch pipe, or both the hot and cold branch pipes.
2. Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.
3. The listed fixture unit values represent their load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as three-quarter of the listed total value of the fixture.
4. The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.
5. For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s), and add it separately to the demand in gpm (L/s) for the distribution system or portions thereof.
6. Assembly [Public Use (See Table 422.1)].
7. Where sizing flushometer systems, see Section 610.10.
8. Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.
9. Nominal tubing size 3/8 shall be permitted to be used where hydraulic calculations support the use of this size.

### SUBSTANTIATION:

Many of the appliances, appurtenances or fixtures which are currently approved for use are subject to water conservation regulations which reduce their WSFU demand, and therefore their required supply pipe sizing. The twelve (12) specific Appliances, Appurtenances or Fixtures to which footnote 9 is proposed to be added meet this description.

Plumbing system designers should have the option to supply these appliances, appurtenances or fixtures with NTS 3/8 tubing, where supported by hydraulic calculations which demonstrate sufficient flow and pressure supply. This will assist with conservation of water, as 3/8 tubing has approximately half the volume of 1/2 tubing, so hot-water fixtures will require less flushing of water before hot water arrives. The addition of footnote 9 as proposed is independent of the tubing material.

### COMMITTEE ACTION: REJECT

### COMMITTEE STATEMENT:

The proposed language may cause a water pressure issue, as well as clogging of the fixtures. There is also a concern with adequate filling of bathtubs and water closets. No technical justification was provided to justify such change.
EXPLANATION OF AFFIRMATIVE:

GORSUCH: I think 3/8 of an inch piping shall only be allowed for very low flow fixtures such as a public lavatory. I have a concern about a mineral buildup (many parts of the country have hard water) that will clog piping that after several years of the initial construction, the systems will need to be re-piped to address the water pressure issue.

EXPLANATION OF NEGATIVE:

BALLANCO: This change was properly substantiated. Tubing 3/8 of an inch in diameter has been used throughout the country without incident.

BROWN, CUDAHY, WHITE: Agree with Ramiro Mata.

MATA: The rejection stating, “no technical justification was provided” does not seem to make sense since the proposal clearly stated, “where hydraulic calculations support its use.” Additionally, 3/8 of an inch is just an option, not mandated.

SIGLER: Agree with Ramiro Mata. This proposal should have been approved as the need for 3/8 inch supply piping has been supported in studies conducted by Gary Klein and others in order to efficiently deliver water to low-flow plumbing fixtures and fittings.
Proposals

Item #: 166
UPC 2024  Section: Table 610.3

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>APPLIANCES, APPURTENANCES OR FIXTURES</th>
<th>MINIMUM FIXTURE BRANCH PIPE SIZE</th>
<th>PRIVATE</th>
<th>PUBLIC</th>
<th>ASSEMBLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonwater Urinal with Drain Cleansing Action</td>
<td>½ (inches)</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
Add "nonwater" to correlate with other sections of this type of urinals. The "Nonwater Urinal with Drain Cleansing Action" term is already in Table 701.2, the definition, and other sections of the UPC.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 167
UPC 2024  Section: 701.2, 701.3.3, 701.8, Table 1701.1

SUBMITTER:  Todd Grayson
Crushproof Tubing Co

RECOMMENDATION:
Revise text

701.0 General.

701.2 Drainage Piping. Materials for drainage piping shall be in accordance with one of the referenced standards in Table 701.2 except that:
(1) No galvanized wrought-iron or galvanized steel pipe shall be used underground and shall be kept not less than 6 inches (152 mm) aboveground.
(2) ABS and PVC DWV piping installations shall be installed in accordance with applicable standards referenced in Table 701.2 and Chapter 14 “Firestop Protection.” Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a flame-spread index of not more than 25 and a smoke-developed index of not more than 50, where tested in accordance with ASTM E84 or UL 723. Plastic piping installed in plenums shall be tested in accordance with all requirements of ASTM E84 or UL 723. Mounting methods, supports and sample sizes of materials for testing that are not specified in ASTM E84 or UL 723 shall be prohibited.
(3) No vitrified clay pipe or fittings shall be used aboveground or where pressurized by a pump or ejector. They shall be kept not less than 12 inches (305 mm) belowground.
(4) Copper or copper alloy tube for drainage and vent piping shall have a weight of not less than that of copper or copper alloy drainage tube type DWV.
(5) Stainless steel 304 pipe and fittings shall not be installed underground and shall be kept not less than 6 inches (152 mm) aboveground.
(6) Cast-iron soil pipe and fittings and the stainless steel couplings used to join these products shall be listed and tested in accordance with standards referenced in Table 701.2. Such pipe and fittings shall be marked with the country of origin, manufacturer’s name or registered trademark as defined in the product standards, the third party certifier’s mark, and the class of the pipe or fitting.
(7) Flexible trap assemblies meeting the IAPMO IGC 361 listing are permissible for all applications in Table 702.1 where the trap is directly accessible.

701.3.3 Type. Fittings used for drainage shall be of the drainage type, have a smooth interior water-way except for Section 701.2 (7) applications, and be constructed to allow 1/4 inch per foot (20.8 mm/m) grade.

701.8 Disinfection. Drainage pipe between a water fixture and trap should be disinfected as necessary using Centers for Disease Control guidelines to help prevent the spread of infectious diseases that can live in these areas. Drain applications in clinical settings shall use a trap system that allows for regular disinfection.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 361-2019</td>
<td>Continuous Flexible Self-Plunging Waste Pipes</td>
<td>Piping</td>
<td>701.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)
Note: IAPMO IGC 361 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The viability of any material or design should be based on meeting the health, safety, and performance requirements for the application. In that respect, the current code is unnecessarily biased against flexible drain pipes in open/exposed applications where there is no risk of pervasive flooding/leaking/damage and access for repair or replacement is convenient. So if the material and design are doing the job as required by the Code and there's little risk, why inhibit the development of new products?

To that end, there are some health and performance issues with existing tailpipe and trap standards that are not being solved with hard pipe, so innovation is badly needed. The most significant example is the ability of viruses and bacteria to live (and in the case of bacteria, multiply) inside the tailpipe and trap when both are functioning as the current Code intends, and then migrate out via normal air exchanges into living space. The COVID-19 outbreak has made the dangers of airborne pathogens all that much more clear, and turning on the HVAC system in your home is like making your sink sneeze on you. Whereas a drain pipe made of soft material can be clamped off to allow for fast and easy disinfection because the entire system can be filled with a dilute bleach solution and allowed to soak, it is much harder for that kind of contact time with a rigid, open-ended system like plastic pipes create today.

Homeowners should be allowed to decide if and when they disinfect their drains, but clinical settings like hospitals would certainly benefit from a regular disinfection regimen, such as when they move a patient out of a room. In that respect, it may actually make sense for health care officials to mandate disinfection in clinical settings in the future. It would therefore be helpful to require new installations in clinical settings to allow for some method of easy and cost-effective disinfection. If we all recognize the dangers of sewer gases to disease spread, why are we ignoring those same pathogens coming up from the exposed pipe surfaces between the faucet and trap?

Other benefits include:
--Flexible pipes are able to be snaked without the risk of breaking the seal on a joint and can be bumped through normal use without the same leak potential.
--Some flexible systems could also meet ADA requirements because they wouldn't hurt knees/legs if someone in a wheelchair uses the sink.
--Regular clog/cleaning maintenance is easier with a flexible system.
--There can be fewer leak points.
--A soft polymer like rubber can create superior seals when compared to plastic-on-plastic.
--Softer materials could be freeze-proof for some outdoor or seasonal applications like public restrooms or campgrounds.
--Help to eliminate the use of hard plastic accordion pipes to solve out-of-alignment applications. This could take a known problem and replace it with a better performing product.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed flexible trap assembly is not permitted as it does not contain a smooth interior waterway as required in Section 701.3.3. A requirement for disinfecting a fixture tailpiece may make sense for healthcare facilities, but not for all occupancies which this proposed language would apply.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 168

UPC 2024  Section: Table 701.2, Table 1701.1

SUBMITTER: William E Chapin
Professional Code Consulting, LLC

RECOMMENDATION:
Revise text

TABLE 701.2
MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>BUILDING SEWER PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM F714, ASTM F894</td>
<td>__</td>
</tr>
<tr>
<td>Polyolefin</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>ASTM F3371</td>
<td>ASTM F3371</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F3371-2019</td>
<td>Polyolefin Pipe and Fittings for Drainage, Waste, and Vent Applications</td>
<td>Piping</td>
<td>Table 701.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASTM F3371 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
ASTM F3371 was developed and published as it includes the same requirements as ASTM F1412 minus the chemical resistance testing. Also, note that other ASTM standards for drain, waste, and vent (DWV) application do not include a chemical resistance test. Under the scope of ASTM F3371, two polyolefins materials are covered; polyethylene (PE) and polypropylene (PP).

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The scope of the standard is vague and does adequately address waste system piping requirements.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1    Daniels
Proposals

Item #: 169
UPC 2024 Section: Table 701.2, Table 1701.1, Table 1701.2

SUBMITTER: Riley Dvorak
Forterra

RECOMMENDATION:
Revise text

TABLE 701.2
MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>BUILDING SEWER PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced Concrete Pipe (RCP)</td>
<td>=</td>
<td>=</td>
<td>X</td>
<td>ASTM C76</td>
<td>ASTM C443, ASTM C923</td>
</tr>
<tr>
<td>Corrugated High Density Polyethylene (HDPE) Pipe</td>
<td>=</td>
<td>=</td>
<td>X</td>
<td>ASTM F2306</td>
<td>ASTM D3212, ASTM F2510</td>
</tr>
<tr>
<td>Corrugated Polypropylene (PP) Pipe</td>
<td>=</td>
<td>=</td>
<td>X</td>
<td>ASTM F2764</td>
<td>ASTM D3212, ASTM F2510</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C76-2020</td>
<td>Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe</td>
<td>Piping</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM C443-2020</td>
<td>Joints for Concrete Pipe and Manholes, Using Rubber Gaskets</td>
<td>Fittings</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM C923/C923M-2020</td>
<td>Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals</td>
<td>Fittings</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM F2306/F2306M-2020</td>
<td>12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications</td>
<td>Piping, Plastic</td>
<td>Table 701.2</td>
</tr>
</tbody>
</table>
### TABLE 1701.2

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C443-2012</td>
<td>Joints for Concrete Pipe and Manholes, Using Rubber Gaskets</td>
<td>Joints</td>
</tr>
<tr>
<td>(R2017)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASTM F2306/F2306M-2018</td>
<td>12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity Flow Storm Sewer and Subsurface Drainage Applications</td>
<td>Piping, Plastic</td>
</tr>
</tbody>
</table>

**SUBSTANTIATION:**
Currently Reinforced Concrete Pipe (RCP) and corrugated plastic products such as HDPE and PP are commonly used for storm drainage on sites within the jurisdiction of the plumbing code (i.e. within 10 feet of the building or 10 feet of a watermain). In these situations, since the pipe is not listed in the table these products currently must receive special approval causing extra work for designers, owners, and plumbing code enforcers. Adding these products into the table will save time for all parties involved.

Supporting document(s) has been provided to the Technical Committee for review.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
There is a concern that Reinforced Concrete Pipe (RCP) and flex piping are not appropriate for maintaining a continuous slope in sanitary sewer applications.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 170
UPC 2024  Section: Table 701.2

SUBMITTER: John Grieco
PPI Pyungwha Co., LTD

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>TABLE 701.2</th>
<th>MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>X</td>
</tr>
</tbody>
</table>

* For building sewer applications.

(portions of the table not shown remain unchanged)

Note: ASTM F1412 and CSA B181.3 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
Polypropylene is used in the industry. The proposed polypropylene standards are currently in Section 811.12 (Waste and Vent Pipes) for corrosive or acidic fluid. Waste fluids can be corrosive, so such piping would be appropriate for Chapter 7.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed provisions are better suited in Chapter 8 where pipe is intended for acid or corrosive chemical waste.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 171
UPC 2024 Section: Table 701.2, 705.5.2, 705.9 – 705.10, Table 1701.1, Table 1701.2

SUBMITTER: Bryan Andrew Miko, P.E.
Advanced Drainage Systems, Inc.

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>BUILDING SEWER PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM D2661, ASTM D2680&lt;sup&gt;1&lt;/sup&gt;</td>
<td>ASME A112.4.4, ASTM D2661, ASTM D2680&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Co-Extruded Composite (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM F628</td>
<td>ASME A112.4.4, ASTM D2661, ASTM D2680&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Co-Extruded PVC (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM F891, ASTM F1760</td>
<td>ASME A112.4.4, ASTM D2661, ASTM D2680&lt;sup&gt;1&lt;/sup&gt;, ASTM F794&lt;sup&gt;1&lt;/sup&gt;, ASTM F1866</td>
</tr>
<tr>
<td>Polyethylene</td>
<td>---</td>
<td>---</td>
<td>X</td>
<td>ASTM F714, ASTM F894, ASTM F2306&lt;sup&gt;2&lt;/sup&gt;</td>
<td>ASTM F3202</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>---</td>
<td>---</td>
<td>X</td>
<td>ASTM F2764, ASTM F2881&lt;sup&gt;2&lt;/sup&gt;</td>
<td>ASTM F3202</td>
</tr>
<tr>
<td>PVC (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM D1785, ASTM D2665, ASTM F794&lt;sup&gt;1&lt;/sup&gt;</td>
<td>ASME A112.4.4, ASTM D2665, ASTM F794&lt;sup&gt;1&lt;/sup&gt;, ASTM F1866</td>
</tr>
<tr>
<td>Reinforced Concrete Pipe</td>
<td>---</td>
<td>---</td>
<td>X</td>
<td>ASTM C76</td>
<td>---</td>
</tr>
</tbody>
</table>

Notes:
<sup>1</sup> For building sewer applications.
<sup>2</sup> For building storm sewer applications.

(portions of table not shown remain unchanged)

705.0 Joints and Connections.
705.5 Polyethylene (PE) Sewer Pipe and Joints. Polyethylene (PE) sewer pipe or tubing and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.5.1 through Section 705.5.3, 705.5.2.
**705.5.2 Mechanical Joints.** Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket that complies with ASTM D3212 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

**705.9 Polypropylene Pipe and Joints.** Joining methods for polypropylene pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.9.1.

**705.9.1 Mechanical Joints.** Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket that complies with ASTM D3212 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

**705.10 Reinforced Concrete Pipe and Joints.** Joining methods for reinforced concrete pipe shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.10.1.

**705.10.1 Mechanical Joints.** Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket that complies with ASTM C1628 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

**705.9 705.11 Special Joints.** (remaining text unchanged)

**705.10 705.12 Joints Between Various Materials.** (remaining text unchanged)

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**TABLE 1701.1**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C76-2020</td>
<td>Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe</td>
<td>Building Sewer</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM C1628-2019</td>
<td>Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets</td>
<td>Building Sewer</td>
<td>705.10</td>
</tr>
<tr>
<td>ASTM F2306/F2306M-2020</td>
<td>12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications</td>
<td>Building Storm Sewer</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM F2764/F2764M-2019</td>
<td>6 to 60 in. [150 to 1500 mm] Polypropylene (PP) Corrugated Double and Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications</td>
<td>Building Sewer</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM F2881/F2881M-2019</td>
<td>12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications</td>
<td>Building Storm Sewer</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM F3202-2019a</td>
<td>Solid Wall Poly (Vinyl Chloride) PVC Fittings for Joining Corrugated Wall High Density Polyethylene (PE) and Polypropylene (PP) Piping</td>
<td>Building Sewer</td>
<td>Table 701.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASTM C76, ASTM C1628, ASTM D3212, ASTM F2306, ASTM F2764, ASTM F2881, and ASTM F3202 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

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**TABLE 1701.2**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F2306/F2306M-2018</td>
<td>12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications</td>
<td>Piping, Plastic</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)
SUBSTANTIATION:
State plumbing boards and their inspectors adopting the UPC are restricting the use of the most common large diameter, gravity flow storm sewer materials in the marketplace. When table 701.2 for building sewer is applied all the way to the property line for larger developments and institutions, this greatly increases the cost for conveying storm water collected all over the site to the public sewer. Currently, many professional engineers are having to request alternate approval for all of these materials on every project they design because of the application of Table 701.2 to the property line. I am proposing adding the most common storm sewer materials in the US for use as building storm sewer pipe to Table 701.2 in order to alleviate that concern and restriction. Since submitting this last time, I have included language for joints/connections for all materials and proper fittings for materials as well which was the primary objection in the 2021 code cycle.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Reinforced Concrete Pipe (RCP) and flex piping are inappropriate for maintaining slope in sanitary sewer applications.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 172
UPC 2024  Section: Table 701.2, Table 1701.1, Table 1701.2

SUBMITTER: Jason John Walton
Pan-Pacific Mechanical

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>BUILDING SEWER PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless Steel 304</td>
<td>—</td>
<td>X</td>
<td>—</td>
<td>ASME A112.3.1, ASTM A312</td>
<td>ASTAM A240, ASTM A351, ASTM A403, ASTM A743, ASTM A774, ASTM A960</td>
</tr>
<tr>
<td>Stainless Steel 304L</td>
<td>—</td>
<td>X</td>
<td>—</td>
<td>ASTM A312</td>
<td>ASTAM A240, ASTM A351, ASTM A403, ASTM A743, ASTM A774, ASTM A960</td>
</tr>
<tr>
<td>Stainless Steel 316</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM A312</td>
<td>ASME A112.3.1, ASTM A240, ASTM A351, ASTM A403, ASTM A743, ASTM A774, ASTM A960</td>
</tr>
<tr>
<td>Stainless Steel 316L</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASME A112.3.1, ASTM A312</td>
<td>ASME A112.3.1, ASTM A240, ASTM A351, ASTM A403, ASTM A743, ASTM A774, ASTM A960</td>
</tr>
</tbody>
</table>

* For building sewer applications.

(portions of table not shown remain unchanged)
### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM A47/A47M-1999(R2018)</td>
<td>Ferritic Malleable Iron Castings</td>
<td>Piping</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM A240/A240M-2020a</td>
<td>Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications</td>
<td>Piping</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM A351/A351M-2018e1</td>
<td>Castings, Austenitic, for Pressure-Containing Parts</td>
<td>Piping</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM A536-1984(R2019)e1</td>
<td>Ductile Iron Castings</td>
<td>Ductile Iron Castings</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM A743/A743M-2019</td>
<td>Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application</td>
<td>Piping</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM A774/A774M-2014(R2019)</td>
<td>As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures</td>
<td>Piping</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM A960-2020</td>
<td>Common Requirements for Wrought Steel Piping Fittings</td>
<td>Fittings</td>
<td>Table 701.2</td>
</tr>
</tbody>
</table>


### TABLE 1701.2
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
</table>

 SUBSTANTIATION:
Table 701.2 does not adequately cover the materials that are commonly used in commercial drainage. Section 710.4 and Section 710.7 require products that are not covered by Table 701.2.

ASME B16.22 and ASME B16.51 fittings are commonly used for trap primers, condensate, indirect waste, and underground pumped discharge.

ASTM A47 and ASTM A536 fittings are commonly used for pumped discharge.

ASTM A312 pipe and ASTM A240, ASTM A351, ASTM A403, ASTM A743, ASTM A774, ASTM A960 fittings are sometimes used for pumped discharge and storm drain/ rainwater harvesting.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The provided technical justification is not sufficient to justify the inclusion of the new materials and standards.
TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 173
UPC 2024  Section: Table 701.2, Table 1701.1

SUBMITTER: Robert D. Ryan
Exact Fit Inc

RECOMMENDATION:
Revise text

TABLE 701.2
MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>BUILDING SEWER PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD (S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM D2661, ASTM D2680*</td>
<td>ASME A112.4.4, ASTM D2661, ASTM D2680*, IAPMO IGC 342</td>
</tr>
<tr>
<td>PVC (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM D1785, ASTM D2665, ASTM F794*</td>
<td>ASME A112.4.4, ASTM D2665, ASTM F794*, ASTM F1866, IAPMO IGC 342</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 342-2018</td>
<td>ABS and PVC Snap-Lock DWV Fittings</td>
<td>Fittings</td>
<td>Table 701.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: IAPMO IGC 342 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The DWV couplings covered by IAPMO IGC 342, ABS and PVC Snap-Lock DWV Fittings address the difficulty faced when repairing and/or replacing a section of DWV pipe that is stationary, immobile, and/or buried. In a typical scenario (movable pipes), the repair would be accomplished through creative methods to insert rigid couplings on both ends using a proper solvent cement (ASTM D2661, ASTM D2665, ASTM D2680, ASTM F794, and ASTM...
In the scenario where pipes are stationary, immobile or buried, creative methods used are the combination of a rigid coupling on one end and a flexible coupling on the other end (ASTM C1173) or the use of a flexible coupling on both ends.

Use of fittings covered under IAMO IGC 342 will allow this same repair/replacement to be completed with a pipe measured to exactly fit the section of pipe that was removed, with the proper use of solvent cements (ASTM D2235, ASTM D2564, ASTM F656) (same as the typical scenario for movable pipes), and with or without the said creative methods to complete the immobile or buried installation.

This proposal is intended to include reference to IGC 342 in the code to allow another option to addressing the repair and replacement of ABS and PVC drainpipe for use of Snap-Lock DWV Fittings in addition to those already covered by the existing references.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed standard is for repairs and not for new installations. This goes beyond the minimum requirements of the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
## TABLE 701.2
MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>BUILDING SEWER PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM D2661, ASTM D2680*</td>
<td>ASME A112.4.4, ASTM D2661, ASTM D2680*, ASTM F1476</td>
</tr>
<tr>
<td>Cast-Iron</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM A74, ASTM A888, CISPI 301</td>
<td>ASME B16.12, ASTM A74, ASTM A888, ASTM F1476, CISPI 301</td>
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<tr>
<td>Co-Extruded ABS (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM F628</td>
<td>ASME A112.4.4, ASTM D2661, ASTM D2680*, ASTM F1476</td>
</tr>
<tr>
<td>Co-Extruded Composite (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM F1488</td>
<td>ASME A112.4.4, ASTM D2661, ASTM D2680, ASTM D2665, ASTM F794*, ASTM F1476, ASTM F1866</td>
</tr>
<tr>
<td>Co-Extruded PVC (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM F891, ASTM F1760</td>
<td>ASME A112.4.4, ASTM D2665, ASTM F794*, ASTM F1336*, ASTM F1476, ASTM F1866</td>
</tr>
<tr>
<td>Galvanized Malleable Iron</td>
<td>—</td>
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<td>—</td>
<td>—</td>
<td>ASME B16.3, ASTM F1476</td>
</tr>
<tr>
<td>Galvanized Steel</td>
<td>—</td>
<td>X</td>
<td>—</td>
<td>ASTM A53</td>
<td>ASME F1476</td>
</tr>
</tbody>
</table>
Polyethylene — — X ASTM F714, ASTM F894

PVC (Schedule 40) X X X ASTM D1785, ASTM D2665, ASTM F794*, ASME A112.4.4, ASTM D2665, ASTM F794*, ASME A112.4.4

PVC (Sewer and Drain) — — X ASTM D2729

PVC PSM — — X ASTM D3034

Stainless Steel 304 — X — ASME A112.3.1

Stainless Steel 316L X X X ASME A112.3.1

Vitrified Clay (Extra strength) — — X ASTM C700

* For building sewer applications.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F1476-2007(R2019)</td>
<td>Performance of Gasketed Mechanical Couplings for Use in Piping Applications</td>
<td>Joints</td>
<td>Table 701.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: ASTM F1476 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F1476-2007(R2013)</td>
<td>Performance of Gasketed Mechanical Couplings for Use in Piping Applications</td>
<td>Joints</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
The ASTM F1476 specification provides the performance characteristics and qualification tests required for gasketed mechanical couplings (GMC) including groove-type mechanical couplings for grooved end pipe, mechanical restraint couplings for plain end pipe and mechanical compression couplings for plain end pipe.

These couplings are for use at temperatures within the recommended temperature range of their respective gaskets.

Couplings manufactured to perform to this standard are utilized around the world for many pipework systems for civils, water, oil & gas, marine, plumbing and mechanical installations with a wide range of pipe materials. Gasketed mechanical pipe couplings allow pipes to be permanently joined without the need for welding, soldering or brazing, eliminating the need for on-site hot work. No pipe threading, grooving, or alternative preparation is required. This gives the system designer and contractor access to a widely used and accepted modern construction method in today’s industry.

Health and safety benefits come from the simple tools required and the use of plain end pipe. There is no heating, welding or manipulation of material on site, so handling is easy and safe. The coupling is light in weight, has no loose parts and all materials are REACH and RoHS compliant and manufactured under an ISO 9001 quality programme. Gaskets are NSF 61 compliant.
The high-level performance of GMCs allows gravity systems to be uprated. For example, where CISPI 310 states that thrust restraint systems are required, a GMC can fulfil the regulation. Global manufacturers of hubless cast iron utilize GMCs in sensitive locations as part of their overall systems.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The change is being rejected as it is mixing gaskets with mechanical joints, which is not appropriate for this section.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  
**AFFIRMATIVE:** 25  
**NOT RETURNED:** 1  
Daniels
Proposals

Item #: 175
UPC 2024  Section: 204.0, Table 702.1

SUBMITTER: Julius Ballanco, P.E.
JB Engineering and Code Consulting, P.C.
Rep. Self

RECOMMENDATION:
Revise text

204.0  -B-

Bathroom Group. Any combination of fixtures, not to exceed one water closet, two lavatories, either one bathtub or one combination bath/shower, and one shower, and may include a bidet and an emergency floor drain.

Half Group. A group of fixtures located together for use by a single occupant consisting of a water closet and lavatory.

702.0 Fixture Unit Equivalents.

702.1 Trap Size. The unit equivalent of plumbing fixtures shown in Table 702.1 shall be based on the size of the trap required, and the unit equivalent of fixtures and devices not shown in Table 702.1 shall be based on the size of trap or trap arm.

Maximum drainage fixture units for a fixture trap and trap arm loadings for sizes up to 4 inches (100 mm) shall be in accordance with Table 702.1(1).

<table>
<thead>
<tr>
<th>PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES</th>
<th>MINIMUM SIZE TRAP AND TRAP ARM? (inches)</th>
<th>PRIVATE</th>
<th>PUBLIC</th>
<th>PUBLIC ASSEMBLY?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathroom Group (1.6 gpf or less water closet)</td>
<td>-</td>
<td>3.5</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Half Group</td>
<td>?</td>
<td>6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1 Bathroom Group</td>
<td>?</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1-1/2 Bathroom Groups</td>
<td>?</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2 Bathroom Groups</td>
<td>?</td>
<td>9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2-1/2 Bathroom Groups</td>
<td>?</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3 Bathroom Groups</td>
<td>?</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Each Additional Half Groups</td>
<td>?</td>
<td>3.5</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Each Additional Bathroom Groups</td>
<td>?</td>
<td>6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bathroom Group (Greater than 1.6 gpf water closet)</td>
<td>?</td>
<td>10</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Half Group</td>
<td>?</td>
<td>11</td>
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<td>-</td>
</tr>
<tr>
<td>1 Bathroom Group</td>
<td>?</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1-1/2 Bathroom Groups</td>
<td>?</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2 Bathroom Groups</td>
<td>?</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2-1/2 Bathroom Groups</td>
<td>?</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3 Bathroom Groups</td>
<td>?</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Each Additional Half Groups</td>
<td>?</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Each Additional Bathroom Groups</td>
<td>?</td>
<td>6</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
For SI units: 1 inch = 25 mm

Notes:
1. Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain thereinto, in accordance with Table 702.2.
2. Provide a 2 inch (50 mm) minimum drain.
3. For refrigerators, coffee urns, water stations, and similar low demands.
4. For commercial sinks, dishwashers, and similar moderate or heavy demands.
5. Buildings having a clothes-washing area with clothes washers in a battery of three or more clothes washers shall be rated at 6 fixture units each for purposes of sizing common horizontal and vertical drainage piping.
6. Water closets shall be computed as 6 fixture units where determining septic tank sizes based on Appendix H of this code.
7. Trap sizes shall not be increased to the point where the fixture discharge is capable of being inadequate to maintain their self-scouring properties.
8. Assembly [Public Use (see Table 422.1)].
9. For a bathtub to shower retrofit, a 1-\(\frac{1}{2}\) inch (40 mm) trap and trap arm shall be permitted with a maximum shower size of 36 inches (914 mm) in width and 60 inches (1524 mm) in length. See Section 408.5 and Section 408.6.

Substantiation:
This change adds a new definition of bathroom group and half bath. These two definitions allow a new category of fixtures to be added to the drainage fixture unit table.
Tom Konen, P.E. did extensive research on the impact of flows in the overall drainage systems design using low flow fixtures. The proposed new table of fixture unit values was published in 1994.
Konen identified in his paper is that families are getting smaller and houses are getting bigger with more bathrooms. Using the queuing theory developed by Dr. Roy B. Hunter, Konen determined that the use of fixtures varies based on the number of fixture installed in a dwelling unit. A five bathroom home occupied by 3 people could not possibly have a peak demand whereby half of the fixture are used simultaneously. Konen's data identified the frequency of use. The data resulted in a revised fixture unit table for bathroom groups. This table has been included in the IAPMO National Standard Plumbing Code since the publication of Konen's paper. To date, I am unaware of the information being proposed to the UPC. This will add the accepted practice of lowering the fixture unit value for bathroom groups.

Committee Action: Reject

Committee Statement:
The provided definition is not necessary as the intent is already covered in the existing definition for "half bathroom group." Additionally, the research does not adequately support the insertion of bathroom groups in the Drainage Fixture Unit Values (DFU) table.

Total Eligible to Vote: 26
Voting Results: Affirmative: 21 Negative: 3 Abstain: 1 Not Returned: 1 Daniels

Explanation of Negative:
GORSUCH: I agree with Charles White.
SOSKIN: Low flow fixtures have difficulty with self-cleaning and self-scouring.
WHITE: I believe the submitted substantiation supports approving this proposal.

Explanation of Abstain:
BALLANCO: I am abstaining since I am the proponent of this code change. I believe the research clearly substantiates the change in the fixture unit values.
Proposals

Item #: 176
UPC 2024 Section: 705.1.1, 705.2.2, 705.3.2, 705.4.1, 705.5.2, 705.6.1, 705.7.1, 705.8.1, 705.10.1, Table 1701.1, Table 1701.2

SUBMITTER: Mr John Wilson
Taylor Kerr Engineering Ltd (Teekay Couplings)

RECOMMENDATION:
Revise text

705.0 Joints and Connections.
705.1 ABS and ABS Co-Extruded Plastic Pipe and Joints. (remaining text unchanged)
705.1.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint. The push-on joint shall include an elastomeric gasket that complies with ASTM D3212 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

A mechanical joint shielded coupling for joining ABS and ABS co-extruded plastic pipe shall comply with ASTM F1476 Type II Class 2 flexible and restrained or Type II Class 3 flexible and unstrained. The mechanical shield shall comply with either 304 or 316L stainless steel with alloy steel coated or 316 / 316L stainless steel fasteners. The coupling shall be installed in accordance with manufacturer's installation instructions.

705.2 Cast-Iron Pipe and Joints. (remaining text unchanged)

705.2.2 Mechanical Joints and Compression Joints. Mechanical joints for cast-iron pipe and fittings shall be of the elastomeric compression type or mechanical joint couplings. Compression type joints with an elastomeric gasket for cast-iron hub and spigot pipe shall comply with ASTM C564 and be tested in accordance with ASTM C1563. Hub and spigot shall be clean and free of dirt, mud, sand, and foreign materials. Cut pipe shall be free from sharp edges. Fold and insert gasket into the hub. Lubricate the joint following manufacturer’s instructions. Insert spigot into hub until the spigot end of the pipe bottom out in the hub. Use the same procedure for the installation of fittings.

A mechanical joint shielded coupling type for hubless cast-iron pipe and fittings shall have a metallic shield that complies with ASTM A1056, ASTM C1277, ASTM C1540, or CISPI 310. The elastomeric gasket shall comply with ASTM C564. Hubless cast-iron pipe and fittings shall be clean and free of dirt, mud, sand, and foreign materials. Cut pipe shall be free from sharp edges. Gasket shall be placed on the end of the pipe or fitting and the stainless steel shield and clamp assembly on the end of the other pipe or fitting. Pipe or fittings shall be seated against the center stop inside the elastomeric sleeve. Slide the stainless steel shield and clamp assembly into a position centered over the gasket and tighten. Bands shall be tightened using an approved calibrated torque wrench specifically set by the manufacturer of the couplings.

A mechanical joint shielded coupling for hubless cast iron pipe and fittings shall have a metallic shield that complies with ASTM A1056, ASTM C1277, ASTM C1540, ASTM F1476 or CISPI 310 Type II Class 2 flexible and restrained or Type II Class 3 Flexible and unstrained. The elastomeric seal shall comply with ASTM C564. The coupling shall be installed in accordance with manufacturer's installation instructions.

705.3 Copper or Copper Alloy Pipe (DWV) and Joints. (remaining text unchanged)

705.3.2 Mechanical Joints. Mechanical joints in copper or copper alloy piping shall be made with a mechanical coupling with grooved end piping or approved joint designed for the specific application.

Mechanical joints for copper or copper alloy piping shall be made with a mechanical coupling with groove end piping, or ASTM F1476 Type II Class 2 flexible and restrained, or approved joint designed for the specific application.
705.4 Galvanized Steel Pipe and Joints. (remaining text unchanged)
705.4.1 Mechanical Joints. Mechanical joints shall be made with an elastomeric gasket. Mechanical joints shall be made with an elastomeric gasket or to ASTM F1476 Type II Class 2 flexible and restrained or Type II Class 3 flexible and un-strained.

705.5 Polyethylene (PE) Sewer Pipe. (remaining text unchanged)
705.5.2 Mechanical Joints. A mechanical joint shielded coupling for polyethylene pipe and fittings shall have a metallic shield that complies with ASTM F1476 Type II Class 3 flexible and unstrained. The coupling shall be installed in accordance with manufacturer’s installation instructions.

705.6 PVC and PVC Co-Extruded Plastic Pipe and Joining Methods. (remaining text unchanged)
705.6.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket that complies with ASTM D3212 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.7 Stainless Steel Pipe and Joints. (remaining text unchanged)
705.7.1 Mechanical Joints. Mechanical joints between stainless steel pipe and fittings shall be of the compression, grooved coupling, hydraulic press-connect fittings, or flanged.

Mechanical Joints between stainless steel pipe and fittings shall be of the compression, grooved coupling, hydraulic press-connect fittings, flanged or ASTM F1476 Type II Class 2 flexible & restrained or Type II class 3 flexible and un-restrained. The push on joint shall include an elastomeric gasket that complies with ASTM C425 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.8 Vitrified Clay Pipe and Joints. (remaining text unchanged)
705.8.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket that complies with ASTM C425 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

Mechanical Joints shall be designed to provide a permanent seal and be of the mechanical or push fit type of joint or ASTM F1476 Type II Class 3 flexible and un-restrained. The push on joint shall include an elastomeric gasket that complies with ASTM C425 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.10 Joints Between Various Materials. Joints between various materials shall be installed in accordance with the manufacturer’s installation instructions and guidelines and with Section 705.10.1 through Section 705.10.4. Mechanical couplings used to join different materials shall comply with ASTM C1173 for belowground use, or ASTM C1460 for aboveground use, or ASTM C1461 for aboveground and or ASTM C1461 or ASTM F1476 Type II Class 3 flexible and unrestrained for both aboveground or belowground use.

705.10.1 Copper or Copper Alloy Pipe to Cast-Iron Pipe. Joints from copper or copper alloy pipe or tubing to cast-iron pipe shall be made with a listed compression-type joint or copper alloy ferrule or stepped mechanical coupling that complies with ASTM F1476 Type II Class 3 flexible and unrestrained. The copper or copper alloy pipe or tubing shall be soldered or brazed to the ferrule, and the ferrule shall be joined to the cast iron hub by a compression or caulked joint.
TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
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</thead>
<tbody>
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<td>Joints</td>
<td>705.1.1, 705.2.2, 705.3.2, 705.4.1, 705.5.2, 705.6.1, 705.7.1, 705.8.1, 705.10.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: ASTM A1056, ASTM C425, ASTM C564, ASTM C1277, ASTM C1461, ASTM C1540, ASTM F1476, and CISPI 310 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

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(portions of table not shown remains unchanged)

SUBSTANTIATION:
The ASTM F1476 specification provides the performance characteristics and qualification tests required for gasketed mechanical couplings (GMC) including groove-type mechanical couplings for grooved end pipe, mechanical restraint couplings for plain end pipe and mechanical compression couplings for plain end pipe.

These couplings are for use at temperatures within the recommended temperature range of their respective gaskets.

Couplings manufactured to perform to this standard are utilized around the world for many pipework systems for civils, water, oil & gas, marine, plumbing and mechanical installations with a wide range of pipe materials. Gasketed mechanical pipe couplings allow pipes to be permanently joined without the need for welding, soldering or brazing, eliminating the need for on-site hot work. No pipe threading, grooving, or alternative preparation is required. This gives the system designer and contractor access to a widely used and accepted modern construction method in today’s industry.

Health and safety benefits come from the simple tools required and the use of plain end pipe. There is no heating, welding or manipulation of material on site, so handling is easy and safe. The coupling is light in weight, has no loose parts and all materials are REACH and RoHS compliant and manufactured under an ISO 9001 quality programme. Gaskets are NSF 61 compliant.

The high-level performance of GMCs allows gravity systems to be uprated. For example, where CISPI 310 states that thrust restraint systems are required, a GMC can fulfil the regulation. Global manufacturers of hubless cast iron utilize GMCs in sensitive locations as part of their overall systems.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is being rejected as it is mixing gaskets with mechanical joints, which is not appropriate for these sections.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 177
UPC 2024  Section: 705.6.2, Table 1701.1, Table 1701.2

SUBMITTER: Michael Cudahy
PPFA

RECOMMENDATION:
Revise text

705.0 Joints and Connections.

705.6 PVC and PVC Co-Extruded Plastic Pipe and Joining Methods.

705.6.2 Solvent Cement Joints. Solvent cement joints for PVC pipe and fittings shall be clean from dirt and moisture. Pipe shall be cut square and pipe shall be deburred. Where surfaces to be joined are cleaned and free of dirt, moisture, oil, and other foreign material, apply primer purple in color that complies with ASTM F656. Primer shall be applied to the surface of the pipe and fitting is softened. Solvent cement that comply with ASTM D2564 shall be applied to all joint surfaces. Joints shall be made while both the inside socket surface and outside surface of pipe are wet with solvent cement. Two-step joining methods shall be in accordance with ASTM D2855. Hold joint in place and undisturbed for 1 minute after assembly.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
<th>REFERENCED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
<td>STANDARD TITLE</td>
</tr>
<tr>
<td>ASTM D2855-2020</td>
<td>Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets</td>
</tr>
</tbody>
</table>

Note: ASTM D2855 meets the requirements for a mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

<table>
<thead>
<tr>
<th>TABLE 1701.2</th>
<th>STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCUMENT NUMBER</td>
<td>DOCUMENT TITLE</td>
</tr>
<tr>
<td>ASTM D2855-2015</td>
<td>Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets</td>
</tr>
</tbody>
</table>

SUBSTANTIATION:
The standard for two step solvent cement joining is ASTM D2855, “Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.”
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the current code language provides the needed requirements regarding joining methods of PVC pipe and joints.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 21  NEGATIVE: 4  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:
BALLANCO, GORSUCH, WHITE: The substantiation justified the acceptance of this change.

KREITENBERG: This is a fine adjustment and provides more clarity.
Proposals

Item #: 178
UPC 2024  Section: 705.7 – 705.7.2, Table 1701.1

SUBMITTER: William E Chapin
Professional Code Consulting, LLC

RECOMMENDATION:
Add new text

705.0 Joints and Connections.

705.7 Polyolefin Pipe (DWV) and Joints. Joints between polyolefin plastic pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.7.1 or Section 705.7.2.

705.7.1 Heat-fusion Joints. Heat-fusion joints for polyolefin pipe and tubing joints shall be installed with socket-type heat-fused polyolefin fittings or electrofusion polyolefin 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 F3371.

705.7.2 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal. Joints shall be made in accordance with ASTM F3371.

(renumber remaining sections)

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F3371-2019</td>
<td>Polyolefin Pipe and Fittings for Drainage, Waste, and Vent Applications</td>
<td>Piping</td>
<td>705.7.1, 705.7.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: ASTM F3371 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
ASTM F3371 was developed and published as it includes the same requirements as ASTM F1412 minus the chemical resistance testing. Also, note that other ASTM for DWV application do not include a chemical resistance test. Under the scope of ASTM F3371, two polyolefins materials are covered; polyethylene (PE) and polypropylene (PP).

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The scope of the standard is vague and does adequately address waste system piping requirements.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 179
UPC 2024  Section: 705.10.3

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

705.10.3 Plastic Pipe to Other Materials. Where connecting plastic pipe to other types of plastic or other types of piping material; approved listed adapter or transition fittings and listed for the specific transition intended shall be used. *Except as provided in Section 705.9.4, PVC and ABS pipe and fittings shall not be solvent welded to any other unlike material.*

(below shown for reference only)

705.9.4 Transition Joint. A solvent cement transition joint between ABS and PVC building drain and building sewer shall be made using listed transition solvent cement in accordance with ASTM D3138.

SUBSTANTIATION:
The current language under Section 705.9.4 allows for a single transition from ABS to PVC or PVC to ABS exterior of the structure. Transition glue is not being represented to be allowable to make transition joints between ABS and PVC anywhere in the building. This code change clarifies that this practice is not approved. I have seen residences where the below slab plumbing was PVC and then the above slab plumbing all PVC with the joints being made with transition glue. This is an improper use of the product. While there is a code change to place this change in Chapter 3 as a prohibited practice it is also important that this be in this section as a prohibited practice to aid the end user and AHJ.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:   AFFIRMATIVE: 25   NOT RETURNED: 1
Daniels
Proposals

Item #: 180

UPC 2024  Section: 706.2

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

706.0 Changes in Direction of Drainage Flow.

706.2 Horizontal to Vertical. Horizontal drainage lines, connecting with a vertical stack, shall enter through 45 degree (0.79 rad) wye branches, 60 degree (1.05 rad) wye branches, combination wye and one-eighth bend branches, double fixture fittings, sanitary tee or sanitary tapped tee branches, or other approved fittings of equivalent sweep. No fitting having more than one inlet at the same level shall be used unless such fitting is constructed so that the discharge from one inlet cannot readily enter any other inlet. Double sanitary tees shall be permitted to be used where the barrel of the fitting is not less than two pipe sizes larger than the largest inlet, (pipe sizes recognized for this purpose are 2 inches, 2½ inches, 3 inches, 3½ inches, 4 inches, 4½ inches, 5 inches, 6 inches, etc.) (50 mm, 65 mm, 80 mm, 90 mm, 100 mm, 115 mm, 125 mm, 150 mm, etc.).

SUBSTANTIATION:
1. If a double fixture fitting can serve back to back or side by side fixture connections with no discharge from one trap arm to the other surely it is adequate to connect horizontal drain lines to a stack.
2. Double fixture fittings are a wye type fitting. Depending upon the material and manufacture the angle may be 45 to 60 degrees, complying with the requirements but not listed as an acceptable fitting
3. From UPC A & A Committee UPC 16-163:
Yes, a figure 5 fitting meets the requirements found in Section 706.2 for horizontal to vertical change in direction.
4. From UPC A&A Committee UPC 20-93:
Yes. Section 706.2 of the 2018 Uniform Plumbing Code (UPC), states “…No fitting having more than one inlet at the same level shall be used unless such fitting is constructed so that the discharge from one inlet cannot readily enter any other inlet”. A figure five cast iron fitting, though designed for back-to-back fixture connections, is configured to prevent the discharge from one inlet from entering the adjacent inlet.
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed double fixture fitting does not have the necessary continuous radial sweep.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
707.4 Cleanouts.

707.4 Location. Each horizontal drainage pipe shall be provided with a cleanout at its upper terminal, and each run of piping, that is more than 100 feet (30 480 mm) in total developed length, shall be provided with a cleanout for each 100 feet (30 480 mm), or fraction thereof, in length of such piping. An additional cleanout shall be provided in a drainage line for each aggregate horizontal change in direction exceeding 135 degrees (2.36 rad). A cleanout shall be installed above the fixture connection fitting, serving each urinal, regardless of the location of the urinal in the building.

Exceptions:
(1) Cleanouts shall be permitted to be omitted on a horizontal drain line less than 5 feet (1524 mm) in length unless such line is serving sinks or urinals.
(2) Cleanouts shall be permitted to be omitted on a horizontal drainage pipe installed on a slope of 72 degrees (1.26 rad) or less from the vertical angle (one-fifth bend).
(3) Excepting the building drain, its horizontal branches, kitchen sinks, and urinals, a cleanout shall not be required on a pipe or piping that is above the floor level of the lowest floor of the building.
(4) An approved type of two-way cleanout fitting or field made double wye (wye and 1/8 bend fitting) in a back to back configuration, installed inside the building wall near the connection between the building drain and the building sewer or installed outside of a building at the lower end of a building drain and extended to grade, shall be permitted to be substituted for an upper terminal cleanout.

Substantiation:
While many of us may not be fans of two cleanouts, they are permitted.

The question is which design offers the best experience for a snaking a drain? The approved type of two-way cleanout(1) has one opening and the deeper in the ground it is located the less control you have on which way the cable it is going to travel in the building sewer. In this pattern there is also a ‘dead’ spot(2) the snake is unable to clean.

The field made two-way cleanout has two openings and the direction of travel is assured. Most users (drain cleaners) believe the field made two-way cleanout is a superior design.
Many times the inspector will reject the installation of the field made two-way cleanout, (commenting it’s design allows better access) because it is not included in 707.4.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
A field installed combination fitting would be installed in reverse when the fitting is required to be installed in the direction of flow.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:

NIELSEN: I think this is a good idea and should be allowed.
Proposals

Item #: 182
UPC 2024  Section: 707.4

SUBMITTER: Mark Woodwick
Woodwick Plumbing LLC

RECOMMENDATION:
Revise text

707.0 Cleanouts.

707.4 Location. Each horizontal drainage pipe shall be provided with a cleanout at its upper terminal, and each run of piping, that is more than 100 feet (30 480 mm) in total developed length, shall be provided with a cleanout for each 100 feet (30 480 mm), or fraction thereof, in length of such piping. An additional cleanout shall be provided in a drainage line for each aggregate horizontal change in direction exceeding 135 degrees (2.36 rad). A cleanout shall be installed above the fixture connection-fitting flood rim, serving each urinal or battery of toilets, regardless of the location of the urinal or battery of toilets in the building.

Exceptions:
(1) Cleanouts shall be permitted to be omitted on a horizontal drain line less than 5 feet (1524 mm) in length unless such line is serving sinks or urinals.
(2) Cleanouts shall be permitted to be omitted on a horizontal drainage pipe installed on a slope of 72 degrees (1.26 rad) or less from the vertical angle (one-fifth bend).
(3) Excepting the building drain, its horizontal branches, kitchen sinks, and urinals, a cleanout shall not be required on a pipe or piping that is above the floor level of the lowest floor of the building.
(4) An approved type of two-way cleanout fitting, installed inside the building wall near the connection between the building drain and the building sewer or installed outside of a building at the lower end of a building drain and extended to grade, shall be permitted to be substituted for an upper terminal cleanout.

SUBSTANTIATION:
Imagine if you will, a battery of 6 toilets in a public restroom that are nearly overflowing due to a down stream blockage. Per the current code, the clean out by which to run the line with a drain machine is located only above the finished floor yet it is below the flood rim of all these toilets. The ensuing mess is and has been horrible.

Whereas, if the clean out is required by code to be above the flood rim of these fixtures, the sewage is not spilt all over the floor, but is contained and the blockage can be cleared more readily.

Please amend the clean out location requirement to be above the flood rim of any fixture served.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The language adds cleanouts that may be excessive and impractical without providing sufficient technical justification.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 183
UPC 2024 Section: 707.4.1

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Add new text

707.0 Cleanouts.

707.4 Location. Each horizontal drainage pipe shall be provided with a cleanout at its upper terminal, and each run of piping, that is more than 100 feet (30 480 mm) in total developed length, shall be provided with a cleanout for each 100 feet (30 480 mm), or fraction thereof, in length of such piping. An additional cleanout shall be provided in a drainage line for each aggregate horizontal change in direction exceeding 135 degrees (2.36 rad). A cleanout shall be installed above the fixture connection fitting, serving each urinal, regardless of the location of the urinal in the building.

Exceptions:
(1) Cleanouts shall be permitted to be omitted on a horizontal drain line less than 5 feet (1524 mm) in length unless such line is serving sinks or urinals.
(2) Cleanouts shall be permitted to be omitted on a horizontal drainage pipe installed on a slope of 72 degrees (1.26 rad) or less from the vertical angle (one-fifth bend).
(3) Excepting the building drain, its horizontal branches, kitchen sinks, and urinals, a cleanout shall not be required on a pipe or piping that is above the floor level of the lowest floor of the building.
(4) An approved type of two-way cleanout fitting, installed inside the building wall near the connection between the building drain and the building sewer or installed outside of a building at the lower end of a building drain and extended to grade, shall be permitted to be substituted for an upper terminal cleanout.

707.4.1 Load Rated Cover. Cleanout floor Covers and top rims meant to take loads shall be rated for the loading in accordance with ASME A112.36.2M.

Note: ASME A112.36.2M meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The code book is currently silent on load bearing covers for floor cleanouts. This is a safety feature that should be included to guide the end users to make sound judgments on appropriate loading applications for these cleanout covers.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 184

UPC 2024  Section: 708.1

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

708.0 Grade of Horizontal Drainage Piping.

708.1 General. Horizontal drainage Building drain piping shall be run in practical alignment and a uniform slope of not less than ¼ inch per foot (20.8 mm/m) or 2 percent toward the point of disposal, provided that, where

Exception: Where it is impractical due to the depth of the street sewer, to the structural features, or to the arrangement of a building or structure to obtain a slope of ¼ inch per foot (20.8 mm/m) or 2 percent, such pipe or building drain piping 4 inches (100 mm) or larger in diameter shall be permitted to have a slope of not less than 1/8 inch per foot (10.4 mm/m) or 1 percent, where first approved by the Authority Having Jurisdiction.

SUBSTANTIATION:
Because building drain and building sewer requirements are both in the same chapter, identifying what is being referenced and spoken about will be helpful for the end user. Furthermore, the addition of a exception for the language stated in Section 708.1 is being added to separate the language where a 1/4 inch is not practical.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
As proposed, this will only apply to building drains. The section needs to apply to all horizontal piping.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
# Proposals

**Item #: 185**

**UPC 2024**  Section: 708.1, Table 703.2

**SUBMITTER:** Arnie Rodio  
Self

**RECOMMENDATION:**  
Revise text

### 708.0 Grade of Horizontal Drainage Piping.

#### 708.1 General.  
Horizontal drainage piping shall be run in practical alignment and a uniform slope of not less than \( \frac{1}{4} \) inch per foot (20.8 mm/m) or 2 percent toward the point of disposal provided that, where it is impractical due to the depth of the street sewer, to the structural features, or to the arrangement of a building or structure to obtain a slope of \( \frac{1}{4} \) inch per foot (20.8 mm/m) or 2 percent, such pipe or piping \( 4\frac{5}{8} \) inches (100–127 mm) or larger in diameter shall be permitted to have a slope of not less than \( \frac{1}{8} \) inch per foot (10.4 mm/m) or 1 percent, where first approved by the Authority Having Jurisdiction.

### TABLE 703.2  
MAXIMUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING

<table>
<thead>
<tr>
<th>SIZE OF PIPE (inches)</th>
<th>1(\frac{1}{4})</th>
<th>1(\frac{1}{2})</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
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<td>Drainage Piping(^1)</td>
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<td>Vertical</td>
<td>1</td>
<td>2(^2), 7</td>
<td>16(^3)</td>
<td>48(^4)</td>
<td>256(^5)</td>
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<td>1380</td>
<td>3600</td>
<td>5600</td>
<td>8400</td>
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<tr>
<td>Horizontal</td>
<td>1</td>
<td>17</td>
<td>8(^3)</td>
<td>35(^4)</td>
<td>216(^5)</td>
<td>428(^5)</td>
<td>720(^5)</td>
<td>2640(^5)</td>
<td>4680(^5)</td>
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<td>Vertical, (feet)</td>
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<td>Maximum Units</td>
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<td>8(^3)</td>
<td>24</td>
<td>84</td>
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<td>Maximum Lengths, (feet)</td>
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<td>390</td>
<td>510</td>
<td>750</td>
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</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

**Notes:**

\(^1\) Excluding trap arm.

\(^2\) Except for sinks, urinals, and dishwashers – exceeding 1 fixture unit.

\(^3\) Except for six-unit traps or water closets.

\(^4\) Not to exceed five six water closets or five six-unit traps.

\(^5\) Based on \( \frac{1}{4} \) inch per foot (20.8 mm/m) slope. For \( \frac{1}{8} \) of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.

\(^6\) The diameter of an individual vent shall be not less than \( 1\frac{1}{4} \) inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2. Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their
entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.3.

7 Up to 8 public lavatories are permitted to be installed on a 1½ inch (40 mm) vertical branch or horizontal sanitary branch sloped at ¼ inch per foot (20.8 mm/m).

SUBSTANTIATION:
The 1/8 slope with the 0.8 factor of Note (5) in Table 703.2, should not be permitted for 4 inch pipe due to requirements of low flow water closets and other water conserving fixtures. The lack of volume of the low flow fixtures have less scouring and carrying rate. The two-percent slope verses a one-percent slope helps alleviate these issues.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

708.0 Grade of Horizontal Drainage Piping.
708.1 General. Horizontal drainage piping shall be run in practical alignment and a uniform slope of not less than ¼ inch per foot (20.8 mm/m) or 2 percent toward the point of disposal provided that, where it is impractical due to the depth of the street sewer, to the structural features, or to the arrangement of a building or structure to obtain a slope of ¼ inch per foot (20.8 mm/m) or 2 percent, such pipe or piping 4 ½-inches (100 427 mm) or larger in diameter shall be permitted to have a slope of not less than ¼ inch per foot (10.4 mm/m) or 1 percent, where first approved by the Authority Having Jurisdiction.

TABLE 703.2
MAXIMUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING

<table>
<thead>
<tr>
<th>SIZE OF PIPE (Inches)</th>
<th>1¼</th>
<th>1½</th>
<th>2</th>
<th>3</th>
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<td>Vertical</td>
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<td>2</td>
<td>16</td>
<td>48</td>
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</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

Notes:
1 Excluding trap arm.
2 Except for sinks, urinals, and dishwashers – exceeding 1 fixture unit.
3 Except for six-unit traps or water closets.
4 Not to exceed six water closets or five six-unit traps.
5 Based on ¼ inch per foot (20.8 mm/m) slope. For 1/8 of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.
6 The diameter of an individual vent shall be not less than 1¼ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2. Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.3.
7 Up to 8 public lavatories are permitted to be installed on a 1½ inch (40 mm) vertical branch or horizontal sanitary branch sloped at ¼ inch per foot (20.8 mm/m).

COMMITTEE STATEMENT:
The modification puts back the "4 inches" to Section 708.1 and adds back the footnote 5 reference under the 4 inch size pipe column in Table 703.2 as these changes were overly restrictive. Therefore, the original values were kept. Only the change to "six" water closets was accepted in footnote 4.
TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 23  NEGATIVE: 2  NOT RETURNED: 1  Daniels
EXPLANATION OF NEGATIVE:
GORSUCH: Agree with Charles White.
WHITE: There is no substantiation provided for the increase to 6 water closets on a 3-inch line.
710.0 Drainage of Fixtures Located Below the Next Upstream Manhole or Below the Main Sewer Level.

710.34401.7-**Building Subdrains.** Building subdrains located below the public sewer level shall discharge into a sump or receiving tank, the contents of which shall be automatically lifted and discharged into the drainage system as required for building sumps.

(renumber remaining sections)

(Section 710.2 is shown for information purposes only)

**710.2 Sewage Discharge.** Drainage piping serving fixtures that are located below the crown level of the main sewer shall discharge into an approved watertight sump or receiving tank, so located as to receive the sewage or wastes by gravity. From such sump or receiving tank, the sewage or other liquid wastes shall be lifted and discharged into the building drain or building sewer by approved ejectors, pumps, or other equally efficient approved mechanical devices.

**SUBSTANTIATION:** Chapter 11 contains provisions on storm drainage. Section 1101.7 is not intended for storm drainage and should be moved to Chapter 7 as building Subdrains are addressed there. The above recommendation would relocate the section “building subdrains” to Chapter 7 where it will be in context with language addressing sewer piping below main sewer level.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
This code change would allow perforated pipe underneath buildings which is not appropriate. The section should remain in its original location.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 187
UPC 2024 Section: 710.4

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

710.0 Drainage of Fixtures Located Below the Next Upstream Manhole or Below the Main Sewer Level.

710.4 Discharge Line. The discharge line from such ejector, pump, or another mechanical device shall be made of approved pressure rated materials listed in Table 701.2 and be provided with an accessible backwater or swing check valve and gate or ball valve. Where the gravity drainage line to which such discharge line connects is horizontal, the method of connection shall be from the top through a wye branch fitting. The gate or ball valve shall be located on the discharge side of the backwater or check valve.

Gate or ball valves, where installed in drainage piping, shall be fullway type with working parts of corrosion-resistant metal. Sizes 4 inches (100 mm) or more in diameter shall have cast-iron bodies and sizes less than 4 inches (100 mm), cast-iron or copper alloy bodies.

SUBSTANTIATION:
The phrase "approved pressure rated" does not provide the installer or AHJ with the pressure rating required or type of material that may be used for the installation. Due to the confusion, many jurisdictions are now requiring pressure rated potable water piping for ejector discharge lines. By doing this, pressure fittings are being used instead of DWV fittings as required in Section 706.0. The Code has allowed DWV piping to be used for ejector discharge lines since 1946. If failures had been reported, the Code would have been changed prior to 2015.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Not all pipe material in Section 701.2 is pressure rated.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
PROPOSALS

Item #: 188

UPC 2024  Section: 710.6, Table 1701.1

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

710.0 Drainage of Fixtures Located Below the Next Upstream Manhole or Below the Main Sewer Level.

710.6 Backwater Valves. Backwater valves, gate valves, fullway ball valves, unions, motors, compressors, air tanks, and other mechanical devices required by this section shall be located where they will be accessible for inspection and repair and, unless continuously exposed, shall be enclosed in a masonry pit fitted with an adequately sized removable cover.

Backwater valves shall comply with ASME A112.14.1 or IAPMO IGC 305, and have bodies of cast-iron, plastic, copper alloy, or other approved materials; shall have noncorrosive bearings, seats, and self-aligning discs; and shall be constructed to ensure a positive mechanical seal. Such backwater valves shall remain open during periods of low flows to avoid screening of solids and shall not restrict capacities or cause excessive turbulence during peak loads. Unless otherwise listed, valve access covers shall be bolted type with gasket, and each valve shall bear the manufacturer’s name cast into the body and the cover.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>IAPMO IGC 305-2019</td>
<td>ABS and PVC Horizontal Backwater Valves with Lifting Devices</td>
<td>Valves</td>
<td>710.6</td>
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</table>

Note: IAPMO IGC 305 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The IAPMO IGC 305 standard covers backwater valves intended for wastewater/sewage systems. Backwater valves can be buried at depths which are difficult to service without having to dig them out. The valves covered under IAPMO IGC 305 contain an access port to a lifting device that allows removal of the backwater valve mechanism for cleaning and maintenance.
COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 189
UPC 2024  Section: 710.9

SUBMITTER: David Mann  
CA State Pipe Trades Council

RECOMMENDATION:
Revise text

710.0 Drainage of Fixtures Located Below the Next Upstream Manhole or Below the Main Sewer Level.
710.9 Alarm. Such sumps and receiving tanks shall be automatically discharged and, wherein a “public use” occupancy, shall be provided with dual pumps or ejectors arranged to function alternately in normal use and independently. Such pumps shall be capable of running continuously in case of overload or mechanical failure of one of the pumps or ejectors. The pumps shall have an audio and visual alarm, readily accessible, that signals pump failure or an overload condition. The lowest inlet shall have a clearance of not less than 2 inches (51 mm) from the highwater or “starting” level of the sump.

SUBSTANTIATION:
The modification clarifies that for public use occupancy, a dual pump system is required to run alternatively, one at a time. Each pump should be capable or running on its own in case one of the pumps fails.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 190
UPC 2024 Section: 712.4 – 712.4.2

SUBMITTER: Riley Dvorak
Forterra

RECOMMENDATION:
Add new text

712.0 Testing.

712.4 Deflection Testing. All plastic storm and sanitary drainage piping greater than or equal to 8 inches (200 mm) in diameter shall be deflection tested. Deflection test shall be conducted no sooner than 30 days after completion of final backfill and compaction testing. The maximum allowable deflection shall be 5 percent unless stated otherwise in the project specifications. All lines shall be cleaned or flushed prior to testing. The deflection test shall be performed on entire length of installed flexible pipeline upon completion of work adjacent to and over the pipeline, including backfilling, placement of fill, grading, paving, placement of concrete, and any other superimposed loads. Deflection of pipe in the installed pipeline under external loads shall not exceed limits as percent of the average inside diameter of pipe. Use a laser profiler or mandrel to determine if allowable deflection has been exceeded.

712.4.1 Laser Profiler. The pipe interior shall be inspected with laser profiling equipment accompanied with video surveillance. Low barrel distortion video equipment shall be utilized for pipe sizes 48 inches (1219 mm) or less. A camera with suitable lighting shall be used to allow a clear picture of the entire periphery of the pipe interior. The camera shall be centered in the pipe both vertically and horizontally. The camera shall be able to pan and tilt to a 90 degree (1.57 rad) angle with the axis of the pipe rotating 360 degrees (6.28 rad). Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition. The video image shall be clear, focused, and relatively free from roll static or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe. For initial post installation inspections for pipe sizes larger than 48 inches (1219 mm), a visual inspection shall be completed of the pipe interior.

712.4.2 Mandrel. The mandrel shall be passed through each run of pipe by pulling it by hand. If deflection readings in excess of the allowable deflection of average inside diameter of pipe are obtained, stop and begin test from the opposite direction. The mandrel shall meet the pipe manufacture's recommendations and the following requirements. The mandrel shall be rigid, nonadjustable, have a minimum of 9 fins, pulling rings at each end, and is engraved with the nominal pipe size and mandrel outside diameter. The mandrel shall be 5 percent less than the certified-actual pipe diameter. The Authority Having Jurisdiction shall verify the outside diameter (OD) of the contractor provided mandrel through the use of Contractor provided proving rings.

SUBSTANTIATION:
Currently there are no limiting criteria for deflection of flexible storm and sanitary sewer pipes within the UPC. Deflection testing of flexible products serves to ensure owners and designers that compaction around the pipe has been completed to a satisfactory level and that no construction activities have damaged the pipe. Over-deflection is an indication that the pipe was not installed to the expected level of quality and subsequently may not last its intended service life.

Deflection testing is a very common practice for storm and sanitary sewers in countless local standards and almost every national specification for these types of products. It should be an especially important consideration for pipes within the jurisdiction of the UPC. Deflection testing is ultimately a relatively inexpensive quality assurance test that provides value-added to owners ensuring them that the pipes installed properly.

The verbiage proposed is from the United Facilities Guide Specifications 33 40 00 Section 3.9.1.4 modified slightly to fit this Plumbing Code section and format.
Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as it is targeted to specific materials where other materials can have deflection issues. Furthermore, the language is overly restrictive as it would create an undue burden.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
713.0 Sewer Required.

713.2 Private Sewage Disposal System. Where no public sewer intended to serve a lot or premises is available in a thoroughfare or right of way abutting such lot or premises, drainage piping from a building or works shall be connected to an approved private sewage disposal system in accordance with Appendix H or as approved by the Authority Having Jurisdiction.

SUBSTANTIATION:
Provisions for Private Sewage Disposal Systems is located in Appendix H. The proposed change directs the end user to the appropriate UPC provisions of Appendix H for private disposal systems.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

713.0 Sewer Required.

713.2 Private Sewage Disposal System. Where no public sewer intended to serve a lot or premises is available in a thoroughfare or right of way abutting such lot or premises, drainage piping from a building or works shall be connected to a private sewage disposal system in accordance with Appendix H or as approved by the Authority Having Jurisdiction. See Appendix H.

COMMITTEE STATEMENT:
The proposed modification relocates the reference to Appendix H to a new sentence at the end of the section. Appendix H is being referenced as an example for private sewage disposal systems.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 192
UPC 2024  Section: 713.2

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

713.0 Sewer Required.

713.2 Private Sewage Disposal System. Where no public sewer intended to serve a lot or premises is available in a thoroughfare or right of way abutting such lot or premises, drainage piping from a building or works shall be connected to an approved private sewage disposal system. (See Appendix H)

SUBSTANTIATION:
Further information about Private Sewage Disposal Systems is located in Appendix H. Seems a reference to Appendix H would assist many users.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the change pertaining to the reference to Appendix H is already being addressed in Item #191.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1  Daniels
Proposals

Item #: 193

UPC 2024  Section: 715.3, Table 1701.1, Table 1701.2

SUBMITTER: Grant Whittle
Nu Flow Technologies

RECOMMENDATION:
Revise text

715.0 Building Sewer Materials.
715.3 Existing Sewers. Replacement of existing building sewer and building storm sewers using trenchless methodology and materials shall be installed in accordance with ASTM F1216, ASTM F1743, ASTM F2561, ASTM F2599, or ASTM F3240.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM F1743-2017</td>
<td>Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)</td>
<td>Piping, Plastic</td>
<td>715.3</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASTM F1743 does not meet the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
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<th>APPLICATION</th>
</tr>
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<tbody>
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<td>Piping, Plastic</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
ASTM F1743 is currently included in Table 1701.2 as a non-mandatory reference. ASTM F1743 has comparable performance property requirements as the alternatively mandated installation practices. Furthermore, Pull-in-Place installation is one of, if not the most, widely practiced installation methods in the plumbing and mechanical pipe sector.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is being rejected as the ASTM F1743 standard is permissive and not written in mandatory language.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 194
UPC 2024  Section: 715.3.1, 715.3.2

SUBMITTER: Joanne Carroll
Subtegic Group Inc.

RECOMMENDATION:
Add new text

715.0 Building Sewer Materials.

715.3 Existing Sewers. Replacement of existing building sewer and building storm sewers using trenchless methodology and materials shall be installed in accordance with ASTM F1216, ASTM F2561, ASTM F2599, or ASTM F3240.

715.3.1 Cured-In-Place Pipe Material. Cured-in-place pipe materials shall be comprised of a specific textile tube combined with a specific resin system at a specific wall thickness that shall be listed (third-party certified) by a listing agency (accredited conformity assessment body) as complying with this code and the approved applicable recognized standards referenced in this code.

715.3.2 Post-Installation Inspection. The installed replacement pipe shall be inspected internally by a recorded video camera survey. The video survey shall be submitted to the Authority Having Jurisdiction prior to acceptance of the work. Any defects identified shall be repaired or replaced as approved by the Authority Having Jurisdiction in accordance with applicable standards and this code.

SUBSTANTIATION:
This addition provides improved efficiencies for code enforcement by including third-party certification for cured-in-place pipe materials. With this addition code officials can easily determine if materials compliant with the code are being used. Because trenchless methodology does not uncover the existing pipe, the addition of post-installation inspection is key to enforcement of the code and verification of compliance of the installed replacement pipe with the code. Although this requirement is included in all of the referenced standards, the addition of this subsection in the code makes the code more user friendly and can improve efficiencies during enforcement. In summary, acceptance of this change will remove confusion in the industry surrounding the use of trenchless methodology and will provide clarity and improve efficiencies for enforcement of the code as it pertains to the use of trenchless methodology and cured-in-place pipe materials to replace or repair buried piping.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed language lists specific resins and wall thicknesses, however, the language is ambiguous. The provisions would be difficult to enforce and should therefore be rejected.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 195

UPC 2024 Section: 715.3 – 715.3.2, Table 1701.1

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

715.0 Building Sewer Materials.

715.3 Trenchless Lining or Replacement of Existing Sewers. Replacement of existing building sewer and building storm sewers using trenchless methodology and materials. Trenchless or replacement of existing sewers shall be in accordance with the Section 715.3.1 or Section 715.3.2.  
715.3.1 Sewer Pipe Lining. The trenchless installation of resin-impregnated flexible tubing to line existing building sewers and building storm sewers shall be installed in accordance with ASTM F1216, ASTM F2561, ASTM F2599, or ASTM F3240. 
715.3.2 Sewer Pipe Replacement. The trenchless installation of polyethylene (PE) pipe using the pipe bursting method to replace existing building sewers and building storm sewers shall comply with ASTM F714, ASTM F894 and installed in accordance with IAPMO IS 26.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
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<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IS 26-2019g2</td>
<td>Trenchless Insertion of Polyethylene (PE) Pipe for Sewer Laterals</td>
<td>Piping</td>
<td>715.3.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ASTM F714, ASTM F894, and IAPMO IS 26 meet the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION: The replacement of existing sewer pipe with Polyethylene (PE) pipe as part of a trenchless pipe bursting methodology is addressed in the standards found in Table 701.2 (ASTM F714-13) and in the Installation Standards, IS 26-2019, but is not mentioned in the body of the Code. Many jurisdictions believe that pipe lining is the only trenchless method of sewer repair/replacement allowed by Code. This new section explains the difference between the two types of products and the standards by which they need to be installed.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

715.0 Building Sewer Materials.

715.3 Trenchless Lining or Replacement of Existing Sewers. Replacement of existing building sewer and building storm sewers using trenchless methodology and materials. Trenchless or replacement of existing sewers shall be in accordance with the Section 715.3.1 or Section 715.3.2:
715.3.1 Sewer Pipe Lining. The trenchless installation of resin-impregnated flexible tubing to line existing building sewers and building storm sewers shall be installed in accordance with ASTM F1216, ASTM F2561, ASTM F2599, or ASTM F3240.

715.3.2 Sewer Pipe Replacement. The trenchless installation of polyethylene (PE) pipe using the pipe-bursting method to replace existing building sewers and building storm sewers shall comply with ASTM F714, ASTM F894 and installed in accordance with IAPMO IS-26.

<table>
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<tr>
<th>TABLE 1701.1</th>
<th>REFERENCED STANDARDS</th>
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(COMMENTS: Portions of table not shown remain unchanged)

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<tr>
<th>TABLE 1701.2</th>
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</tbody>
</table>

(COMMENTS: Portions of table not shown remain unchanged)

COMMITTEE STATEMENT:
The proposed language lists specific resins, however, the language is ambiguous and would be difficult to enforce. For consistency with the action taken on Item #196, IAPMO IS 26 is being relocated to Table 1701.2.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

GORSUCH: Same reason as Item # 196, code shall not reference standards in Table 1701.2.
Proposals

Item #: 196

UPC 2024  Section: 715.3, Table 1701.1, Table 1701.2

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

715.0 Building Sewer Materials.

715.3 Existing Sewers. Where permitted by the Authority Having Jurisdiction, in accordance with Section 301.3, trenchless methods of rehabilitation Replacement of existing building sewer and building storm sewers using trenchless methodology and materials shall be installed in accordance with the standards listed in Chapter 17, ASTM F1216, ASTM F2561, ASTM F2599, or ASTM F3240:

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<th>TABLE 1701.1</th>
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</tr>
<tr>
<td>ASTM F1216-2016</td>
<td>Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube</td>
</tr>
<tr>
<td>ASTM F2561-2017</td>
<td>Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner</td>
</tr>
<tr>
<td>ASTM F2599-2016</td>
<td>The Sectional Repair of Damaged Pipe by Means of an Inverted Cured-in-Place Liner</td>
</tr>
<tr>
<td>ASTM F3240-2017</td>
<td>Installation of Seamless Molded Hydrophilic Gaskets (SMHG) for Long-Term Watertightness of Cured-in-Place Rehabilitation of Main and Lateral Pipelines</td>
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</table>

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<td>Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner</td>
</tr>
<tr>
<td>ASTM F2599-2020</td>
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</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)
There is nothing in the current language of this section that requires a permit. Language is being added to require permits and inspections by the AHJ. These standards contain a section on “significance in use” which does not address installers. These standards are installation standards, and in order to properly enforce, the AHJ would have to be present during the entire installation. For example, it is required that the cleaning of the line prior to the installation would require inspection; there are provision in the standards which need to be addressed by the AHJ.

ASTM F1216 is not written in mandatory language. All the other standards reference ASTM F1216 which is not enforceable, therefore should all be moved to Table 1701.2.

The standards ASTM F2599, ASTM F3240, and ASTM F2561 places undue responsibility and liability on the AHJ. These standards all contain a Section 1.4 which indicates the following: "1.4 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use."

Committee Action: Accept as amended by the TC

Amend proposal as follows:

715.3 Existing Sewers. Where permitted by the Authority Having Jurisdiction, in accordance with Section 301.3, trenchless methods of rehabilitation of existing building sewer and building storm sewers shall be installed in accordance with the standards listed in Chapter 17 following:

715.3.1 Sewer Pipe Lining. For trenchless installation of resin-impregnated flexible tubing to line existing building sewers and building storm sewers see the applicable standards listed in Table 1701.2.

715.3.2 Sewer Pipe Replacement. For trenchless installation of polyethylene (PE) pipe using the pipe bursting method to replace existing building sewers and building storm sewers see the applicable standards listed in Table 1701.2.

Table 1701.2 Standards, Publications, Practices, and Guides

<table>
<thead>
<tr>
<th>Document Number</th>
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<tbody>
<tr>
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<td>Piping</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Committee Statement:
The modification is adding provisions to ensure that such rehabilitation methods are approved by the AHJ prior to installation. Additionally, the standards referenced in the existing Section 715.3 are considered a list of additional approved standards, publications, practices, and guides that are being relocated to Table 1701.2. Currently standards are written in non-mandatory language as exemplified by ASTM F1216 which has 16 "may," 15 "shall," and 102 "should."

Furthermore, as indicated in the proponent's substantiation: ASTM F1216 is not written in mandatory language. All the other standards reference ASTM F1216 which is not enforceable, therefore should all be moved to Table 1701.2.

The ASTM F2599, ASTM F3240, and ASTM F2561 standards place undue responsibility and liability on the AHJ. These standards all contain a Section 1.4 which indicates the following: "1.4 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use."
TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 22 NEGATIVE: 3 NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: This change is inconsistent with procedures for referencing standards. The code should never be referencing random standards in Table 1701.2. When the standards are appropriate to reference, they are included in Table 1701.1. The proposal should have been rejected since the proper approach to referencing the standards is correct as currently shown in the UPC.

GORSUCH, WHITE: I agree with Julius Ballanco.
Proposals

Item #: 197
UPC 2024  Section: 718.1

SUBMITTER: Shane Peters  
City of Santa Monica

RECOMMENDATION:  
Revise text

718.0 Grade, Support, and Protection of Building Sewers.

718.1 Slope. Building sewers shall be run in practical alignment and at a uniform slope of not less than \( \frac{1}{4} \) inch per foot (20.8 mm/m) toward the point of disposal.

Exception: Where approved by the Authority Having Jurisdiction and where it is impractical, due to the depth of the street sewer, or to the structural features or the arrangement of a building or structure, to obtain a slope of \( \frac{1}{4} \) inch per foot (20.8 mm/m), such pipe or piping 4 inches (100 mm) through 6 inches (150 mm) shall be permitted to have a slope of not less than \( \frac{1}{8} \) inch per foot (10.4 mm/m) and such piping 8 inches (200 mm) and larger shall be permitted to have a slope of not less than \( \frac{1}{16} \) inch per foot (5.2 mm/m). The maximum and minimum fixture unit loading shall be in accordance with Table 717.1.

SUBSTANTIATION:  
While there is a reference to Table 717.1 in the previous section and the table is located between the 2 sections, adding a ‘reminder’ here for users is prudent.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  
AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

WHITE: This is adding duplicate content and is unnecessary. The section is not about the sizing of the piping. Further, the concept of maximum/minimum sizing is not appropriate anyway. What do you do when one toilet flushes in a facility with an 8-inch drain? Tell it to wait for its friends before it can continue? Run a parallel smaller drain line and have a toll booth operator direct traffic?
Proposals

Item #: 198
UPC 2024  Section: 803.3

SUBMITTER: Samantha Liu
    Self

RECOMMENDATION:
Revise text

803.0 Indirect Waste Piping.

803.3 Pipe Size and Length. Except as hereinafter provided, the size of indirect waste piping shall be in accordance with other sections of this code applicable to drainage and vent piping. No vent from indirect waste piping shall combine with a sewer-connected vent, but Vents from indirect waste piping shall extend separately to the outside air. Indirect waste pipes exceeding 5 feet (1524 mm), but less than 15 feet (4572 mm) in length shall be directly trapped, but such traps need not be vented. Indirect waste pipes less than 15 feet (4572 mm) in length shall be not less than the diameter of the drain outlet or tailpiece of the fixture, appliance, or equipment served, and in no case less than 1/2 of an inch (15 mm). Angles and changes of direction in such indirect waste pipes shall be provided with cleanouts to permit flushing and cleaning.

SUBSTANTIATION:
As written, the text on vents gives the provision followed by an exception. Placing a period and stating exactly what is needed will remove any confusion. This change will clarify the intent of the section. Indirect waste pipes must vent separately to the outside.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
803.0 Indirect Waste Piping.

803.3 Pipe Size and Length. Except as hereinafter provided, the size of indirect waste piping shall be in accordance with other sections of this code applicable to drainage and vent piping. No vent from indirect waste piping shall combine with a sewer-connected vent, but shall extend separately to the outside air. Indirect waste pipes exceeding 5 feet (1524 mm), but less than 15 feet (4572 mm) in length shall be directly trapped, but such traps need not be vented.

Indirect waste pipes less than 15 feet (4572 mm) in length shall be not less than the diameter of the drain outlet or tailpiece of the fixture, appliance, or equipment served, and in no case less than 1/2 of an inch (15 mm). Angles and changes of direction in such indirect waste pipes shall be provided with cleanouts to permit flushing and cleaning.

Exceptions:
1. Refrigeration coils and ice-maker machines shall not be limited in length.
2. The trap, drain, and vent shall comply with the sizing requirements of Section 702.0, Section 703.0 and Section 904.0 if the indirect waste piping exceeds 15 feet (4572 mm) in length.

The addition of the exceptions intends to clarify the intent between Sections 803.3 and Section 801.3.1.
Proposals

Item #: 200
UPC 2024  Section: 807.1

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

807.0 Appliances.

807.1 Non-Classed Apparatus. Commercial dishwashing machines, silverware washing machines, and other appliances, devices, equipment, or other apparatus not regularly classed as plumbing fixtures, which are equipped with pumps, drips, or drainage outlets, shall be permitted to be drained by indirect waste pipes discharging through an air break into an approved type of open receptor.

SUBSTANTIATION:
The change is adding an air break for clarification as it is already allowed in Section 414.3 for commercial dishwashing machines. Adding the specific indirect connection type will assist the end user to clarify what indirect method should be used without having to look back to Section 414.3. This does not preclude the use of an air gap installation which is more restrictive.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1  Daniels
Proposals

Item #: 201
UPC 2024  Section: 807.3, 807.3.1, Table 1701.1, Table 1701.2

SUBMITTER: Mike Durfee
self

RECOMMENDATION:
Revise text

807.0 Appliances.

807.3 Domestic Dishwashing Machine. No domestic dishwashing machine shall be directly connected to a drainage system or food waste disposer without the use of an approved dishwasher air gap fitting on the discharge side of the dishwashing machine. Listed dishwasher air gap fittings shall be installed with the flood-level (FL) marking at or above the flood level of the sink or drainboard, whichever is higher.

807.3.1 Dishwasher Airgap Fittings. Dishwasher air gap fitting shall comply with IAPMO PS 23.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
<th>REFERENCED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
<td>STANDARD TITLE</td>
</tr>
<tr>
<td>IAPMO PS 23-2019</td>
<td>Dishwasher Drain Airgaps</td>
</tr>
</tbody>
</table>

Note: IAPMO PS 23 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

<table>
<thead>
<tr>
<th>TABLE 1701.2</th>
<th>STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCUMENT NUMBER</td>
<td>DOCUMENT TITLE</td>
</tr>
<tr>
<td>IAPMO PS-23-2006a</td>
<td>Dishwasher-Drain-Airgaps</td>
</tr>
</tbody>
</table>

SUBSTANTIATION:
The proposed change clarifies that air gap fittings are specific to dishwashing machines, covered in Section 807.3. Additionally, the proposed new section calls out the appropriate standard to establish a generally acceptable quality standard for dishwasher airgap fittings. The standards will assist inspectors and users to ensure minimum design requirements are met for the health and safety of public.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

807.0 Appliances.

807.3 Domestic Dishwashing Machine. No domestic dishwashing machine shall be directly connected to a drainage system or food waste disposer without the use of an approved dishwasher air gap fitting on the discharge
side of the dishwashing machine. Listed dishwasher air gap fittings shall be installed with the flood-level (FL) marking at or above the flood level of the sink or drainboard, whichever is higher.

**807.3.1 Dishwasher Airgap Fittings.** Dishwasher air gap fitting shall comply with IAPMO PS 23.

### TABLE 1701.1
<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO PS 23-2019</td>
<td>Dishwasher Drain Airgaps</td>
<td>Backflow Protection</td>
<td>807.3.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

### TABLE 1701.2
<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO PS 23-2006a</td>
<td>Dishwasher Drain Airgaps</td>
<td>Backflow Protection</td>
</tr>
</tbody>
</table>

(ports of table not shown remains unchanged)

**COMMITTEE STATEMENT:**
The proposal is being modified to remove Section 807.3.1 and relocate the reference to IAPMO PS 23 to Table 1701.2, as there is a concern that there may be other standards that may cover the same intent as IAPMO PS 23 for dishwasher drain air gap fittings.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**
- **AFFIRMATIVE:** 25
- **NOT RETURNED:** 1  Daniels
Item #: 202

UPC 2024  Section: 414.3, 807.3

SUBMITTER: Cathy Tran
MN DEPT OF LABOR & INDUSTRY

RECOMMENDATION:
Revise text

807.0 Appliances.

807.3 Domestic Dishwashing Machine. No domestic dishwashing machine shall be directly connected to a drainage system or food waste disposer without the use of an approved dishwasher air gap fitting on the discharge side of the dishwashing machine, or run as the discharge line as high as possible under the countertop, securely fastened. Listed air gap fittings shall be installed with the flood-level (FL) marking at or above the flood level of the sink or drainboard, whichever is higher.

414.0 Dishwashing Machines.

414.3 Drainage Connection. Domestic dishwashing machines shall discharge indirectly through an air gap fitting in accordance with Section 807.3 into a waste receptor, a wye branch fitting on the tailpiece of a kitchen sink, or dishwasher connection of a food waste disposer. Commercial dishwashing machines shall discharge indirectly through an air break or direct connection. The indirect discharge for commercial dishwashing machines shall be in accordance with Section 807.1, and the direct discharge shall be in accordance with Section 704.3.

SUBSTANTIATION:
The proposed change seeks modifications to Sections 807.3 and Section 414.3 by adding another installation method for a domestic dishwasher machine that does not require an installation of a listed air gap fitting on the discharge side of the dishwasher. The additional installation method allows the domestic dishwasher machine discharge pipe to be secured and routed as high as possible under the countertop and connected to a tailpiece of a kitchen sink or food waste grinder. This proposed additional installation option is consistent with other national model codes. The change is reasonable because it allows for another installation option that has historically been proven protective with lower installation costs, adds installation flexibility for homes, and yet prevents unsanitary conditions from waste water backups from the kitchen sink or sewage backups.

Section 807.3 change also includes adding the word “fittings” in the last sentence for correct and consistent use of the “listed air gap fittings” rather than “listed air gaps” and not a substantive change.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
An air gap fitting is required to be above the flood level rim to prevent dishwashers from being flooded when a sink backs up.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
Proposals

Item #: 203
UPC 2024  Section: 809.1

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Revise text

809.0 Drinking Fountains.
809.1 General. Drinking fountains shall be permitted to be installed with indirect wastes through an air break.

(below shown for reference only)

415.3 Drainage Connection. Drinking fountains shall be permitted to discharge directly into the drainage system or indirectly through an air break in accordance with Section 809.1.

SUBSTANTIATION:
Section 415.3 refers to Section 809.1 for indirect waste of drinking fountains. However, Section 809.1 does not give any guidance. The additional language to Section 809.1 is needed to specify the intent of the section.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1  Daniels
Proposals

Item #: 204
UPC 2024  Section: 814.1

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

814.0 Condensate Waste and Control.
814.1 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 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 an approved corrosion-resistant material not smaller than the outlet size in accordance with Section 814.3 or Section 814.4 for air-cooling coils or condensing appliances, respectively. Condensate or wastewater shall not drain over a public way, a street, alley way, or location that will cause a nuisance.

SUBSTANTIATION:
The change adds examples that may not necessarily be considered a public way. Additionally, such locations mentioned may not cover an area that will cause a nuisance.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
A street and alley way are a public way. It is difficult to decide what constitutes a nuisance, making the language unenforceable.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 205

UPC 2024 Section: 814.2

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

814.0 Condensate Waste and Control.

814.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section 814.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

(1) A water level detecting device that will shut off the equipment or appliance in the event the primary drain is blocked.
(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 than the primary drain line connection of the drain pan.
(4) An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

SUBSTANTIATION:
It is important to determine where the condensate is coming from. If you see two condensate lines near each other it is impossible to determine whether is is a primary or secondary drain. An inspector or owner will not be able to identify an emergency that needs attention until the inspector or owner physically looks inside the drain pans to see where it was coming from. Identifying the condensate lines will allow the appropriate action to be taken quickly and prevent unnecessary damage.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The method of marking is not clear. There is validity to identifying the primary and secondary drains, however, the language needs work to clarify the intent.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
814.0 Condensate Waste and Control.

814.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section 814.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

1. A water level detecting device that will shut off the equipment or appliance in the event the primary drain is blocked. Such detecting device shall be installed inside the primary pan above the primary drain and below the flood level rim of the pan.

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 than the primary drain line connection of the drain pan.

4. An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

SUBSTANTIATION:
As written, option (1) is not clear where a water detecting device shall be installed. The language gives clear direction to the location and will prevent installers from placing such devices in the drain line.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

814.0 Condensate Waste and Control.

814.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section 814.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

1. A water level detecting device that will shut off the equipment or appliance in the event the primary drain is blocked. Such detecting device shall be installed inside the primary pan above the primary drain and below the flood level rim of the pan.

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 than the primary drain line connection of the drain pan.

4. An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.
The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

COMMITTEE STATEMENT:
The modification will clarify that the directions and guidance for such detecting devises are found in the manufacturer's installation instructions. Additionally, there may be devices that are not installed directly inside the pan.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 207
UPC 2024  Section: 814.2

SUBMITTER: Arnie Rodio  
Self

RECOMMENDATION:
Revise text

814.0 Condensate Waste and Control.

814.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section 814.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

(1) A water level detecting device that will shut off the equipment or appliance in the event the primary drain is blocked.

(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 separate drain line at a level that is higher than the primary drain line connection of the drain pan.

(4) An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

SUBSTANTIATION:
The addition of "separate" ensures that the primary and secondary condensate drains are not tied together. They must be run separate in case the primary is clogged.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UMC Item # 070, Section 310.2(1) (Condensate Control), UPC Item # 207, Section 814.2(1) (Condensate Control), and UPC Item # 206, Section 814.2(1) (Condensate Control) resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

814.0 Condensate Waste and Control.

814.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section
814.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

(1) A water level detecting device that will shut off the equipment or appliance in the event the primary drain is blocked. Such detecting device shall be in accordance with the manufacturer's installation instructions.

(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 separate drain line at a level that is higher than the primary drain line connection of the drain pan.

(4) An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT:
UPC Item # 207, Section 814.2(1) (Condensate Control) is being revised to correlate with the action taken by the UPC TC for Item # 206, Section 814.2(1) (Condensate Control) to add the sentence “Such detecting device shall be in accordance with the manufacturer’s installation instructions.”

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 814.2 regarding the addition of the sentence “Such detecting device shall be in accordance with the manufacturer’s installation instructions,” and to correlate with the action taken by UPC Item # 206.
Proposals

Item #: 208

UPC 2024  Section: 814.2, Table 1701.1

SUBMITTER: John Taecker
UL LLC

RECOMMENDATION:
Revise text

814.0 Condensate Waste and Control.

814.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section 814. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

(1) A water level detecting device listed and labeled to UL 508 that will shut off the equipment or appliance in the event the primary drain is blocked.

(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 than the primary drain line connection of the drain pan.

(4) An additional watertight pan of corrosion-resistant material with a water level detection device listed and labeled to UL 508 installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 508-2018</td>
<td>Industrial Control Equipment</td>
<td>Control Equipment</td>
<td>814.2</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: UL 508 meets the requirements for mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
Water level detecting devices need to properly function where used as part of the protection method for condensate overflow. UL 508 is the standard used for listing and labeling of these types of devices.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed standard is an electrical standard as the scope indicates, that these should be in accordance with NFPA 70. There may be other standards that are applicable for these types of devices.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 22  NEGATIVE: 3  NOT RETURNED: 1  Daniels
EXPLANATION OF NEGATIVE:

BALLANCO: The reference to this UL standard is appropriate for this location. This change should have been accepted as submitted based on the substantiation.

GORSUCH: I agree with Julius Ballanco.

WHITE: This is an appropriate standard for the referenced product and should be accepted.
Proposals

Item #: 209
UPC 2024  Section: 814.3

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

814.3 Condensate Waste Pipe Material and Sizing. Condensate waste pipes from air-cooling coils shall be sized in accordance with the equipment capacity as specified in Table 814.3. The material of the piping shall comply with the pressure and temperature rating of the appliance or equipment and shall be approved for use with the liquid being discharged.

<table>
<thead>
<tr>
<th>EQUIPMENT CAPACITY IN TONS OF REFRIGERATION</th>
<th>MINIMUM CONDENSATE PIPE DIAMETER (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 20</td>
<td>3/4</td>
</tr>
<tr>
<td>21 – 40</td>
<td>1</td>
</tr>
<tr>
<td>41 – 90</td>
<td>1 1/4</td>
</tr>
<tr>
<td>91 – 125</td>
<td>1 1/2</td>
</tr>
<tr>
<td>126 – 250</td>
<td>2</td>
</tr>
</tbody>
</table>

For SI units: 1 ton of refrigerant = 3.52 kW, 1 inch = 25 mm

The size of condensate waste pipes is for one unit or a combination of units, or as recommended by the manufacturer. The capacity of waste pipes assumes a 1/8 inch per foot (10.4 mm/m) or 1 percent slope, with the pipe running threequarters full at the following pipe conditions:

<table>
<thead>
<tr>
<th>Outside Air – 20%</th>
<th>Room Air – 80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB</td>
<td>WB</td>
</tr>
<tr>
<td>90°F</td>
<td>73°F</td>
</tr>
<tr>
<td>75°F</td>
<td>62.5°F</td>
</tr>
</tbody>
</table>

For SI units: °C = (°F-32)/1.8

Condensate drain sizing for other slopes or other conditions shall be approved by the Authority Having Jurisdiction. Air-conditioning waste pipes, 1 1/4 of an inch (32 mm) and larger in size, shall be constructed of materials specified in Chapter 7. Condensate waste piping less than 1 1/4 of an inch (32 mm) in size shall be permitted to be PVC, CPVC, PE, PP, copper, or other rigid materials approved by the Authority Having Jurisdiction.

SUBSTANTIATION:
Section 814.3 addresses condensate piping for air-conditioning equipment by stating that the material must meet the requirements found in Chapter 7. If the materials found in Table 701.2 are required to be used, the minimum size of piping, per Table 703.2, would be 1-1/4". Many air-conditioning condensate lines are 3/4" and 1" There is no drainage pipe or fittings available in those sizes. Listing acceptable materials for smaller sizes of condensate waste lines in the Code, will eliminate interpretation issues between installers and the AHJ.
COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
814.0 Condensate Waste and Control.

814.3 Condensate Waste Pipe Material and Sizing. Condensate waste pipes from air-cooling coils shall be sized in accordance with the equipment capacity as specified in Table 814.3. The material of the piping shall comply with the pressure and temperature rating of the appliance or equipment and shall be approved for use with the liquid being discharged.

### TABLE 814.3

<table>
<thead>
<tr>
<th>EQUIPMENT CAPACITY IN TONS OF REFRIGERATION</th>
<th>MINIMUM CONDENSATE PIPE DIAMETER (inches)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>3/4</td>
</tr>
<tr>
<td>21 – 40</td>
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</tr>
</tbody>
</table>

For SI units: 1 ton of refrigerant = 3.52 kW, 1 inch = 25 mm

The size of condensate waste pipes is for one unit or a combination of units, or as recommended by the manufacturer. The capacity of waste pipes assumes a 1/8 inch per foot (10.4 mm/m) or 1 percent slope, with the pipe running three-quarters full at the following pipe conditions:

<table>
<thead>
<tr>
<th>Outside Air – 20%</th>
<th>Room Air – 80%</th>
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</thead>
<tbody>
<tr>
<td>DB</td>
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</tr>
<tr>
<td>90°F</td>
<td>73°F</td>
</tr>
<tr>
<td>75°F</td>
<td>62.5°F</td>
</tr>
</tbody>
</table>

For SI units: °C = (°F-32)/1.8

Condensate drain sizing for other slopes or other conditions shall be approved by the Authority Having Jurisdiction.

Air-conditioning waste pipes shall be constructed of materials specified in Chapter 7.

814.3.2 Material. Condensate waste pipes shall be constructed of materials specified in Table 701.2.

(below shown for reference only)

### TABLE 701.2

MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS

(portions of table not shown remain unchanged)
SUBSTANTIATION:
The last sentence is being relocated as its own section (814.3.2 Material) to make it visible and clear as to what materials are permitted for condensate waste. Currently the section indicates that “air conditioning” waste pipes shall be in accordance with Chapter 7. The term “Chapter 7” is being replaced with “Table 701.2” which lists the acceptable materials for condensate lines. Additionally, “air-conditioning” is being replaced with “condensate waste” as condensate is generated by other means than air-conditioning.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the change directs the end user to Table 701.2 which may not contain all applicable materials used for condensate waste pipe.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 211

UPC 2024  Section: 814.5

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

814.0 Condensate Waste and Control.

814.5 Point of Discharge. Air-conditioning condensate waste pipes shall connect indirectly, except where permitted in Section 814.6, to the drainage system through an air gap or air break to trapped and vented receptors, dry wells, mop sinks, leach pits, or the tailpiece of plumbing fixtures. A condensate drain shall be trapped in accordance with the appliance manufacturer’s instructions or as approved.

SUBSTANTIATION:
The change clarifies that mop sinks are an option for indirect connections for condensate waste pipes. Condensate drainage through mop sinks is common and will assist the end user in installing indirect waste piping.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 212

UPC 2024  Section: 814.5

SUBMITTER: Arnie Rodio
Self

RECOMMENDATION:
Revise text

814.0 Condensate Waste and Control.

814.5 Point of Discharge. Air-conditioning condensate waste pipes shall connect indirectly, except where permitted in Section 814.6, to the drainage system through an air gap or air break to trapped and vented receptors, dry wells, or leach pits, or the tailpiece of plumbing fixtures. A condensate drain shall be trapped in accordance with the appliance manufacturer’s instructions or as approved.

Exception: Direct connections as permitted in Section 814.6.

(814.6 is shown for information only)

814.6 Condensate Waste from Air-Conditioning Coils. Where the condensate waste from air-conditioning coils discharges by direct connection to a lavatory tailpiece or to an approved accessible inlet on a bathtub overflow, the connection shall be located in the area controlled by the same person controlling the air-conditioned space.

SUBSTANTIATION:
The first sentence of Section 814.5 starts with indirect connection and then gives the exception. The change relocates language in Section 814.5 to an exception for clarity and to ensure it is not overlooked. Such “direct” connection to the tailpiece is covered in Section 814.6. Additionally, the term “tailpiece of plumbing fixtures” is grouped with the list of locations allowed for “air gap” or “air breaks.” A connection to a tailpiece of a plumbing fixture is neither through an air break or air gap.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

814.0 Condensate Waste and Control.

814.5 Point of Discharge. Air-conditioning condensate waste pipes shall connect indirectly to the drainage system through an air gap or air break to trapped and vented receptors, dry wells, mop sinks, or leach pits. A condensate drain shall be trapped in accordance with the appliance manufacturer’s instructions or as approved.

Exception: Direct connections as permitted in Section 814.6.

COMMITTEE STATEMENT:
The modification includes "mop sinks" which was accepted in Item # 211. The modification clarifies that mop sinks are an option for indirect connections for condensate waste pipes. Condensate drainage through mop sinks is common and will assist the end user in installing indirect waste piping.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in
According to Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 212, Section 814.5 (Point of Discharge) and UMC Item # 074, Section 310.5 (Point of Discharge) resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

814.0 Condensate Waste and Control.

814.5 Point of Discharge. Air-conditioning condensate waste pipes shall connect indirectly to the drainage system through an air gap or air break to trapped and vented receptors, dry wells, mop sinks, or leach pits. A condensate drain shall be trapped in accordance with the appliance manufacturer’s instructions or as approved.

Exception: Direct connections as permitted in accordance with Section 814.6.

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT: The language in UPC Item # 212, Section 814.5 (Point of Discharge) is being revised to correlate with the action taken by the UMC TC for Item # 074, Section 310.5 (Point of Discharge) to change the phrase “as permitted in” to “in accordance with” for consistency throughout the code.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 814.5 regarding changing the phrase from “as permitted in” to “in accordance with.”
Proposals

Item #: 213
UPC 2024  Section: 814.5

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

814.0 Condensate Waste and Control.

814.5 Point of Discharge. Air-conditioning condensate waste pipes shall connect indirectly, except where permitted in Section 814.6, to the drainage system through an air gap or air break to trapped and vented receptors, dry wells, leach pits, or the tailpiece of plumbing fixtures. Condensate from roof top air conditioning units may drain indirectly into a roof drain. A condensate drain shall be trapped in accordance with the appliance manufacturer’s instructions or as approved.

SUBSTANTIATION:
Condensate is essentially distilled water, low in mineral content and when pure is neutral (pH 7). Condensate in contact with air is slightly acidic (approximately pH 5.6) due to dissolved carbon dioxide (CO2)(COX2). The same applies to rainwater.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as allowing condensate waste to discharge into a roof drain is prohibited and may violate federal laws.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 214
UPC 2024  Section: 905.5

SUBMITTER:  David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Revise text

905.0 Vent Pipe Grades and Connections.

905.5 Location of Opening. The vent pipe opening from soil or waste pipe, except for water closets and similar fixtures, shall not be below the weir of the trap.

Exception: Water closets and similar fixtures.

SUBSTANTIATION:
The above recommendation is to relocate the stricken language as an exception. Currently the language is mixed as one sentence with what is allowed and what is not. The change will make the intent clear.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 215

UPC 2024  Section: 906.7

SUBMITTER: David Mann
CA State Pipe Trades Council

RECOMMENDATION:
Revise text

906.0 Vent Termination.

906.7 Frost or Snow Closure. Where frost or snow closure is likely to occur in locations having minimum design temperature below 0°F (-17.8°C), vent terminals shall be not less than 2\(\frac{3}{4}\) inches (50.76 mm) in diameter, but in no event smaller than the required vent pipe. The change in diameter shall be made inside the building not less than 1 foot (305 mm) below the roof in an insulated space and terminate not less than 10 inches (254 mm) above the roof, or in accordance with the Authority Having Jurisdiction.

SUBSTANTIATION:
The proposed change will increase terminating end of vent pipe in to prevent frost closure in freezing temperatures from 2 inches to 3 inches. Other jurisdictions use the three inch requirement to prevent frost closure. Additionally, this will be consistent with the National Standard Plumbing Code (NSPC).

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 216
UPC 2024 Section: 908.2.1

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

908.0 Wet Venting.

908.2 Horizontal Wet Venting for a Bathroom Group. (remaining text unchanged)

908.2.1 Vent Connection. The dry vent connection to the wet vent shall be an individual vent for the bidet, shower, or bathtub. One or two vented lavatory(s) shall be permitted to serve as a wet vent for a bathroom group. Only one wet-vented fixture drain or trap arm shall discharge upstream of the dry-vented fixture drain connection.

Exception: Dry vent connections to the horizontal wet vent shall be in accordance with Section 905.2 and Section 905.3.

(below shown for reference only)

905.2 Horizontal Drainage Pipe. Where vents connect to a horizontal drainage pipe, each vent pipe shall have its invert taken off above the drainage centerline of such pipe downstream of the trap being served.

905.3 Vent Pipe Rise. Unless prohibited by structural conditions, each vent shall rise vertically to a point not less than 6 inches (152 mm) above the flood-level rim of the fixture served before offsetting horizontally, and where two or more vent pipes converge, each such vent pipe shall rise to a point not less than 6 inches (152 mm) in height above the flood-level rim of the plumbing fixture it serves before being connected to any other vent. Vents less than 6 inches (152 mm) above the flood-level rim of the fixture shall be installed with approved drainage fittings, material, and grade to the drain.

SUBSTANTIATION:
The last sentence is really an exception to the rest of the section. This change will emphasize it is an exception.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is not an exception, it is a requirement.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 217
UPC 2024  Section: 910.4

SUBMITTER: Shane Peters  
City of Santa Monica

RECOMMENDATION:
Revise text

910.0 Combination Waste and Vent Systems.

910.4 Connections and Size. Branches serving traps shall connect to the main line at an angle not exceeding 2 percent. Each waste pipe and each trap in such a system shall be not less than two pipe sizes exceeding the sizes required by Chapter 7 of this code, and not less than two pipe sizes exceeding a fixture tailpiece or connection.

SUBSTANTIATION:
The belief that branches line of a CWV system serving traps can discharge into the main at a 45° angle. See images.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 218
UPC 2024  Section: 911.1

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

911.0 Circuit Venting.
911.1 Circuit Vent Permitted. A maximum of eight floor outlet water closets, showers, bathtubs, or floor drains connected to a horizontal branch shall be permitted to be circuit vented. Each trap arm shall connect horizontally to the horizontal branch being circuit vented in accordance with Table 1002.2. The horizontal branch shall be classified as a drain and a vent from the most downstream trap arm connection to the most upstream trap arm connection to the horizontal branch.

Exception: Back-outlet and wall-hung water closets shall be permitted to be circuit vented provided that no floor-outlet fixtures are connected to the same horizontal branch. Back-outlet and wall-hung water closets shall connect horizontally to the horizontal circuit vented drain.

SUBSTANTIATION:
Currently, the exception is not clear as to “how” the back-outlet and wall-hung water closets are to be connected to the circuit vented system. As written, it can be interpreted as allowing a vertical connection to the circuit vent drainage. However, the second sentence of Section 911.1 clearly requires a horizontal-to-horizontal connection ("Each trap arm shall connect horizontally to the horizontal branch being circuit vented..."). The additional sentence to the 911.1 exception clarifies the intent of this section.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

WHITE: The language is redundant and unnecessary.
911.0 Circuit Venting.

911.1 Circuit Vent Permitted. A maximum of eight floor-outlet water closets, showers, bathtubs, or floor drain fixtures connected to a horizontal branch shall be permitted to be circuit vented. Each trap arm shall connect horizontally to the horizontal branch being circuit vented in accordance with Table 1002.2. The horizontal branch shall be classified as a drain and a vent from the most downstream trap arm connection to the most upstream trap arm connection to the horizontal branch.

Exception: Back-outlet and wall-hung water closets shall be permitted to be circuit vented provided that no floor-outlet fixtures are connected to the same horizontal branch.

SUBSTANTIATION:
This proposed change can be thought of in 2 parts, "911.1 Circuit Vent Permitted" and the "Exception".

"911.1 Circuit Vent Permitted": The listing of specific fixtures only excludes fixtures permitted per this section in previous Code. The noted exclusions are floor mount urinals, banks of urinals, bidets, mop sinks, floor sinks, bank of lavatories, area drains. The listed excluded fixtures produce less of a water surge into the circuit vented line than that of the allowable water closets. I would ask the question what are the prohibiting factors that would exclude the other similar fixtures compared to water closets, showers, bathtubs, or floor drains? Oregon State has been allowing a form of this piping configuration for years for floor drains AND floor sinks. See, 2017 Oregon Plumbing Specialty Code (OPSC) Section 1006.2 (Vents Not Required).

Supporting document(s) has been provided to the Technical Committee for review.

"Exception": This statement could stand but is already stated as prohibited by Section 911.4 (Slope and Size of Horizontal Branch). Any fixture connecting to the horizontal circuit vent must be connected in the horizontal with the circuit vent having a grade of no greater than 1 inch per foot. As per the proposed code change, the statement is too narrow in the stated "Exception" because this statement would now need to list all approved fixtures such as lavs, urinals, etc.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change will allow any fixtures to be connected within a circuit vent system. The intent of circuit venting was to vent "floor mounted" fixtures. The proposed language permits any fixture when the intended fitting is for floor mounting only. Circuit venting requirements need to be specific as to what is permitted.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 23  NEGATIVE: 2  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:
BALLANCO: The substantiation justifies the acceptance of this proposed change. Circuit venting works for all fixtures, not just floor outlet fixtures.
WHITE: I agree with the proponent's substantiation.
Proposals

Item #: 220
UPC 2024 Section: 911.1

SUBMITTER: Armando Barragan
Self

RECOMMENDATION:
Revise text

911.0 Circuit Venting.
911.1 Circuit Vent Permitted. A maximum of eight floor outlet fixtures water closets, showers, bathtubs, or floor drains connected to a horizontal branch shall be permitted to be circuit vented. Each trap arm shall connect horizontally to the horizontal branch being circuit vented in accordance with Table 1002.2. Back-outlet, wall-hung, carrier type water closets connecting to a horizontal circuit vent branch drainpipe within the wall shall be considered a horizontal connection. The horizontal branch shall be classified as a drain and a vent from the most downstream trap arm connection to the most upstream trap arm connection to the horizontal branch.

Exception: Back-outlet and wall-hung water closets shall be permitted to be circuit vented provided that no floor-outlet fixtures are connected to the same horizontal branch.

SUBSTANTIATION:
The change is clarifying that a horizontal carrier type water closet is permitted to be circuit vented.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the changes pertaining to back-outlet water closets in this proposal are already being addressed in Item # 218.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 221
UPC 2024  Section: 911.2, 911.2.2

SUBMITTER: Armando Barragan
Self

RECOMMENDATION:
Revise text

911.0 Circuit Venting.

911.2 Circuit Vent Size and Connection. The circuit vent size shall be in accordance with Table 703.2 according to the number of circuit vented fixtures connected to the horizontal branch but shall be not less than 2 inches (50 mm) in diameter. The vent shall connect to the horizontal branch on the vertical between the two most upstream trap arms. The circuit vent pipe shall not receive the discharge of soil or waste.

911.2.1 Multiple Circuit Vents. When multiple circuit vents are interconnected according to Section 911.4.1, each individual circuit vent shall be sized according to Section 911.2. The vent pipe connecting each circuit vent shall be sized according to Table 703.2.

911.2.2 Circuit Vent Connection. The vent shall connect to the horizontal branch on the vertical between the two most upstream trap arms. The circuit vent pipe shall not receive the discharge of soil or waste.

Exception: Where the two most upstream fixtures connect at the same point, the circuit vent shall be installed downstream of this connection and upstream of the next fixture drain connection to the circuit vented horizontal branch drain.

SUBSTANTIATION:
The change relocates the second sentence of Section 911.2 as it relates to circuit vent “connections.” The remaining language, including Section 911.2.1 are related to “sizing.”

The language on “circuit vent connections” is relocated to its own new section (911.2.2). Additionally, an exception is being added to address two fixtures connecting at the same point for a circuit vent system. This is common practice in the industry but is silent in the code. This will clarify these types of installation for circuit vents.
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proponent's image looks as though it is allowing a double fixture fitting, which are not permitted to be placed in the horizontal for drainage. Double fittings are not permitted in the horizontal position as they do not allow minimum slope in both directions.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 222
UPC 2024  Section: 911.2, 911.2.2

SUBMITTER: Armando Barragan
Self

RECOMMENDATION:
Revise text

911.0 Circuit Venting.

911.2 Circuit Vent Size and Connection. The circuit vent size shall be in accordance with Table 703.2 according to the number of circuit vented fixtures connected to the horizontal branch but shall be not less than 2 inches (50 mm) in diameter.

911.2.2 Circuit Vent Connection. The vent shall connect to the horizontal branch on the vertical between the two most upstream trap arms. The circuit vent pipe shall not receive the discharge of soil or waste, shall be permitted to serve as a fixture drain. Fixtures discharging into the circuit vent shall be lavatories or similar fixtures and shall not exceed a total of two fixture units.

SUBSTANTIATION:
As written, the language pertaining to the circuit vent is overly restrictive. Low DFU value fixtures will not restrict or otherwise compromise the circuit vent’s ability to protect trap seals. This will be similar to the existing language for “relief vents” which allow these types of low DFU fixtures to tie in. This practice is used in many jurisdictions and a proven industry practice.

Additionally, the phrase “on the vertical” is being stricken as this requirement is already addressed for vent connection in Section 905.2 (Horizontal Drainage Pipe).
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
There is a concern that placing fixtures in the circuit vent will not allow the required air flow needed to prevent trap siphonage. No technical substantiation was given to warrant such change.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
911.0 Circuit Venting.

911.3 Relief Vent. A 2 inch (50 mm) relief vent shall be provided for circuit-vented horizontal branches receiving the discharge of four or more water closets when connecting to a drainage stack that receives the discharge of soil or waste from upper horizontal branches.

911.3.1 Connection and Installation. The relief vent shall connect to the horizontal branch between the stack and the most downstream trap arm of the circuit vent. The relief vent shall be installed on the vertical to the horizontal branch.

911.3.2 Fixture Drain. The relief vent is shall be permitted to serve as a fixture drain. Fixtures discharging to a relief vent shall be one or two fixture unit fixtures but shall not exceed a total of 4 fixture units.

SUBSTANTIATION:
The sentence being stricken is not needed as it is already covered in the UPC. Section 905.2 requires a dry vent to connect above the spring line. If the vent was wet, it could tie in as permitted by code with the appropriate fittings to the horizontal or vertical. Additionally, Section 911.3.2 is being updated to add enforceable language.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The sentence on how to install the relief vent is needed as it is critical to this specialized circuit vent system to allow the appropriate airflow and prevent trap siphonage.
Proposals

Item #: 224
UPC 2024  Section: 911.5

SUBMITTER: Armando Barragan
Self

RECOMMENDATION:
Revise text

911.0 Circuit Venting.

911.5 Additional Fixtures. Lavatories or similar fixtures, other than the circuit-vented fixtures, are shall be permitted to discharge to the horizontal branch drain. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.

SUBSTANTIATION:
The proposed change clarifies that the fixtures permitted are intended to be 1-drainage fixture units (DFU) or less. Lavatories and similar fixtures are such types and will not add a tremendous load on the circuit vented system.

COMMITTEE ACTION: REJECT
COMMITTEE STATEMENT:
The proposed change is overly restrictive as the section allows for fixtures that are not part of the circuit vent system.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 225
UPC 2024  Section: 913.0 – 913.5, Table 1701.1

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Add new text

913.0 Air Admittance Valves.
913.1 General. Vent systems utilizing air admittance valves shall comply with this section. Stack-type air admittance valves shall conform to ASSE 1050. Individual and branchtype air admittance valves shall conform to ASSE 1051.
913.2 Installation. The valves shall be installed in accordance with the requirements of this section and the manufacturer’s instructions. Air admittance valves shall be installed after the DWV testing required by Section 312.2 or Section 312.3 has been performed.
913.3 Where Permitted. Individual, branch and circuit vents shall be permitted to terminate with a connection to an individual or branch-type air admittance valve in accordance with Section 918.3.1. Stack vents and vent stacks shall be permitted to terminate to stack-type air admittance valves in accordance with Section 918.3.2.
913.4 Prohibited Installations. Air admittance valves shall not be installed in nonneutralized special waste systems as described in Chapter 8 except where such valves are in compliance with ASSE 1049, are constructed of materials approved in accordance with Section 702.5, and are tested for chemical resistance in accordance with ASTM F1412. Air admittance valves shall not be located in spaces utilized as supply or return air plenums. Air admittance valves shall not be used to vent sumps or tanks except where the vent system for the sump or tank has been designed by an engineer. Air admittance valves shall not be installed on outdoor vent terminals for the sole purpose of reducing clearances to gravity air intakes or mechanical air intakes.
913.5 Chemical Waste Vent Systems. The vent system for a chemical waste system shall be independent of the sanitary vent system and shall terminate separately through the roof to the outdoors or to an air admittance valve that complies with ASSE 1049. Air admittance valves for chemical waste systems shall be constructed of materials approved in accordance with Section 702.6 and shall be tested for chemical resistance in accordance with ASTM F1412.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>ASSE 1049-2009</td>
<td>Individual and Branch Type Air Admittance Valves for Chemical Waste Systems</td>
<td>Vents</td>
<td>913.4, 913.5</td>
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<tr>
<td>ASSE 1050-2009</td>
<td>Stack Air Admittance Valves for Sanitary Drainage Systems</td>
<td>Vents</td>
<td>913.1</td>
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<tr>
<td>ASSE 1051-2009</td>
<td>Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems</td>
<td>Vents</td>
<td>913.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: ASSE 1049, ASSE 1050, ASSE 1051, and ASTM F1412 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
ASSE 1049, 1050 and 1051 provides another way of venting a drainage systems.
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
These systems use mechanical devices and there is a concern that they can and do fail. There is concern that these devices will be used for chemical waist venting and the risk for the health and safety of the public should these devices fail. Furthermore, the system should be able to withstand the test being required.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 23 NEGATIVE: 2 NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: This change would allow a method of venting that has been successfully used for the last 30 years. There is no justification for not including this venting method in the code.

GORSUCH: Agree with Julius Ballanco. Air admittance valves are allowed in other plumbing codes; there are occasions that traditional VTRs would not work due to the special building configuration that we have to apply for an AMC to use air admittance valves.
Item #: 226

UPC 2024  Section: 913.0 – 913.10, Table 913.2

SUBMITTER: John Lansing
PAE Consulting Engineers
Rep. American Society of Plumbing Engineers

RECOMMENDATION:
Revise text

**C 601.0-913.0 Single-Stack Vent System.**

**C 601.1-913.1 Where permitted.** Single-stack venting shall be designed by a registered design professional as an engineered design. A drainage stack shall be permitted to serve as a single-stack vent system where sized and installed in accordance with Section C 601.2 through Section C 601.9. The drainage stack and branch piping in a single-stack vent system shall provide for the flow of liquids, solids, and air without the loss of fixture trap seals exceeding the pressure differential described in Section 901.3.

**C 601.2-913.2 Stack Size.** Drainage stacks shall be sized in accordance with Table C 601.2. Not more than two water closets shall be permitted to discharge to a 3 inch (80 mm) stack. Stacks shall be uniformly sized based on the total connected drainage fixture unit load, with no reductions in size.

**C 601.2.1-913.2.1 Stack Vent.** The drainage stack vent shall have a stack vent of the same size terminating to the outdoors.

**C 601.3-913.3 Branch Size.** Horizontal branches connecting to a single-stack vent system shall be sized in accordance with Table 703.2.

**Exceptions:**
(1) Not more than one water closet within 18 inches (457 mm) of the stack horizontally shall be permitted on a 3 inch (80 mm) horizontal branch.
(2) A water closet within 18 inches (457 mm) of a stack horizontally and one other fixture with up to 1 ½ inch (40 mm) fixture drain size shall be permitted on a 3-inch (80 mm) horizontal branch where connected to the stack through a sanitary tee.

**C 601.4-913.4 Length of Horizontal Branches.** Water closets shall be not more than 4 feet (1219 mm) horizontally from the stack.

**Exception:** Water closets shall be permitted to be up to 8 feet (2438 mm) horizontally from the stack where connected to the stack through a sanitary tee.

**C 601.4.1-913.4.1 Other Fixtures.** Fixtures other than water closets shall be not more than 12 feet (3658 mm) horizontally from the stack.

**C 601.4.2-913.4.2 Length of Vertical Piping.** The length of a vertical piping from a fixture trap to a horizontal branch shall not be considered in computing the fixture’s horizontal distance from the stack.

**C 601.5-913.5 Maximum Vertical Drops from Fixtures.** Vertical drops from fixture traps to horizontal branch piping shall be one size larger than the trap size, but not less than 2 inches (50 mm) in diameter. Vertical drops shall be 4 feet (1219 mm) maximum length. Fixture drains that are not increased in size, or have a vertical drop exceeding 4 feet (1219 mm) shall be individually vented.

**C 601.6-913.6 Additional Venting Required.** Additional venting shall be provided where more than one water closet is on a horizontal branch and where the distance from a fixture trap to the stack exceeds the limits in Section C 601.4. Where additional venting is required, the fixture(s) shall be vented by individual vents, common vents, wet vents, circuit vents, or a combination waste and vent pipe one of the methods described in Sections 908.0 through Section 911.5. The dry vent extensions for the additional venting shall connect to a branch vent, vent stack, stack vent, or be extended outdoors and terminate to the open air.

**C 601.7-913.7 Stack Offsets.** Where there are no fixture drain connections below a horizontal offset in a stack, the offset does not need to be vented. Where there are fixture drain connections below a horizontal offset in a stack, the offset shall be vented. There shall be no fixture connections to a stack within 2 feet (610 mm) above and below a
C 601.8–913.8 Prohibited Connections Near Base of Stack Separate Stack Required. Where stacks are more than two stories 75 feet (22 860 mm) high, a separate stack shall be provided for the fixtures on the lower two stories. The stack for the lower two stories shall be permitted to be connected to the branch of the building drain that serves the stack for the upper stories at a point that is not less than 10 pipe diameters 8 feet (2438 mm) downstream from the base of the upper stack. Where stacks are less than 75 feet (22 860 mm) high but more than two stories high, the lowest story shall not connect within 8 feet (2438 mm) downstream from the base of the stack. Vents for the lowest story shall be provided in accordance with Section 913.8.1 and Section 913.8.2.

913.8.1 Conditional Vent. Venting of fixtures on the lowest floor shall be in accordance with Sections 908.0 through Section 911.5 and may connect into the single-stack as a conditional vent. The conditional vent connects into the stack by means of a wye-fitting to prevent ingress of drainage into the vent. No more than 12 drainage fixture units (DFU) may be connected into the conditional vent and shall connect not less than 8 feet (2438 mm) above the stack base.

913.8.2 Other Branch Vent. Other branch vents shall be vented in accordance with Sections 908.0 through Section 911.5.

C 601.9–913.9 Sizing Building Drains and Sewers. In a single-stack vent system, the building drain and branches thereof shall be sized in accordance with Table 703.2, and the building sewer shall be sized in accordance with Table 717.1.

913.10 Parallel Vent Stacks. Drainage stacks extending more than 75 feet (22 860 mm) shall be provided with a parallel vent stack and shall meet the requirements of Section 907.1 and Section 907.2.

### TABLE C 601.2 913.2

**SINGLE STACK SIZE***

<table>
<thead>
<tr>
<th>STACK SIZE (INCHES)</th>
<th>STACKS LESS THAN 75 FEET IN HEIGHT</th>
<th>STACK 75 FEET TO LESS THAN 160 FEET IN HEIGHT</th>
<th>STACK 160 FEET OR GREATER IN HEIGHT</th>
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<tbody>
<tr>
<td>3</td>
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<tr>
<td>15</td>
<td>13 600</td>
<td>8100</td>
<td>4500</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm
* NP = Not permitted

**SUBSTANTIATION:**

By ensuring free airflow into the top of the single-stack, fixtures may discharge into the stack without individual vents between the fixture trap and stack connection. The restricted height and drainage flow ensure that airflow faces limited frictional resistance so as to operate within the ±1 inch of water column pressure tolerance at each trap location. Additionally, fixtures must be installed within a limited distance from the stack to eliminate issues of self-siphonage. Page 1 of the Supporting Document shows an example of the proposed single-stack next to a conventional stack sized according to UPC requirements. The ‘one-pipe’ system shown on page 2 of the Supporting Document, was developed in 1911 by Boston architect and plumbing innovator J. Pickering Putnam and was further tested and developed in the UK in the 1950s through experimental testing. The single-stack is now a standard sanitary drainage configuration throughout the UK and Europe, as well as Australia, Japan, Singapore, China, Brazil and many other regions. The single-stack is an approved method in roughly 50% of the United States by population and typical in Philadelphia. Testing has shown this method to match the performance of conventional vented drainage systems. Unlike the conventional sanitary stack in the UPC, all single-stacks must be extended to atmosphere above the highest sanitary branch connection. As can be seen on Page 3 of the Supporting Document, the single-stack has comparable performance to conventional stack, though the conventional stack in this test has a stack vent, which is not required in the UPC, though a parallel vent stack is required for buildings greater than 10
stories. The UPC incorporated the single stack into the Alternative Methods Appendix in the 2006 edition, 6 years before the IPC, but has yet to transition this to Chapter 9 as an approved method. Transitioning the single-stack vent system to the main body of the code will recognize this as a proven design method. In the attached document, you can see an example of a single-stack design. Pressure flow profiles are shown below from Transient Airflow in Building Drainage Systems by Dr. John Swaffield, a researcher at Heriot-Watt University well known in the building drainage research field.

The single-stack system proposed here has key advantages over the single-stack configuration used on the East Coast and UPC appendix. The current single-stack vent system used in the US differs from international variations in that the lower two floors are required to connect to a separate stack, in essence, requiring a vent alongside the single-stack through the roof. It is well established in Europe and Asia that dedicated vent piping alongside stacks is unnecessary for midrise buildings and only an appropriate requirement for very tall stacks, such as those greater than 10 or so floors, where the developed negative pressure is potentially significant. It is also well accepted that separation of the lower two floors is unnecessary for stacks shorter than 75 feet in length and only recommended for stacks greater than 20 floors. The separation of the lower two floors is only required for stacks greater than 75 feet. Single-stacks used abroad do not require separate vents for the lower floor to extend through the roof independently. Allowances are given to connect a vent from fixtures into the stack by means of a wye-fitting to prevent the ingress of drainage, as seen on page 4 of the Supporting Document. Other countries, such as the UK allow ‘stub stacks’ which rely on free airflow in the upper portion of the drainage system to relieve pressure differentials. Given that the standard allowable pressure differential variance of 1 inch of water column is shared by many drainage system specifications used internationally, performance between drainage systems can more easily be compared.

Conventional sanitary drainage requirements in the UPC make it difficult to drain all fixtures in a bathroom group to one stack, often requiring a dedicated stack for the bathtub or shower. This configuration will easily allow bathrooms to be served by one stack without dedicated vent piping. Firestopping and acoustical transmittance is reduced with fewer penetrations through each level. Midrise multifamily applications such as the podium style or ‘five-over-one’ buildings will see benefits in using the single-stack configuration, given the limited height.

A competing approach has become more common in the US, known as the Sovent system, which requires proprietary fittings containing an internal baffle to help maintain airflow through the stack. While Sovent will may produce superior airflow performance compared to the single-stack for very tall buildings, Sovent systems offer no advantages over the single-stack in terms for stacks in mid-rise buildings. The single-stack alternatively uses standard drainage fittings and offers comparable performance to Sovent systems, provided that the length of the stacks are limited to the heights specified in Table C 601.2.

Supporting document(s) has been provided to the Technical Committee for review.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
Single stack vent systems should remain in Appendix C as an engineered system. Section C 601.1 addresses single stack venting and shall be designed be a registered design professional. The Technical Committee recommends that the changes be resubmitted as a public comment to Appendix C without the relocation.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**
- **AFFIRMATIVE:** 24
- **NEGATIVE:** 1
- **NOT RETURNED:** 1
  - Daniels

**EXPLANATION OF AFFIRMATIVE:**
**MATA:** During the technical committee meeting, there was a significant amount of support expressed for incorporating the changes to the single stack vent system but retaining the section in Appendix C as an "engineered design." The proponent intends to issue this as a recommendation in a public comment.

**EXPLANATION OF NEGATIVE:**
**BALLANCO:** Single stack venting can move from the appendix into Chapter 9. The system will still be designed by a registered design professional based on state licensing requirements.
**TABLE 1002.2**
**HORIZONTAL LENGTHS OF TRAP ARMS**
(EXCEPT FOR WATER CLOSETS AND SIMILAR FIXTURES)\(^1, 2\)

<table>
<thead>
<tr>
<th>TRAP ARM PIPE DIAMETER (inches)</th>
<th>DISTANCE TRAP TO VENT MINIMUM (inches)</th>
<th>LENGTH MAXIMUM (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1¼</td>
<td>2½</td>
<td>30</td>
</tr>
<tr>
<td>1½</td>
<td>3</td>
<td>42</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>72</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>120</td>
</tr>
<tr>
<td>Exceeding 4</td>
<td>2 x Diameter</td>
<td>120</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

**Notes:**
1. Maintain ¼ inch per foot slope (20.8 mm/m).
2. The developed length between the trap of a water closet or similar fixture (measured from the top face of the closet flange to the inner edge of the vent) and its vent shall not exceed 6 feet (1829 mm).

**SUBSTANTIATION:**
Flanges are installed either flush with the floor or flush with the wall. This change is a clarification which will address the intent of footnote (2) as the measurement should always be taken from the face of the flange which is not necessarily the top.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 228
UPC 2024 Section: Table 1002.2

SUBMITTER: John Lansing
PAE Consulting Engineers
Rep. American Society of Plumbing Engineers

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>TRAP ARM PIPE DIAMETER (inches)</th>
<th>DISTANCE TRAP TO VENT MINIMUM (inches)</th>
<th>LENGTH MAXIMUM (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1¼</td>
<td>2½</td>
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<td>1½</td>
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<td>4</td>
<td>8</td>
<td>120</td>
</tr>
<tr>
<td>Exceeding 4</td>
<td>2 x Diameter</td>
<td>120</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

Notes:
1. Maintain 1/4 inch per foot slope (20.8 mm/m).
2. The developed length between the trap of a water closet or similar fixture (measured from the top of the closet flange to the inner edge of the vent) and its vent shall not exceed 6 feet (1829 mm).
3. Horizontally wet vented bathtubs, showers and similar fixtures shall be limited to a maximum of 6 feet (1830 mm) for 1-1/2 inch (40 mm) fixture drains and 8 feet (2440 mm) for 2 inch (50 mm) fixture drains, maintaining 1/4 inch per foot slope (20 mm/m).

SUBSTANTIATION:
Since the introduction of horizontal wet venting in the 2009 Uniform Plumbing Code, many installations feature roundabout piping configurations in order to meet the maximum 3’-6” trap-to-vent distance from the bathtub, as required in Table 1002.2 for 1-1/2 inch fixture drains. We believe that the trap-to-vent requirement was mistakenly incorporated into the code language, given that the original conclusions from the National Bureau of Standards analysis and experimental testing on horizontal wet venting recommended greater allowances for trap arm lengths. The National Bureau of Standards, which originally helped produce many of the tables and recommendations in the UPC regarding sanitary drainage and vent systems, investigated horizontal wet vent systems to verify performance for the inclusion into plumbing codes. Their report, BMS 119 Wet Venting of Plumbing Fixtures, found that a 1-1/2 inch bathtub drain sloped at 1/4-inch per foot may have a length of 6’-0” between the horizontal wet vent (from the lavatory) and trap weir of the bathtub while maintaining within the required ±1 inch of water column pressure differential at the fixture trap to mitigate self-siphonage conditions. They also found that increasing the diameter of the fixture drain from the bathtub to 2 inches allowed a distance of 8’-0”. Recognizing the rest of the conclusions from the original work of the NBS on wet venting will reduce unnecessary horizontal piping and increase drainline.
performance while optimizing the use of drainage piping. The additional piping installed to meet current code requirements does not add value to the drainage system, consequently increasing the cost, materials, and complexity of the installation. The impact of extending the maximum bathtub/shower trap arm length is substantial for multi-family applications utilizing wet vent configurations, allowing bathrooms to more easily be served by one sanitary stack, particularly in wood-frame construction where horizontal runs are more challenging. An example schematic and installation photo is provided in the attached document as well as supporting data from BMS 119. We recommend including the revised values as a footnote under Table 1002.2.
EXAMPLE OF CURRENT INSTALLATION

BATHTUB FIXTURE DRAIN INCREASED FROM 1-1/2 INCH TO 2 INCH TO COMPLY WITH CURRENT REQUIREMENTS

WET VENT FROM LAVATORY RUNS TOWARD THE BATHTUB FIXTURE DRAIN TO COMPLY WITH CURRENT REQUIREMENTS

6-story mixed-use building in Portland, OR
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
There is a concern that the vent opening will be below the trap weir.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 20  NEGATIVE: 5  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: This was a good change that appeared to be misunderstood. The proponent was attempting to identify the lengths that are appropriate.

KREITENBERG: Agree with Julius Ballanco.

MATA: A drain sloped at ¼-inch per foot will have a change in elevation by 1.5-inches over a run of 6.0 feet and 2.0-inches over a run of 8 feet. Therefore, the trap-to-vent distances proposed will not be located below the trap weir.

NIELSEN: I think it is a good proposed change and substantiation.

WHITE: I agree with the proponent's substantiation and the NBS research.
Proposals

Item #: 229
UPC 2024  Section: 1003.1

SUBMITTER: Pennie Feehan
Pennie L Feehan Consulting
Rep. Copper Development Association

RECOMMENDATION:
Revise text

1003.0 Traps – Described.
1003.1 General Requirements. Each trap, except for traps within an interceptor or similar device shall be self-cleaning. Traps for bathtubs, showers, lavatories, sinks, laundry tubs, floor drains, urinals, drinking fountains, dental units, and similar fixtures shall be of standard design, weight and shall be of ABS, cast-brass copper alloy, cast-iron, lead, PP, PVC, or other approved material. An exposed and readily accessible drawn-copper alloy tubing trap, not less than 17 B & S Gauge (0.045 inch) (1.143 mm), shall be permitted to be used on fixtures discharging domestic sewage. Exception: Drawn-copper alloy tubing traps shall not be used for urinals. Each trap shall have the manufacturer's name stamped legibly in the metal of the trap, and each tubing trap shall have the gauge of the tubing in addition to the manufacturer's name. A trap shall have a smooth and uniform interior waterway. Exception: Drawn-copper alloy tubing traps shall not be used for urinals.

SUBSTANTIATION:
This proposal removes the word brass and replaces with the correct terminology. The exception is lost in the middle of the paragraph and is for urinals only. The manufacturer's name stamped and smooth and uniform interior appears to be part of the exception.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Clarity is needed as to what the intent of the change is. Also, it is not clear and when the stamping requirements apply. The Technical Committee asks that the change be resubmitted as a public comment with the requested clarifications.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1  Daniels
Proposals

Item #: 230
UPC 2024  Section: 1003.1

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

1003.0 Traps – Described.
1003.1 General Requirements. Each trap, except for traps within an interceptor or similar device, shall be self-cleaning.
Traps shall have a smooth and uniform interior waterway. Traps for bathtubs, showers, lavatories, sinks, laundry tubs, floor drains, urinals, drinking fountains, dental units, and similar fixtures shall be of standard design, weight and shall be of ABS, cast-brass, cast-iron, lead, PP, PVC, or other approved material.

An exposed and readily accessible drawn-copper alloy tubing trap, not less than 17 B & S Gauge (0.045 inch) (1.143 mm), shall be permitted to be used on fixtures discharging domestic sewage.

Each trap shall have the manufacturer’s name and gauge or schedule legibly stamped on the trap.

Exception: Drawn-copper alloy tubing traps shall not be used for urinals. Each trap shall have the manufacturer’s name stamped legibly in the metal of the trap, and each tubing trap shall have the gauge of the tubing in addition to the manufacturer’s name. A trap shall have a smooth and uniform interior waterway.

SUBSTANTIATION:
Only the first sentence in the “exception” is a true exception. The relocated language are current provisions that are requirements and should not be exempt. The change moves the exception provisions to the body of the section.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Clarity is needed as to what the intent of the change is. Also, it is not clear and when the stamping requirements apply. The Technical Committee asks that the change be resubmitted as a public comment with the requested clarifications.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
Proposals

Item #: 231
UPC 2024 Section: 221.0, 1004.2, Table 1701.1

SUBMITTER: Gary S. Duren
Self

RECOMMENDATION:
Revise text

1004.0 Traps.

1004.2 Movable Parts. Bladders, check valves or another type of devices with movable parts shall be prohibited to serve as a trap.
Exception: Sanitary waste valves conforming to ANSI/ASME A112.18.8.

221.0 - S - Sanitary Waste Valve. A device listed and labeled to ASME A112.18.8 used as an alternate to a water-filled tubular waste trap that provides protections of the property from foul air in the sewer.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>ANSI/ASME A112.18.8-2020</td>
<td>Sanitary Waste Valves for Plumbing Drainage Systems</td>
<td>Valves</td>
<td>1004.2</td>
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</tbody>
</table>

(portions of table not shown remain unchanged)

Note: ANSI/ASME A112.18.8 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
This change is necessary to prevent any conflict within the plumbing code with respect to the installation of sanitary waste valve companion code change proposals. Additionally, a definition for "Sanitary Wast Valve" is being added for clarity.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The code requires traps to contain a liquid seal and these devices do not provide equivalent protection. These devices contain mechanical/movable parts which may conflict with Section 1004.1 and Section 1004.2.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 232
UPC 2024  Section: 221.0, 1006.0 – 1006.4, Table 1701.1

SUBMITTER: Gary S. Duren
Self

RECOMMENDATION:
Add new text

1006.0 Sanitary Waste Valves.
1006.1 General. Sanitary waste valve shall be permitted to be installed as an alternate to the liquid seal tubular traps required in Section 1001.2. Sanitary waste valves shall comply with ANSI/ASME A112.18.8.
1006.2 Installation. Sanitary waste valves shall be installed in accordance with the requirements of Section 1006.0 and the manufacturer’s installation instructions.
1006.3 Where Permitted. Sanitary waste valves shall be permitted to be installed as an alternate to 1 ¼ inch (32 mm) and/or 1 ½ inch (40 mm) tubular traps. When a sanitary waste valve is installed on the outlet of a food waste grinder the device shall be installed in the vertical orientation.
1006.4 Location. Sanitary waste valves shall be permitted to be installed as an alternate to where tubular traps are required for sinks, lavatories, laundry trays, tubs and/or showers and similar fixtures. Sanitary waste valves shall not be used on urinals. Sanitary waste valves shall be accessible.

(renumber remaining sections)

221.0 - S -
Sanitary Waste Valve. A device listed and labeled to ANSI/ASME A112.18.8 used as an alternate to a water-filled tubular waste trap that provides protections of the property from foul air in the sewer.

(below shown for reference only)

1001.2 Where Required. Each plumbing fixture shall be separately trapped by an approved type of liquid seal trap. This section shall not apply to fixtures with integral traps. Not more than one trap shall be permitted on a trap arm. Food waste disposers installed with a set of restaurant, commercial, or industrial sinks shall be connected to a separate trap. Each domestic clothes washer and each laundry tub shall be connected to a separate and independent trap, except that a trap serving a laundry tub shall also be permitted to receive the waste from a clothes washer set adjacent to it. The vertical distance between a fixture outlet and the trap weir shall be as short as practicable, but in no case shall the tailpiece exceed 24 inches (610 mm) in length. One trap shall be permitted to serve a set of not more than three single compartment sinks or laundry tubs of the same depth or three lavatories immediately adjacent to each other and in the same room where the waste outlets are not more than 30 inches (762 mm) apart, and the trap is centrally located where three compartments are installed.

TABLE 1701.1
REFERENCED STANDARDS

<table>
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<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>ANSI/ASME A112.18-2020</td>
<td>Sanitary Waste Valves for Plumbing Drainage Systems</td>
<td>Valves</td>
<td>1006.1</td>
</tr>
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</table>

(portions of table not shown remain unchanged)
Note: ANSI/ASME A112.18.8 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
REASON/PURPOSE

This group of code changes is being introduced to improve the efficacy of the drain waste and vent system by providing a more sanitary option to the ancient practice of requiring water reservoir p-traps as the exclusive method of preventing sewer gas from entering occupied spaces. Public health and safety is thereby improved by allowing an alternate solution which reduces the risk of foul odor and disease spreading via the DWV system. The cost of construction is not negatively impacted. A definition is being added to clarify what a "Sanitary Waste Valve" is.

BACKGROUND

Foul air routinely enters the occupied building space when p-traps lose their water seal. Such losses are a serious area of public health concern since in recent years important research has been published that directly links the spread of harmful pathogens via the DWV piping system. The research demonstrates that there are essentially two primary means by which harmful pathogens are spread in occupied building spaces via the conventional water-reservoir-trap-based DWV system:

1. Evaporation, lack of use or over/under-pressure conditions caused by the routine discharge of a water closet depletes the water level within the trap to a point where waste water is aerosolized and released into the air currents present in buildings.[Gormley et al]
2. Water reservoirs within traps have been shown to spread pathogens via “biological slime” creeping up the drainage pipes into the adjacent sinks.[Mathers, et al]

The age old mantra of the Plumbing Industry is: “Plumbers Protect the Health of the Nation”. If this is true, now it is time to introduce an alternative to the ancient water reservoir traps into the code. ANSI/ASME A112.18.8-2020 compliant Sanitary Waste Valves (SWV) provide an effective alternate to 1-1/4” and 1-1/2” tubular water reservoir p-traps.

Since SWV’s do not retain water or other waste they are inherently more sanitary than water filled p-traps. The ASME A112.18.8-2020 Standard has been strengthened following comments at previous code cycles and now provides a 100% higher level of protection against sewer gas intrusion than is provided by water filled tubular traps currently required.

Complete copies of the latest research referenced above and additional educational materials are available at PlumbingResearchGroup.org

Proponent respectfully requests that the Committee improve the efficacy of the UPC by permitting the use of ANSI/ASME A112.18.8-2020 compliant sanitary waste valves as an alternate to accessible tubular traps and improve the plumbing code. In support of this request, please consider the following statements:

SUPPORTING STATEMENT

Sanitary Waste Valves Intended for Use as an Alternate to 1-1/4 and 1-1/2 Tubular P-traps.

It is clearly the intent of the plumbing code that there is a water seal at every plumbing fixture outlet. The exclusive water reservoir sealing that the code currently requires has inherent physical limitations against pressure fluctuations within the DWV system. The most significant pressure fluctuations occur within the waste system upon the discharge of one or more water closets. It is well known and documented that water traps are subject to failure (full or partial loss of the two inch water seal) due to excessive positive or negative pressure excursions and also loss of the water seal can and routinely does occur due to evaporation especially in conditions of low use or high ambient temperature.

When considering acceptance of an alternate a code official must determine that the alternate meets the intent of the current code, by demonstrating equivalency in terms of strength, effectiveness, safety, and performance: Sanitary Waste Valves comply with the code in the following ways

1. A Sanitary Waste Valve conforming to ANSI/ASME A112.18.8 is equal in strength to conventional tubular water traps since the material requirements of ASTM F409 are part of the standard.
The strength of a trap is determined by the materials used in construction and by its resistance to pressure fluctuations in the sanitary drainage system produced by flowing water.

2. A Sanitary Waste Valve conforming to ANSI/ASME A112.18.8 is more effective than a conventional tubular trap in terms of sanitation and over/under-pressure resistance.

Water traps not only retain water, they retain waste solids and other potentially dangerous bacteriological, fungal and viral pathogens. They are in effect miniature septic systems. Depending on the frequency of use and the location of the trap these solids may decay or harmful pathogens can breed, multiply and spread to surrounding areas. In food prep sinks this may cause food contamination and/or food-borne illness to occur.

A Sanitary Waste Valve is not a trap since by definition it does not significantly retain liquid (water) or foreign particles so there is not the same scope to provide a breeding ground for potentially dangerous bacteriological and harmful viral pathogens. Since a Sanitary Waste Valve has a greater resistance against pressures excursions the effectiveness of its sealing ability is greater and thereby safer over a conventional water reservoir trap, even in the fixture it serves is infrequently or never used.

3. A Sanitary Waste Valve conforming to ANSI/ASME A112.18.8 is actually safer than a conventional tubular trap in that conventional traps are subject to loss of water seal by evaporation or siphonage and the SWV is not.

Studies by Professor JA Swaffield et al of Heriot-Watt University, Edinburgh, Scotland have shown how the SARS virus was spread in 2003 throughout Amoy Gardens, a high-rise residential structure located in Hong Kong. Part of the causal effect was the failure of water traps due to evaporation, and/or losses from pressure excursions. A Sanitary Waste Valve is not subject to evaporation. A Sanitary Waste Valve is much more effective than a water trap in resisting positive and negative pressure fluctuations.

4. A Sanitary Waste Valve that conforms to ANSI/ASME A112.18.8 performance is at a minimum equal to a tubular trap in regard to reliability, connectivity, material durability and flow capacity.

The referenced Standard contains prescriptive requirements to insure that a compliant/listed Sanitary Waste Valve meets the flow capacity and material requirements of conventional code-required 1-1/4 and 1-1/2 tubular traps. Specifically the Standard requires that the Sanitary Waste Valve must reliably and repeatedly withstand a 4” water gage back-pressure test, which is significantly beyond the capability of a fully replenished p-trap

[Supporting document(s) has been provided to the Technical Committee for review.]

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
The code requires traps to contain a liquid seal and the proposed devices do not provide equivalent protection. These devices contain mechanical/movable parts which may conflict with Section 1004.1 and Section 1004.2.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 233

UPC 2024  Section: 1007.2, Table 1701.1, Table 1701.2, L 412.1

SUBMITTER: Mike Durfee

RECOMMENDATION:
Revise text

1007.0 Trap Seal Protection.

1007.2 Trap Seal Primers. Potable water supply trap seal primer valves shall comply with ASSE 1018. Drainage and or electronic design type trap seal primer devices shall comply with ASSE 1044 or IAPMO PS 76.

L 412.0 Trap Seal Protection.
L 412.1 Water Supplied Trap Primers. Water supplied trap primers shall be electronic or pressure activated and shall use not more than 30 gallons (114 L) per year per drain. Where an alternate water source, as defined by this code, is used for fixture flushing or other uses in the same room, the alternate water source shall be used for the trap primer water supply.

Exception: Flushometer tailpiece trap primers in accordance with ASSE 1044 or IAPMO PS 76.

Note: IAPMO PS 76 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
ASSE 1044 and IAPMO PS 76 both cover trap primers for fill valves and flushometer valves. ASSE 1044 also covers electronic design type trap seal primer. Additionally, IAPMO PS 76 covers trap seal primer adapters. IAPMO PS 76 is currently referenced as an appropriate standard in Appendix L for flushometer type trap seal primers. ASSE 1044 is also an appropriate standard for flushometer tailpiece trap seal primers. Therefore, both standards should be referenced on both areas.

COMMITTEE ACTION: ACCEPT AS SUBMITTED
TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 234
UPC 2024  Section: 1007.3

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Add new text

1007.0 Trap Seal Protection.

1007.3 Piping Material. Piping material installed from the outlet of a potable water supplied or drainage supplied
trap primer to the tailpiece of a floor drain or floor sink shall be PVC, CPVC, PE, PP, copper or other rigid materials
approved by the Authority Having Jurisdiction. A minimum horizontal grade of $\frac{1}{4}$ of an inch per foot (20.8 mm/m)
shall be maintained to the fixture connection.

SUBSTANTIATION:
The Uniform Plumbing Code does not currently address the types of piping materials permitted downstream of a
trap primer to the connecting floor drain or floor sink. This is causing interpretation issues between installers and the
AHJ. A list of acceptable materials in the Code would clarify what piping materials are acceptable for this
application.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is overly restrictive by mandating a $\frac{1}{4}$” per foot slope to the fixture connection as other slopes are
permitted. Furthermore, there are other acceptable piping materials that are not listed in the section.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 235
UPC 2024  Section: 1007.3, Table 1701.1

SUBMITTER:  Jason M Shank
ASSE International

RECOMMENDATION:
Add new text

1007.0 Trap Seal Protection.

1007.3 Barrier-Type Trap Seal Protection Device. A barrier-type trap seal protection device shall protect the floor drain trap seal from evaporation. Barrier-type floor drain trap seal protection devices shall conform to ASSE 1072. The devices shall be installed in accordance with the manufacturer’s instructions.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
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<tr>
<td>ASSE 1072-2020</td>
<td>Barrier Type Trap Seal Protection for Floor Drains</td>
<td>Trap Seal</td>
<td>1007.3</td>
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</tbody>
</table>

Note: ASSE 1072 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
ASSE 1072 provides another method for trap seal protection as required by Section 1007.0.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
There is a concern that these devices will not prevent the trap from evaporating. The standard does not sufficiently justify the replacement of a trap seal primer with these devices.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:
BALLANCO: This standard is an appropriate standard to include in the code. The justification is not correct for rejecting this change since the products have been proven to prevent trap seal evaporation.
Proposals

Item #: 236
UPC 2024  Section: 1009.1, Table 1009.1, Table 1701.1, Table 1701.2

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

1009.0 Interceptors (Clarifiers) and Separators.
1009.1 Where Required. Interceptors (clarifiers) (including grease, oil, sand, solid interceptors, etc.) shall be required by the Authority Having Jurisdiction where they are necessary for the proper handling of liquid wastes containing grease, flammable wastes, sand, solids, acid or alkaline substances, or other ingredients harmful to the building drainage system, the public or private sewer, or to public or private sewage disposal. A list of acceptable interceptor standards is referenced in Table 1009.1.

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease, Non-petroleum Oil</td>
<td>ASME A112.14.6, PDI G-102</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>IAPMO IGC 167</td>
</tr>
<tr>
<td>Non-petroleum Oil</td>
<td>IAPMO PS 80</td>
</tr>
<tr>
<td>Petroleum Oil</td>
<td>ASTM D6104, IAPMO IGC 183, IAPMO IGC 325</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM D6104-1997(R2011)</td>
<td>Determining the Performance of Oil/Water Separators Subjected to Surface Run-Off</td>
<td>Interceptors</td>
<td>Table 1009.1</td>
</tr>
<tr>
<td>IAPMO IGC 167-2011a62(R2021)</td>
<td>Solid Waste Containment Interceptors</td>
<td>Interceptors</td>
<td>Table 1009.1</td>
</tr>
<tr>
<td>IAPMO IGC 183-2016</td>
<td>Oil/Water Separators and Coalescing Plate Separators</td>
<td>Interceptors</td>
<td>Table 1009.1</td>
</tr>
<tr>
<td>IAPMO IGC 325-2016</td>
<td>Oil/Water Separators Performance</td>
<td>Interceptors</td>
<td>Table 1009.1</td>
</tr>
<tr>
<td>IAPMO PS 80-2019</td>
<td>Clarifiers</td>
<td>Interceptors</td>
<td>Table 1009.1</td>
</tr>
</tbody>
</table>
(portions of table not shown remains unchanged)


Note: PDI-G 101 and PDI-G 102 do not meet the requirements for consensus referenced standards in accordance with Section 3-3.7.1.2 of IAPMO’s Regulations Governing Committee Projects.

<table>
<thead>
<tr>
<th>TABLE 1701.2</th>
<th>STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCUMENT NUMBER</td>
<td>DOCUMENT TITLE</td>
</tr>
<tr>
<td>IAPMO IGC 183-2016</td>
<td>Oil/Water Separators and Coalescing Plate Separators</td>
</tr>
<tr>
<td>IAPMO PS 80-2008</td>
<td>Clarifiers</td>
</tr>
</tbody>
</table>

(Substantiation: There are no guidance to acceptable standards for different type of interceptors in the UPC. This is a list of approved interceptor standards categorized by application. There are many types of interceptors and this list will help the end user select the appropriate type for the specific use.

Committee Action: Accept as amended by the TC

Amend proposal as follows:

**1009.0 Interceptors (Clarifiers) and Separators.**

**1009.1 Where Required.** Interceptors (clarifiers) (including grease, oil, sand, solid interceptors, etc.) shall be required by the Authority Having Jurisdiction where they are necessary for the proper handling of liquid wastes containing grease, flammable wastes, sand, solids, acid or alkaline substances, or other ingredients harmful to the building drainage system, the public or private sewer, or to public or private sewage disposal. A list of acceptable interceptor standards is referenced in Table 1009.1.

**TABLE 1009.1**

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease, Non-petroleum Oil</td>
<td>ASME A112.14.6, PDI G-102</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>IAPMO IGC 167</td>
</tr>
<tr>
<td>Non-petroleum Oil</td>
<td>ASME A112.14.6, IAPMO PS 80, PDI G-102</td>
</tr>
<tr>
<td>Petroleum Oil</td>
<td>ASTM D6104, IAPMO IGC 183, IAPMO IGC 325</td>
</tr>
</tbody>
</table>

**TABLE 1701.1**

<table>
<thead>
<tr>
<th>REFERENCED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
</tr>
<tr>
<td>ASTM D6104-1997(R2011)</td>
</tr>
<tr>
<td>IAPMO IGC 167-2011a(R2021)</td>
</tr>
<tr>
<td>IAPMO IGC 183-</td>
</tr>
<tr>
<td>2016 and Coalescing Plate Separators</td>
</tr>
<tr>
<td>--------------------------------------</td>
</tr>
<tr>
<td>IAPMO PS 80-2019</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

**COMMITTEE STATEMENT:**
The modification removes the duplicate interceptor category row and relocates the standards to the separate interceptor categories that are addressed by each of the standards.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  **AFFIRMATIVE:** 25  **NOT RETURNED:** 1  **Daniels**
Proposals

Item #: 237

UPC 2024  Section: 1014.1

SUBMITTER: Amie Rodio
Self

RECOMMENDATION:
Revise text

1014.0 Grease Interceptors.

1014.1 General. Where it is determined by the Authority Having Jurisdiction that waste pretreatment is required, an approved type of grease interceptor(s) shall comply with ASME A112.14.3, ASME A112.14.4, CSA B481, IAPMO Z1001, PDI G-101, or PDI G-102, and sized in accordance with Section 1014.2.1 or Section 1014.3.6, shall be installed in accordance with the manufacturer’s installation instructions to receive the drainage from fixtures or equipment that produce grease-laden waste. Grease-laden waste fixtures shall include, but not be limited to, sinks and drains, such as floor drains, floor sinks, and other fixtures or equipment in serving establishments, such as restaurants, cafes, lunch counters, cafeterias, bars and clubs, hotels, hospitals, sanitariums, factory or school kitchens, or other establishments where grease is introduced into the drainage or sewage system in quantities that can effect line stoppage or hinder sewage treatment or private sewage disposal systems. A combination of hydromechanical, gravity grease interceptors and engineered systems shall be allowed to meet this code and other applicable requirements of the Authority Having Jurisdiction where space or existing physical constraints of existing buildings necessitate such installations. A grease interceptor shall not be required for individual dwelling units or private living quarters. Water closets, urinals, and other plumbing fixtures conveying human waste shall not drain into or through the grease interceptor.

SUBSTANTIATION:
This standard belongs in the general provisions as an acceptable grease interceptor standard along with the other grease interceptor standards located in Section 1014.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 238
UPC 2024 Section: 1014.2

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

1014.0 Grease Interceptors.

1014.2 Hydromechanical Grease Interceptors. Plumbing fixtures or equipment connected to a Type A-1 and B-2 hydromechanical grease interceptor shall discharge through an approved type of vented flow control installed in a readily accessible and visible location. Flow control devices shall be designed and installed so that the total flow through such device or devices shall at no time be greater than the rated flow of the connected grease interceptor. No flow control device having adjustable or removable parts shall be approved. The vented flow control device shall be located such that no system vent shall be between the flow control and the grease interceptor inlet. The vent or air inlet of the flow control device shall connect with the sanitary drainage vent system, as elsewhere required by this code, or shall terminate through the roof of the building, and shall not terminate to the free atmosphere inside the building.

Exception: Listed grease interceptors with integral flow controls or restricting devices shall be installed in an accessible location in accordance with the manufacturer’s installation instructions.

SUBSTANTIATION:
The designations for Type A,B,C & D hydromechanical grease interceptors changed to Type 1, 2, 3 & 4 in Chapter 2 - Definitions, Section 210.0 the 2015 UPC. References to the types of hydromechanical grease interceptor in the body of the Code should use the same designations as though found in the definition.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The 2015 UPC definitions do not indicate the changes mentioned in the substantiation. The proper designations “1” and “2.”

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 239
UPC 2024  Section: 1014.3.5

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

1014.0 Grease Interceptors.

1014.3 Gravity Grease Interceptors. (portions of text not shown remain unchanged)

1014.3.5 Construction Requirements. Gravity grease interceptors shall be designed to remove grease from effluent and shall be sized in accordance with this section. Gravity grease interceptors shall also be designed to retain grease until accumulations can be removed by pumping the interceptor. It is recommended that Where required, a sample box is shall be located at the outlet end of gravity grease interceptors so that the Authority Having Jurisdiction can periodically sample effluent quality.

SUBSTANTIATION:
The term "recommended" is not enforceable. The language is being updated to make the provisions for sample box a requirement when required by the Authority Having Jurisdiction.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is overly restrictive as a sample box is not necessary for taking samples. The change may be misinterpreted to mean that such sample boxes are required.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1   Daniels
1017.0 Oil and Flammable Liquid Interceptors. 

1017.1 Interceptors Required. Repair garages and gasoline stations with grease racks or grease pits, and factories that have oily, flammable, or both types of wastes as a result of manufacturing, storage, maintenance, repair, or testing processes, shall be provided with an oil or flammable liquid interceptor. Interceptors shall be connected to necessary floor drains. Floor drains in such locations shall be connected directly to oil and flammable liquid interceptors. 

1017.2 Interceptor Design Alternatives. Oil interceptors shall comply with IAPMO IGC 183 or be in accordance with Section 1017.3 through Section 1017.4. 

1017.3 Interceptor Details. Oil and flammable liquid interceptors shall be in accordance with the following:

(1) The separation or vapor compartment shall be independently vented to the outer air. Where two or more separation or vapor compartments are used, each shall be vented to the outer air or shall be permitted to connect to a header that is installed at a minimum of 6 inches (152 mm) above the spill line of the lowest floor drain and vented independently to the outer air. 

(2) The minimum size of a flammable vapor vent shall be not less than 2 inches (50 mm), and, where vented through a sidewall, the vent shall be not less than 10 feet (3048 mm) above the adjacent level at an approved location.

(3) The interceptor shall be vented on the sewer side and shall not connect to a flammable vapor vent. Oil and flammable interceptors shall be provided with gastight cleanout covers that shall be readily accessible. 

(4) The waste line shall be not less than 3 inches (80 mm) in diameter with a full-size cleanout to grade. 

(5) Where an interceptor is provided with an overflow, it shall be provided with an overflow line [not less than 2 inches (50 mm) in diameter] to an approved waste oil tank having a minimum capacity of 550 gallons (2082 L) and meeting the requirements of the Authority Having Jurisdiction.

(a) The waste oil from the separator shall flow by gravity or shall be pumped to a higher elevation by an automatic pump. 

(b) Pumps shall be adequately sized and accessible. 

(c) Waste oil tanks shall have a 2 inch (50 mm) minimum pump-out connection at grade and an 11/2 inch (40 mm) minimum vent to atmosphere at an approved location not less than 10 feet (3048 mm) above grade. 

1017.4 Design of Interceptors. Each manufactured interceptor that is rated shall be stamped or labeled by the manufacturer with an indication of its full discharge rate in gpm (L/s). The following shall apply:

(1) The full discharge rate to such an interceptor shall be determined at full flow. Each interceptor shall be rated equal to or greater than the incoming flow and shall be provided with an overflow line to an underground tank. 

(2) Interceptors not rated by the manufacturer shall have a depth of not less than 2 feet (610 mm) below the invert of the discharge drain. The outlet opening shall have not less than an 18 inch (457 mm) water seal and shall have a minimum capacity as follows:

(a) Where not more than three motor vehicles are serviced, stored, or both, interceptors shall have a minimum capacity of 6 cubic feet (0.2 m³), and 1 cubic foot (0.03 m³) of capacity shall be added for each vehicle up to 10 vehicles. 

(b) Above 10 vehicles, the Authority Having Jurisdiction shall determine the size of the interceptor required. 

(c) Where vehicles are serviced and not stored, interceptor capacity shall be based on a net capacity of 1
cubic foot (0.03 m$^3$) for each 100 square feet (9.29 m$^2$) of the surface to be drained into the interceptor, with a minimum of 6 cubic feet (0.2 m$^3$).

**TABLE 1701.1**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 183-2016</td>
<td>Oil/Water Separators and Coalescing Plate Separators</td>
<td>Interceptor</td>
<td>1017.2</td>
</tr>
</tbody>
</table>

Note: IAPMO IGC 183 meets the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

**TABLE 1701.2**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 183-2016</td>
<td>Oil/Water Separators and Coalescing Plate Separators</td>
<td>DWV Components</td>
</tr>
</tbody>
</table>

SUBSTANTIATION:
The proposed standard is not intended to replace the current provisions for Oil Separators. It gives the end user an option for this type of interceptor. This standard covers oil/water separators and coalescing plate separators designed to remove petroleum based oils from storm or process water and specifies requirements for materials, physical characteristics, performance testing, and markings. Oil/Water separators covered by this standard shall be designed to separate oils and solids having different specific gravities than water. The separators shall retain the oil until accumulations can be removed.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 241
UPC 2024  Section: 1102.2

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

1102.0 Roof Drains.

1102.2 Dome Strainers Required. Primary and secondary roof drains shall have domed strainers.

SUBSTANTIATION:
The question is often asked whether the secondary drain requires a strainer. The addition of the language will clarify the intent of the strainer requirement for both primary and secondary drains.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Not all secondary roof drains require a strainer. No technical justification was provided to warrant such change.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 242

UPC 2024  Section: 1102.4, Table 1701.1

SUBMITTER: Julius Ballanco, P.E.
   JB Engineering and Code Consulting, P.C.

RECOMMENDATION:
Add new text

1102.0 Roof Drains.

1102.4 Roof Drain Flow Rate. The flow rate through an atmospheric roof drain shall be determined by testing to ASPE/IAPMO Z1034 or ASME A112.6.4. The flow rate through a siphonic roof drain shall be determined by testing to ASME A112.6.9.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
<th>REFERENCED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
<td>STANDARD TITLE</td>
</tr>
<tr>
<td>ASPE/IAPMO Z1034-2015(R2020)</td>
<td>Test Method For Evaluating Roof Drain Performance</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: ASME A112.6.4, ASME A112.6.9, and ASPE/IAPMO Z1034 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
This proposed change will require roof drains to be tested for flow rate in accordance with one of three standards. The first standard, ASPE/IAPMO Z1034, is the most commonly used test method for determining flow rate through a roof drain. ASME A112.6.4 flow rate test method is in draft form at the time this code change is submitted. If the updated standard is not complete, the reference to ASME A112.6.4 should be deleted. ASME A112.6.9 includes a test method for siphonic roof drains.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The flow rates for siphonic roof drains should be part of an engineered design. Additionally, ASME A112.6.4 does not contain flow rate requirements.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 ABSTAIN: 1 NOT RETURNED: 1 Daniels

EXPLANATION OF ABSTAIN:
BALLANCO: As the proponent of this code change, I am abstaining to avoid any perceived conflict of interest.
Proposals

Item #: 243
UPC 2024  Section: 1103.4

SUBMITTER: Nguyen Thong Nhat
PTA Asia Consultant Co.,Ltd

RECOMMENDATION:
Revise text

1103.0 Size of Leaders, Conductors, and Storm Drains.

1103.4 Side Walls Draining onto a Roof. Where vertical walls project above a roof to permit storm water to drain into the roof area below, the adjacent roof area shall be permitted to be computed from Table 1103.1 as follows:
(1) – (7) (text not shown remains unchanged)
(8) In calculation of the effective catchment area, the height of a single wall should be taken up to a maximum exposed height of 32.8 feet (10 m).

SUBSTANTIATION:
Actually, when calculating the storm water of eaves in the first floor of high-rise building, the flow rate which drain to these eaves are unrealistically large due to the height of adjacent walls, a limitation of these walls will remove the amount of rain water which was flashed out of the walls during falling procedure.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The justification provided was not sufficient to warrant such change. Additionally, the proposal contains unenforceable language.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 244

UPC 2024  Section: 1106.4, C 701.0 - C 701.6

SUBMITTER:  Julius Ballanco, P.E.
  JB Engineering and Code Consulting, P.C.
  Rep. Self

RECOMMENDATION:
Add new text

1106.0 Engineered Storm Drainage System.

1106.4 Alternative Engineered Roof Drainage Design. Alternative engineered roof drainage systems shall be designed in accordance with Section C 701.1.

APPENDIX C
ALTERNATE PLUMBING SYSTEMS

C 701.0 Alternative Engineered Roof Drainage Design.
C 701.1 General. The roof drainage system shall be sized as a system in accordance with Section C 701.2 or Section C 701.3. The piping sizing shall be designed to accommodate the rainfall rates specified in Table D 101.1.
C 701.2 Roof Drainage Table Method. The rainwater drainage flow rate from the roof surface shall be determined based on the rainfall rate of a 60 minute storm with a 100 year return period and the area of the roof being drained in accordance with Table C 701.2.
C 701.2.2 Secondary Roof Drainage. The opening for the secondary roof drainage shall be not less than 2 inches (51 mm) and not more than 4 inches (102 mm) above the bottom opening of the primary roof drain. The secondary roof drainage system shall comply with Section 1101.12.2.
C 701.3 Engineered Roof Drain Flow Rate. The flow rate used for sizing the roof drainage piping shall be based on the maximum anticipated ponding at the roof drain based on a rainfall rate of a 60 minute storm with a 100 year return period and a 5 minute storm with a 10 year return period. The roof drain shall be sized for the anticipated flow rate. The roof drainage piping shall be sized in accordance with Section C 701.4 through Section C 701.6 for the anticipated flow rate.
C 701.3.1 Secondary Roof Drain. The discharge through the secondary roof drain shall not be considered where establishing the maximum height of ponding at the primary roof drain. The opening for the secondary roof drainage shall be not less than 2 inches (51 mm) above the bottom opening of the primary roof drain. The secondary roof drainage system shall comply with Section 1101.12.2.
### TABLE C 701.2
#### ROOF DRAINAGE FLOW RATE

<table>
<thead>
<tr>
<th>Roof Drainage Area (sq ft)</th>
<th>Drainage Flow Rate (gpm) Based on Rainfall Rates (in/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>500</td>
<td>5</td>
</tr>
<tr>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>1500</td>
<td>16</td>
</tr>
<tr>
<td>2000</td>
<td>21</td>
</tr>
<tr>
<td>2500</td>
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<td>3000</td>
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<td>3500</td>
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<td>104</td>
</tr>
<tr>
<td>11,000</td>
<td>114</td>
</tr>
<tr>
<td>12,000</td>
<td>125</td>
</tr>
</tbody>
</table>

For SI units: 1 square foot = 0.0929 m², 1 inch per hour = 25.4 mm/h, 1 gallon per minute = 0.06 L/s

### C 701.4 Sizing Roof Drainage Piping
Vertical and horizontal roof drainage piping shall be sized to receive the discharge from the roof drain(s), and in accordance Table C 701.4.

### TABLE C 701.4
#### ROOF DRAINAGE PIPE SIZING

<table>
<thead>
<tr>
<th>Pipe Size (inch)</th>
<th>Maximum Permitted Flow Rate (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vertical Drain</td>
</tr>
<tr>
<td></td>
<td>1/16</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>3</td>
<td>87</td>
</tr>
<tr>
<td>4</td>
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<td>5</td>
<td>311</td>
</tr>
<tr>
<td>6</td>
<td>538</td>
</tr>
<tr>
<td>8</td>
<td>1117</td>
</tr>
<tr>
<td>10</td>
<td>2050</td>
</tr>
<tr>
<td>12</td>
<td>3272</td>
</tr>
<tr>
<td>15</td>
<td>5543</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 inch per foot = 83.3 mm/m, 1 gallon per minute = 0.06 L/s
C 701.5 Sizing Conductors and Leaders. Conductors and leaders shall be in accordance with Table C 701.5.

### TABLE C 701.5
**CONDUCTOR AND LEADER SIZING**

<table>
<thead>
<tr>
<th>Size of Conductor or Leader (inch)</th>
<th>Maximum Permitted Flow Rate (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>2 x 2</td>
<td>30</td>
</tr>
<tr>
<td>1 1/2 x 2 1/2</td>
<td>30</td>
</tr>
<tr>
<td>2 1/2</td>
<td>54</td>
</tr>
<tr>
<td>2 1/2 x 2 1/2</td>
<td>54</td>
</tr>
<tr>
<td>3</td>
<td>92</td>
</tr>
<tr>
<td>2 x 4</td>
<td>92</td>
</tr>
<tr>
<td>2 1/2 x 3</td>
<td>92</td>
</tr>
<tr>
<td>4</td>
<td>192</td>
</tr>
<tr>
<td>3 x 4 1/4</td>
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<td>8</td>
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<tr>
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<td>1208</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s

C 701.6 Sizing Gutters. Gutters shall be sized based on the flow rate from the roof surface and in accordance with Table C 701.6.

### TABLE C 701.6
**GUTTER SIZING**

<table>
<thead>
<tr>
<th>Diameter of Gutter (inches)</th>
<th>Slope (in/ft)</th>
<th>Capacity (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2 x 2 1/2</td>
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</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 inch per foot = 83.3 mm/m, 1 gallon per minute = 0.06 L/s
SUBSTANTIATION:
This sizing method is being added to the engineered sizing section in Appendix C. This sizing method is being used by the plumbing engineers since the publication of the paper by the ASPE Research Foundation.

ASPE Research Foundation and IAPMO cosponsored research on the performance of roof drains in storm drainage system. The code change is consistent with the recommendations in the ASPE RF report. The research report states the problem and the justification for this change. The research report can be downloaded at no cost at www.aspe.org.

The only difference between this change and the recommendation in the ASPE RF report is the first methodology for sizing a storm drainage system in proposed Section C 701.1. These requirements were developed by the Storm Drainage Task Group. While the Task Group did not vote to bring these forward, it was thought that in the best interest of code development, the proposed text would be included. This first method is a cook book method for designing a storm drainage system.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The new Section 1106.4 may imply that the proposed sections for Appendix C are considered mandatory. The concern is that not all jurisdictions adopt the appendices.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 ABSTAIN: 1 NOT RETURNED: 1 Daniels

EXPLANATION OF ABSTAIN:

BALLANCO: As the proponent of this code change, I am abstaining to avoid any perceived conflict of interest.
Proposals

Item #: 245
UPC 2024 Section: 1202.3

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text

1202.0 Coverage of Piping System.

1202.3 Applications. This code chapter shall not apply to the following items: (1) - (20) (remaining text unchanged) {NFPA 54:1.1.1.2}

SUBSTANTIATION:
This change will clarify the intent of this section. The direct extract is referencing the entire code, however, in the UPC, this section is referencing Chapter 12.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 246

UPC 2024  Section: Chapter 12

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 54 Extract Update

RECOMMENDATION:
Revise text

CHAPTER 12
FUEL GAS PIPING

1208.2 Provision for Location of Point of Delivery. The location of the point of delivery shall be acceptable to the serving gas supplier. [NFPA 54:5.2]

(renumber remaining sections)

1208.3 Interconnections Between Gas Piping Systems Supplying Separate Users. Where two or more meters, or two or more service regulators where meters are not provided, are located on the same premises and supply separate users, the gas piping systems shall not be interconnected on the outlet side of the meters or service regulators. [NFPA 54:5.3.4 – 5.3.5]

1208.3.1 Interconnections for Standby Fuels. Where a supplementary gas for standby use is connected downstream from a meter or a service regulator where a meter is not provided, equipment to prevent backflow shall be installed. A three-way valve installed to admit the standby supply and at the same time shut off the regular supply shall be permitted to be used for this purpose. [NFPA 54:5.3.2.1 – 5.3.2.2]

1208.4 Sizing of Gas Piping Systems. Gas piping systems shall be of such size and so installed as to provide a supply of gas sufficient to meet the maximum demand and supply gas to each appliance inlet at not less than the minimum supply pressure required by the appliance. [NFPA 54:5.4.1 – 5.4.2.1]

1208.4.1 Maximum Gas Demand. The volumetric flow rate of gas to be provided shall be the sum of the maximum input of the appliances served. The volumetric flow rate of gas to be provided shall be adjusted for altitude where the installation is above 2000 feet (610 m). [NFPA 54:5.4.2.1 – 5.4.2.2 – 5.3.2.1] Where the input rating is not indicated, the gas supplier, appliance manufacturer, or a qualified agency shall be contacted, or the rating from Table 1208.4.1 shall be used for estimating the volumetric flow rate of gas to be supplied. The total connected hourly load shall be used as the basis for piping sizing, assuming all appliances are operating at full capacity simultaneously. Exception: Sizing shall be permitted to be based upon established load diversity factors. [NFPA 54:5.4.2.3 – 5.3.2.3]

1208.4.2 Sizing Methods. Gas piping shall be sized in accordance with one of the following:
(1) Pipe sizing tables or sizing equations in this chapter.
(2) Other approved engineering methods.
(3) Sizing tables included in a listed piping system manufacturer’s installation instructions.
(3) Engineering methods. [NFPA 54:5.4.35.3.3]

1208.4.3 Allowable Pressure Drop. The design pressure loss in any piping system under maximum probable flow conditions from the point of delivery to the inlet connection of the appliance, all appliances served shall be such that the supply pressure at the each appliance inlet is greater than or equal to the minimum pressure required by the appliance. [NFPA 54:5.4.45.3.4]

1208.5 Maximum Operating Pressure in Buildings. The maximum operating pressure for any piping systems located inside buildings shall not exceed 5 psi (34 kPa) unless one or more of the following conditions are met:
(1) The piping joints are welded or brazed.
(2) The piping is joined by fittings listed to ANSI LC 4/CSA 6.32 and installed according to the manufacturer’s installation instructions.
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1208.6.6 Regulator Vent Piping. Plastic pipe and fittings used to connect regulator vents to remote vent terminations shall be PVC conforming to UL 651 (Schedule 40 and 80). PVC vent piping shall not be installed indoors. [NFPA 54: 5.6.4.2-5.5.4.2]

1208.6.7.1 Factory-Assembled Anodeless Risers. Factory-assembled anodeless risers shall be recommended by the manufacturer for the gas used and shall be leak tested by the manufacturer in accordance with written procedures. [NFPA 54: 5.6.4.3(4)-5.5.4.3(1)]

1208.6.7.2 Service Head Adapters and Field-Assembled Anodeless Risers. Service head adapters and field-assembled anodeless risers incorporating service head adapters shall be recommended by the manufacturer for the gas used and shall be design-certified to meet the requirements of Category I of ASTM D2513 and 49 CFR 192.281(e). The manufacturer shall provide the user qualified installation instructions as prescribed by 49 CFR 192.283(b). [NFPA 54: 5.6.4.3(2)-5.5.4.3(2)]

1208.6.7.3 Undiluted Liquified Petroleum Gas Piping. The use of plastic pipe, tubing, and fittings in undiluted LP-Gas piping systems shall be in accordance with NFPA 58. [NFPA 54: 5.6.4.3(3)-5.5.4.3(3)]

1208.6.8 Workmanship and Defects. Gas pipe, tubing, and fittings shall be clear and free from cutting burrs and defects in structure or threading; and shall be thoroughly brushed and chip and scale blown. Defects in pipe, tubing, and fittings shall not be repaired. Defective pipe, tubing, and fittings shall be replaced. [NFPA 54: 5.6.5.5.5]

1208.6.9 Metallic Pipe Threads. Metallic pipe and fitting threads shall be taper pipe threads and shall comply with ASME B1.20.1. [NFPA 54: 5.6.6-5.5.6.1]

1208.6.9.1 Damaged Threads. Pipe with threads that are stripped, chipped, corroded, or otherwise damaged shall not be used. Where a weld opens during the operation of cutting or threading, that portion of the pipe shall not be used. [NFPA 54: 5.6.6-5.5.6.2]

1208.6.9.2 Number of Threads. Field threading of metallic pipe shall be in accordance with Table 1208.6.9.2. [NFPA 54: 5.6.6-5.5.6.3]

1208.6.9.3 Thread Joint Compounds Sealing. Threaded joints shall be made using a thread joint sealing material. [NFPA 54: 5.5.4.2] Thread joint sealing materials shall be compatible with the pipe and fitting material on which the compounds are used. [NFPA 54: 5.5.6.2] Thread joint compounds-sealing materials shall be resistant to the action of LP-Gas or to any other chemical constituents of the gases to be conducted through the piping. [NFPA 54: 5.6.6.4 5.5.6.4.3]

1208.6.10 Metallic Piping Joints and Fittings. The type of piping joint used shall be suitable for the pressure and temperature conditions and shall be selected giving consideration to joint tightness and mechanical strength under the service conditions. The joint shall be able to sustain the maximum end force due to the internal pressure and any additional forces due to temperature expansion or contraction, vibration, fatigue, or the weight of the pipe and its contents. [NFPA 54: 5.6.7-5.5.7]

1208.6.10.1 Pipe Joints. Schedule 40 and heavier pipe joints shall be threaded, flanged, brazed, welded, or assembled with press-connect fittings listed to CSA LC 4.

(1) Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1000°F (538°C).

(2) Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54: 5.6.7-5.5.7.1]

1208.6.10.2 Copper Tubing Joints. Copper tubing joints shall be assembled with approved gas tubing fittings, shall be brazed with a material having a melting point in excess of 1000°F (538°C), or shall be assembled with press-connect fittings listed to CSA LC 4. Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54: 5.6.7-5.5.7.7]

1208.6.10.3 Stainless Steel Tubing Joints. Stainless steel joints shall be welded, assembled with approved tubing fittings, brazed with a material having a melting point in excess of 1000°F (538°C), or assembled with press-connect fittings listed to CSA LC 4. Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys and fluxes shall be recommended by the manufacturer for use on stainless steel alloys. [NFPA 54: 5.6.7-5.5.7.3]

1208.6.10.4 Flared Joints. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing where experience or tests have demonstrated that the joint is suitable for the conditions and where provisions are made in the design to prevent separation of the joints. [NFPA 54: 5.6.7-5.5.7.3]

1208.6.10.5 Metallic Pipe Fittings. Metallic fittings shall comply with the following:

(1) Threaded fittings in sizes larger than 4 inches (100 mm) shall not be used.

(2) Fittings used with steel, stainless steel, or wrought-iron pipe shall be steel, stainless steel, copper alloy, malleable iron, or cast iron.

(3) Fittings used with copper or copper alloy pipe shall be copper or copper alloy.

(4) Fittings used with aluminum alloy pipe shall be aluminum alloy.

(5) Cast-iron fittings shall comply with the following:

(a) Flanges shall be permitted.

(b) Bushings shall not be used.

(c) Fittings shall not be used in systems containing flammable gas-air mixtures.

(d) Fittings in sizes 4 inches (100 mm) and larger shall not be used indoors unless approved by the Authority Having Jurisdiction.

(e) Fittings in sizes 6 inches (150 mm) and larger shall not be used unless approved by the Authority Having Jurisdiction.
Aluminum alloy fitting threads shall not form the joint seal.
Zinc-aluminum alloy fittings shall not be used in systems containing flammable gas-air mixtures.
Special fittings such as couplings, proprietary-type joints, saddle tees, gland-type compression fittings, and flared, flareless, or compression-type tubing fittings shall be as follows:
(a) Used within the fitting manufacturer's pressure-temperature recommendations.
(b) Used within the service conditions anticipated with respect to vibration, fatigue, thermal expansion, or contraction.
(c) Acceptable to the Authority Having Jurisdiction.

When pipe fittings are drilled and tapped in the field, the operation shall be in accordance with the following:
(a) The operation shall be performed on systems having operating pressures of 5 psi (34 kPa) or less.
(b) The operation shall be performed by the gas supplier or their designated representative.
(c) The drilling and tapping operation shall be performed in accordance with written procedures prepared by the gas supplier.
(d) The fittings shall be located outdoors.
(e) The tapped fitting assembly shall be inspected and proven to be free of leaks. [NFPA 54:5.6.7.5.5.7.5]  

1208.6.11 Plastic Piping, Joints, and Fittings. Plastic pipe, tubing, and fittings shall be joined in accordance with the manufacturer's instructions. Section 1208.6.11.1 through Section 1208.6.11.4 shall be observed when making such joints. [NFPA 54:5.6.8.5.5.8]

1208.6.11.1 Joint Design. The joint shall be designed and installed so that the longitudinal pullout resistance of the joint will be at least equal to the tensile strength of the plastic piping material. [NFPA 54:5.6.8.1-5.5.8(1)]

1208.6.11.2 Heat Fusion Joint. Heat fusion joints shall be made in accordance with qualified procedures that have been established and proven by test to produce gastight joints at least as strong as the pipe or tubing being joined. Joints shall be made with the joining method recommended by the pipe manufacturer. Polyethylene heat fusion fittings shall be marked “ASTM D2513.” Polyamide heat fusion fittings shall be marked “ASTM F2945.” [NFPA 54:5.6.8.2-5.5.8(2)]

1208.6.11.3 Compression-Type Mechanical Joints. Where compression-type mechanical joints are used, the gasket material in the fitting shall be compatible with the plastic piping and with the gas distributed by the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting. The stiffener shall be flush with the end of the pipe or tubing and shall extend at least to the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force fit in the plastic. Split tubular stiffeners shall not be used. [NFPA 54:5.6.8.3-5.5.8(3)]

1208.6.11.4 Liquefied Petroleum Gas Piping Systems. Plastic piping joints and fittings for use in LP-Gas piping systems shall be in accordance with NFPA 58. [NFPA 54:5.6.8.4-5.5.8(4)]

1208.6.12.1 Cast Iron Flanges. Cast iron flanges shall be in accordance with ASME B16.1. [NFPA 54:5.6.9.1.1]

1208.6.12.2 Steel Flanges. Steel flanges shall be in accordance with the following:
(1) ASME B16.5
(2) ASME B16.47. [NFPA 54:5.6.9.1.2]

1208.6.12.3 Non-Ferrous Flanges. Non-ferrous flanges shall be in accordance with ASME B16.24. [NFPA 54:5.6.9.1.3]

1208.6.12.4 Ductile Iron Flanges. Ductile iron flanges shall be in accordance with ASME B16.42. [NFPA 54:5.6.9.1.4]

1208.6.12.5 Dissimilar Flange Connections. Raised-face flanges shall not be joined to flat-faced cast iron, ductile iron or nonferrous material flanges. [NFPA 54:5.6.9.2-5.5.9.2]

1208.6.12.6 Flange Facings. Standard facings shall be permitted for use under this code. Where 150 psi (1034 kPa) steel flanges are bolted to Class 125 cast-iron flanges, the raised face on the steel flange shall be removed. [NFPA 54:5.6.9.3-5.5.9.3]

1208.6.12.7 Lapped Flanges. Lapped flanges shall be used only aboveground or in exposed locations accessible for inspection. [NFPA 54:5.6.9.4-5.5.9.4]

1208.6.13 Flange Gaskets. The material for gaskets shall be capable of withstanding the design temperature and pressure of the piping system and the chemical constituents of the gas being conducted without change to its chemical and physical properties. The effects of fire exposure to the joint shall be considered in choosing the material. [NFPA 54:5.6.10-5.6.13]

1208.6.13.1 Flange Gasket Materials. Acceptable materials shall include the following:
(1) Metal (plain or corrugated)
(2) Composition
(3) Aluminum "O" rings
(4) Spiral-wound metal gaskets
(5) Rubber-faced phenolic
(6) Elastomeric [NFPA 54:5.6.10-1.5.5.10.1]

1208.6.13.2 Metallic Flange Gaskets. Metallic flange gaskets shall be in accordance with ASME B16.20. [NFPA 54:5.6.10.2-1.5.5.10.2.1]
1208.6.13.3 Non-Metallic Flange Gaskets. Non-metallic flange gaskets shall be in accordance with ASME B16.21. [NFPA 54:5.6.10.2.2-5.5.10.2.2]

1208.6.13.4 Full-Face Flange Gasket. Full-face flange gaskets shall be used with all non-steel flanges. [NFPA 54:5.6.10.3-5.5.10.3]

1208.6.13.5 Separated Flanges. When a flanged joint is separated, the gasket shall be replaced. [NFPA 54:5.6.10.4-5.5.10.4]

1208.7 Gas Meters. Gas meters shall be selected for the maximum expected pressure and permissible pressure drop. [NFPA 54:5.6.7-5.6.1]

1208.7.1 Location. Gas meters shall be located in ventilated spaces readily accessible for examination, reading, replacement, or necessary maintenance. [NFPA 54:5.6.7-5.6.2.1]

1208.7.1.1 Subject to Protection from Damage. Gas meters shall not be placed where they will be subjected to damage, such as adjacent to a driveway, under a fire escape, in public passages, halls, or where they will be subject to excessive corrosion or vibration. [NFPA 54:5.6.7-5.6.2.2]

1208.7.1.2 Extreme Temperatures. Gas meters shall not be located where they will be subjected to extreme temperatures or sudden extreme changes in temperature or in areas where they are subjected to temperatures beyond those recommended by the manufacturer. [NFPA 54:5.6.7-5.6.2.3]

1208.7.2 Supports. Gas meters shall be supported or connected to rigid piping so as not to exert a strain on the meters. Where flexible connectors are used to connect a gas meter to downstream piping at mobile homes in mobile home parks, the meter shall be supported by a post or bracket placed in a firm footing or by other means providing equivalent support. [NFPA 54:5.6.7-5.6.3]

1208.7.3 Meter Protection. Meters shall be protected against overpressure, backpressure, and vacuum. [NFPA 54:5.7-5.6.4]

1208.7.4 Identification. Gas piping at multiple meter installations shall be marked by a metal tag or other permanent means designating the building or the part of the building being supplied and attached by the installing agency. [NFPA 54:5.6.7-5.6.5]

1208.8 Gas Pressure Regulators. A line pressure regulator shall be installed where the gas supply pressure exceeds the maximum allowable inlet pressure of the appliance served. [NFPA 54:5.8.1-5.7.1]

1208.8.1 Listing. Line pressure regulators shall be listed in accordance with CSA Z21.80 where the outlet pressure is set to 2 psi (14 kPa) or less. [NFPA 54:5.6.2-5.7.2]

1208.8.2 Location. The gas pressure regulator shall be accessible for servicing. [NFPA 54:5.6.3-5.7.3]

1208.8.3 Regulator Protection. Pressure regulators shall be protected against physical damage. [NFPA 54:5.8.4-5.7.4]

1208.8.4 Regulator Vents Venting of Line Pressure Regulators. Regulator vents shall be in accordance with Section 507.21. [NFPA 54:5.7.5]

Line pressure regulators shall comply with all of the following:

(1) An independent vent to the exterior of the building, sized in accordance with the regulator manufacturer’s instructions, shall be provided where the location of a regulator is such that a ruptured diaphragm will cause a hazard. [NFPA 54:5.6.5.1]

(a) Where more than one regulator is at a location, each regulator shall have a separate vent to the outdoors or, if approved by the Authority Having Jurisdiction, the vent lines shall be permitted to be manifolded in accordance with accepted engineering practices to minimize back pressure in the event of diaphragm failure.

(b) Materials for vent piping shall be in accordance with Section 1208.6 through Section 1208.6.13.5.

Exception: A regulator and vent limiting means combination listed as complying with CSA Z21.80 shall be permitted to be used without a vent to the outdoors.

(2) The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.

(3) The regulator vent shall terminate at least 3 feet (914 mm) from a source of ignition.

(4) At locations where regulators might be submerged during floods, a special antiflood type breather vent fitting shall be installed, or the vent line shall be extended above the height of the expected flood waters.

(5) A regulator shall not be vented to the appliance flue or exhaust system.

1208.8.5 Venting of Gas Appliance Pressure Regulators. For venting of gas appliance pressure regulators see Section 507.21. [NFPA 54:5.8.6.2]

1208.8.6 Bypass Piping. Valved and regulated bypasses shall be permitted to be placed around gas line pressure regulators where continuity of service is imperative. [NFPA 54:5.8.6]

1208.8.7 1208.8.8 Identification. Line pressure regulators at multiple regulator installations shall be marked by a metal tag or other permanent means designating the building or the part of the building being supplied. [NFPA 54:5.8.7-5.7.6]

1208.9 Overpressure Protection Required. Where the serving gas supplier delivers gas at a pressure greater than 2 psi (14 kPa) for piping systems serving appliances designed to operate at a gas pressure of 14 inches water column (3.5 kPa) or less, overpressure protection devices shall be installed. Piping systems serving equipment designed to operate at inlet pressures greater than 14 inches water column (3.5 kPa) shall be equipped with overpressure protection devices as required by the appliance manufacturer’s installation instructions. [NFPA 54:5.9.1-5.8.1]

1208.10 Overpressure Protection Devices. Overpressure protection devices shall be one of the following:

(1) Pressure relief valve.

(2) Monitor regulator.
(4) Automatic shutoff device installed in series with the line pressure regulator and set to shut off when the pressure on the downstream piping system reaches the maximum values specified by Section 1208.11 or less. This device shall be designed so that it will remain closed until manually reset. [NFPA 54:5.9.3.4-5.8.3.1]

1208.10.1 Separate Devices. The devices in Section 1208.10 shall be installed either as an integral part of the service or line pressure regulator or as separate units. Where separate overpressure protection devices are installed, they shall comply with Section 1208.10.2 through Section 1208.10.7. [NFPA 54:5.9.3.2-5.8.3.2]

1208.10.2 Construction and Installation. All overpressure protection devices shall meet the following requirements:

1. Be constructed of materials so that the operation of the device is not impaired by corrosion of external parts by the atmosphere or of internal parts by the gas.

2. Be designed and installed so they can be operated to determine whether the valve is free. The devices shall also be designed and installed so they can be tested to determine the pressure at which they operate and be examined for leakage when in the closed position. [NFPA 54:5.9.4-5.8.4]

1208.10.3 External Control Piping. External control piping shall be designed and installed so that damage to the control piping of one device does not render both the regulator and the overpressure protective device inoperative. [NFPA 54:5.9.5-5.8.5]

1208.10.4 Setting. Each pressure limiting or pressure relieving device shall be set so that the gas pressure supplied to the connected appliance(s) does not exceed the limits specified in Section 1208.11 and Section 1208.11.1. [NFPA 54:5.9.6-5.8.6]

1208.10.5 Unauthorized Operation. Where unauthorized operation of any shutoff valve could render a pressure relieving valve or pressure limiting device inoperative, one of the following shall be accomplished:

1. The valve shall be locked in the open position. Instruct authorized personnel in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises.

2. Duplicate relief valves shall be installed, each having adequate capacity to protect the system, and arrange the isolating valves or three-way valve so that only one relief valve can be rendered inoperative at a time. [NFPA 54:5.9.7 5.8.7]

1208.10.6 Discharge of Vents. The discharge stacks, vents, or outlet parts of all pressure relieving and pressure limiting devices shall be located so that gas is safely discharged to the outdoors. Discharge stacks or vents shall be designed to prevent the entry of water, insects, or other foreign material that could cause blockage. The discharge stack or vent line shall be at least the same size as the outlet of the pressure relieving device. [NFPA 54:5.9.8.1-5.9.8.2-5.8.1-5.8.8.2]

1208.10.7 Size of Fittings, Pipe, and Openings. The fittings, pipe, and openings located between the system to be protected and the pressure relieving device shall be sized to prevent hammering of the valve and to prevent impairment of relief capacity. [NFPA 54:5.9.8.9]

1208.11 Pressure Limitation Requirements. Where piping systems serving appliances designed to operate with a gas supply pressure of 14 inches water column (3.5 kPa) or less are required to be equipped with overpressure protection by Section 1208.9, each overpressure protection device shall be adjusted to limit the gas pressure to each connected appliance to 2 psi (14 kPa) or less upon a failure of the line pressure regulator. [NFPA 54:5.9.2.1-5.8.2.1]

1208.11.1 Overpressure Protection Required. Where piping systems serving appliances designed to operate with a gas supply pressure greater than 14 inches water column (3.5 kPa) are required to be equipped with overpressure protection by Section 1208.9, each overpressure protection device shall be adjusted to limit the gas pressure to each connected appliance as required by the appliance manufacturer’s installation instructions. [NFPA 54:5.9.2.2-5.8.2.2]

1208.11.2 Overpressure Protection Devices. Each overpressure protection device installed to meet the requirements of this section shall be capable of limiting the pressure to its connected appliance(s) as required by this section independently of any other pressure control equipment in the piping system. [NFPA 54:5.9.2.3-5.8.2.3]

1208.11.3 Detection of Failure. Each gas piping system for which an overpressure protection device is required by this section shall be designed and installed so that a failure of the primary pressure control device(s) is detectable. [NFPA 54:5.9.2.4-5.8.2.4]

1208.11.4 Flow Capacity. If a pressure relief valve is used to meet the requirements of this section, it shall have a flow capacity such that the pressure in the protected system is maintained at or below the limits specified in Section 1208.11 under the following conditions:

1. The line pressure regulator for which the relief valve is providing overpressure protection has failed wide open.

2. The gas pressure at the inlet of the line pressure regulator for which the relief valve is providing overpressure protection is not less than the regulator’s normal operating inlet pressure. [NFPA 54:5.9.2.5-5.8.2.5]

1208.12 Backpressure Protection. Protective devices shall be installed as close to the equipment as practical where the design of equipment connected is such that air, oxygen, or standby gases could be forced into the gas supply system.

Gas and air combustion mixers incorporating double diaphragm “zero” or “atmosphere” governors or regulators shall require no further protection unless connected directly to compressed air or oxygen at pressures of 5 psi (34 kPa) or more. [NFPA 54:5.10.1.1-5.10.1.2-5.9.1.1-5.9.1.2]
1208.12.1 Protective Devices. Protective devices shall include but not be limited to the following:

(1) Check valves.
(2) Three-way valves (of the type that completely closes one side before starting to open the other side).
(3) Reverse flow indicators controlling positive shutoff valves.
(4) Normally closed air-actuated positive shutoff pressure regulators. [NFPA 54:5.10.2-5.9.2]

1208.13 Low-Pressure Protection. A protective device shall be installed between the meter and the appliance or equipment if the operation of the appliance or equipment is such that it could produce a vacuum or a dangerous reduction in gas pressure at the meter. Such protective devices include, but are not limited to, mechanical, diaphragm-operated, or electrically operated low-pressure shutoff valves. [NFPA 54:5.11-5.10]

1208.14 Shutoff Valves. Shutoff valves shall be approved and shall be selected giving consideration to pressure drop, service involved, emergency use, and reliability of operation in accordance with Table 1208.14. Shutoff valves of size 1 inch (25 mm) National Pipe Thread and smaller shall be listed and labeled. Where used outdoors, such use shall be in accordance with the manufacturer's recommendation. [NFPA 54:5.14-5.11]

1208.15 Expansion and Flexibility. Piping systems shall be designed to prevent failure from thermal expansion or contraction. [NFPA 54:5.14+5.13.1]

1208.15.1 Special Local Conditions. Where local conditions include earthquake, tornado, unstable ground, or flood hazard, special consideration shall be given to increased strength and flexibility of piping supports and connections. [NFPA 54:5.14-5.13.2]

1208.16 Pressure Regulator and Pressure Control Venting. The venting of the atmospheric side of diaphragms in line pressure regulators, gas appliance regulators, and gas pressure limit controls shall be in accordance with all of the following:

(1) An independent vent pipe to the outdoors, sized in accordance with the device manufacturer's instructions, shall be provided where the location of a device is such that a discharge of fuel gas will cause a hazard. For devices other than appliance regulators, vents are not required to be independent where the vents are connected to a common manifold designed in accordance with engineering methods to minimize backpressure in the event of diaphragm failure and such design is approved.

Exceptions:

(1) A regulator and vent limiting means combination listed as complying with ANSI Z21.80/CSA 6.22, shall not be required to be vented to the outdoors.
(2) A listed gas appliance regulator factory equipped with a vent limiting device is not required to be vented to the outdoors.
(3) Materials for vent piping shall be in accordance with Section 1208.6 through Section 1208.6.13.5.
(4) The vent terminus shall be designed to prevent the entry of water, insects, and other foreign matter that could cause blockage.
(5) Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas pressure control devices.
(6) Vents shall terminate not less than 3 feet (914 mm) from a possible source of ignition.
(7) Vent piping from pressure regulators and gas pressure controls shall not be connected to a common manifold that serves a bleed line from a diaphragm-type gas valve. [NFPA 54:5.14]

1209.1 General. Where automatic excess flow valves are installed, they shall be listed in accordance with ANSI Z21.93/CSA 6.30 and shall be sized and installed in accordance with the manufacturer's instructions. [NFPA 54:5.14-5.12]

1210.1 Piping Underground. Underground gas piping shall be installed with sufficient clearance from any other underground structure to avoid contact therewith, to allow maintenance, and to protect against damage from proximity to other structures. In addition, underground plastic piping shall be installed with sufficient clearance or shall be insulated from any source of heat so as to prevent the heat from impairing the serviceability of the pipe. [NFPA 54:7.1.1-7.1.1.1-7.1.1.2]

1210.1.1 Cover Requirements. Underground piping systems shall be installed with a minimum of 12 inches (305 mm) of cover. The minimum cover shall be increased to 18 inches (457 mm) if external damage to the pipe or tubing from external forces is likely to result. Where a minimum of 12 inches (305 mm) of cover cannot be provided, the pipe-piping shall be installed in conduit or bridged (shielded). [NFPA 54:7.1.2.1 – 7.1.2.1(B)]

1210.1.5 Piping through Foundation Wall. Piping through a foundation wall shall comply with all of the following:

(1) Underground piping, where installed through the outer foundation or basement wall of a building, shall be encased in a protective sleeve or protected by an approved device or method.
(2) The space between the gas piping and the sleeve and between the sleeve and the wall shall be sealed to prevent entry of gas and water.
(3) Sealing materials shall be compatible with the piping and sleeve. [NFPA 54:7.1.5]
1210.1.7 **Connections of Plastic Piping.** Plastic piping shall be installed outdoors, underground only.

**Exceptions:**
1. Plastic piping shall be permitted to terminate aboveground where an anodeless riser is used.
2. Plastic piping shall be permitted to terminate with a wall head adapter aboveground in buildings, including basements, where the plastic piping is inserted in a piping material permitted for use in buildings. [NFPA 54:7.1.7.1]

1210.3 Installation of Aboveground Piping. Piping installed aboveground shall comply with all of the following:

1. Piping shall be securely supported and located where it will be protected from physical damage.
2. Where passing through an exterior wall, the piping shall also be protected from corrosion by coating or wrapping with an inert material approved for such applications.
3. The piping shall be sealed around its circumference at the point of the exterior penetration to prevent the entry of water, insects, and rodents.
4. Where piping is encased in a protective pipe sleeve, the annular spaces between the gas piping and the sleeve and between the sleeve and the wall opening shall be sealed.
5. Piping installed outdoors shall be elevated not less than 3½ inches (89 mm) above the ground.
6. Sealing materials shall be compatible with the piping and sleeve. [NFPA 54:7.2.6.4.1, 7.2.6.4.2]

1210.3.5.3 Piping on Roofs. Gas piping installed on the roof surfaces shall be elevated above the roof surface and shall be supported in accordance with Table 1210.3.5.1. Gas piping shall be elevated not less than 3½ inches (89 mm) above the roof surface. [NFPA 54:7.2.6.4.1, 7.2.6.4.2]

1210.4.4 Piping in Floors-Industrial Occupancies. In industrial occupancies, gas piping in solid floors such as concrete shall be laid in channels in the floor and covered to permit access to the piping with a minimum of damage to the building. Where piping in floor channels could be exposed to excessive moisture or corrosive substances, the piping shall be protected in an approved manner. [NFPA 54:7.3.5.1]

1210.4.5 Other Occupancies. In other than industrial occupancies and where approved by the Authority Having Jurisdiction, gas piping embedded in concrete floor slabs constructed with portland cement shall be surrounded with a minimum of 1½ inches (38 mm) of concrete and shall not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. All piping, fittings, and risers shall be protected against corrosion in accordance with Section 1210.3.1. Piping shall not be embedded in concrete slabs containing quick-set-quickset additives or cinder aggregate. [NFPA 54:7.3.5.1—7.3.5.2]

1210.9 Manual Gas Shutoff Valves. An accessible gas shutoff valve shall be provided upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve shall not be required at the second regulator. [NFPA 54:7.8.1.1—7.8.2]

1210.9.1 Accessibility of Gas Valves Controlling Multiple Systems. Main gas-system shutoff valves controlling several gas-piping systems shall be readily accessible for operation and installed so as to be protected from physical damage. They-system shutoff valves shall be marked with a metal tag or other permanent means attached by the installing agency so that the gas piping systems supplied through them can be readily identified. [NFPA 54:7.8.2.1—7.8.1.2]

1210.9.2 Shutoff Valves for Multiple House Lines. In multiple-tenant buildings supplied through a master meter, through one service regulator where a meter is not provided, or where meters or service regulators are not readily accessible from the appliance or equipment location, an individual shutoff valve for each apartment or tenant line shall be provided at a convenient point of general accessibility. In a common system serving a number of individual buildings, shutoff valves shall be installed at each building. [NFPA 54:7.8.2.1—7.8.3.1]

1210.9.3 Emergency Shutoff Valves. An exterior shutoff valve to permit turning off the gas supply to each building in an emergency shall be provided. The emergency shutoff valves shall be plainly marked as such and their locations posted as required by the Authority Having Jurisdiction. [NFPA 54:7.8.2.3—7.8.3.2]

1210.9.4 Shutoff Valve for Laboratories. Each laboratory space containing two or more gas outlets installed on tables, benches, or in hoods in educational, research, commercial and industrial occupancies shall have a single shutoff valve through which all such gas outlets are supplied. The shutoff valve shall be accessible, located within the laboratory or adjacent to the laboratory’s egress door, and identified. [NFPA 54:7.8.2.4—7.8.3.3]

1210.9.5 System Shutoff Valves. Where a system shutoff valve is installed, the valve shall comply with Section 1208.14. [NFPA 54:7.8.4]

1210.12.5 Installation of Gas-Mixing Machines. Installation of gas-mixing machines shall comply with the following:

1. **Location.** The gas-mixing machine shall be located in a well-ventilated area or in a detached building or cutoff room provided with room construction and explosion vents in accordance with sound engineering principles methods. Such rooms or below-grade installations shall have adequate positive ventilation. [NFPA 54:7.11.5.1]
2. **Electrical Requirements.** Where gas-mixing machines are installed in well-ventilated areas, the type of electrical equipment shall be in accordance with NFPA 70 for general service conditions unless other hazards in the
area prevail. Where gas-mixing machines are installed in small detached buildings or cutoff rooms, the electrical equipment and wiring shall be installed in accordance with NFPA 70 for hazardous locations (Articles 500 and 501, Class I, Division 2). [NFPA 54:7.11.5.2]

(2) 1210.12.5.3 Air Intakes. Air intakes for gas-mixing machines using compressors or blowers shall be taken from outdoors whenever practical. [NFPA 54:7.11.5.3]

(4) 1210.12.5.4 Controls. Controls for gas-mixing machines shall include interlocks and a safety shutoff valve of the manual reset type in the gas supply connection to each machine arranged to automatically shut off the gas supply in the event of high or low gas pressure. Except for open burner installations only, the controls shall be interlocked so that the blower or compressor stops operating following a gas supply failure. Where a system employs pressurized air, means shall be provided to shut off the gas supply in the event of air failure. [NFPA 54:7.11.5.4]

(5) 1210.12.5.5 Installation in Parallel. Centrifugal gas-mixing machines in parallel shall be reviewed by the user and equipment manufacturer before installation, and means or plans for minimizing the effects of downstream pulsation and equipment overload shall be prepared and utilized as needed. [NFPA 54:7.11.5.5]

1210.12.6 Use of Automatic Firechecks, Safety Blowouts, or Backfire Preventers. Automatic firechecks and safety blowouts or backfire preventers shall be provided in piping systems distributing flammable air-gas mixtures from gas-mixing machines to protect the piping and the machines in the event of flashback, in accordance with the following:

1. Approved automatic firechecks shall be installed upstream as close as practical to the burner inlets following the firecheck manufacturer's instructions.

2. A separate manually operated gas valve shall be provided at each automatic firecheck for shutting off the flow of the gas-air mixture through the firecheck after a flashback has occurred. The valve shall be located upstream as close as practical to the inlet of the automatic firecheck.

Caution: These valves shall not be reopened after a flashback has occurred until the firecheck has cooled sufficiently to prevent re-ignition of the flammable mixture and has been reset properly.

3. A safety blowout or backfiring preventer shall be provided in the mixture line near the outlet of each gas-mixing machine where the size of the piping is larger than 2 1/2 inches (65 mm) NPS, or equivalent, to protect the mixing equipment in the event of an explosion passing through an automatic firecheck. The manufacturer's instructions shall be followed when installing these devices, particularly after a disc has burst. The discharge from the safety blowout or backfire preventer shall be located or shielded so that particles from the ruptured disc cannot be directed toward personnel. Wherever there are interconnected installations of gas-mixing machines with safety blowouts or backfire preventers, provision shall be made to keep the mixture from other machines from reaching any ruptured disc opening. Check valves shall not be used for this purpose.

4. Large-capacity premix systems provided with explosion heads (rupture discs) to relieve excessive pressure in pipelines shall be located at and vented to a safe outdoor location. Provisions shall be provided for automatically shutting off the supply of the gas-air mixture in the event of rupture. [NFPA 54:7.11.6]

1211.4 Prohibited Use. Gas piping shall not be used as a grounding conductor or electrode. [NFPA 54:7.42.4-7.12.4.1]

1212.1 Connecting Appliances and Equipment. Appliances and equipment shall be connected to the building piping in compliance with Section 1212.6 through Section 1212.8 by one of the following:

1. Rigid metallic pipe and fittings.

2. Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing shall not be used in exterior locations.

3. A listed connector for gas appliances listed in compliance-accordance with CSA-ANSI Z21.24/CSA 6.27. The connector shall be used in accordance with the manufacturer's installation instructions and shall be in the same room as the appliance. Only one connector shall be used per appliance.

4. A listed connector for outdoor gas appliances and manufactured homes listed in compliance-accordance with CSA ANSI Z21.75/CSA 6.27. Only one connector shall be used per appliance.

5. CSST where installed in accordance with the manufacturer's installation instructions. CSST shall not be directly routed into a metallic appliance enclosure where the appliance is connected to a metallic vent that terminates above a roofline. CSST shall connect only to appliances that are fixed in place.

6. Listed nonmetallic gas hose connectors in accordance with Section 1212.3.

7. Unlisted gas hose connectors for use in laboratories and educational facilities in accordance with Section 1212.4. [NFPA 54:9.6.1]

1212.1.1 Commercial Cooking Appliances—Food Service Appliance Connectors. Connectors used with commercial cooking—food service appliances that are moved for cleaning and sanitation purposes shall be installed in accordance with the connector manufacturer's installation instructions. Such connectors shall be listed in accordance with CSA ANSI Z21.69/CSA 6.16. [NFPA 54:9.6.1.3]

1212.7 Quick-Disconnect Devices. Quick-disconnect devices used to connect appliances to the building piping shall be listed in accordance with CSA-ANSI Z21.41/CSA 6.9. Where installed indoors, an approved manual shutoff valve with a non-displaceable nondisplaceable valve member shall be installed upstream of the quick-disconnect device. [NFPA 54:9.6.6.1 – 9.6.6.2]
### TABLE 1208.4.1
APPROXIMATE GAS INPUT FOR TYPICAL APPLIANCES

[NFPA 54: TABLE A.5.4.2.1-A.5.3.2.1]

<table>
<thead>
<tr>
<th>APPLIANCE</th>
<th>INPUT (Btu/h approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Space Heating Units</strong></td>
<td></td>
</tr>
<tr>
<td>Warm air furnace</td>
<td></td>
</tr>
<tr>
<td>Single family</td>
<td>100 000</td>
</tr>
<tr>
<td>Multifamily, per unit</td>
<td>60 000</td>
</tr>
<tr>
<td>Hydronic boiler</td>
<td></td>
</tr>
<tr>
<td>Single family</td>
<td>100 000</td>
</tr>
<tr>
<td>Multifamily, per unit</td>
<td>60 000</td>
</tr>
<tr>
<td><strong>Space and Water Heating Units</strong></td>
<td></td>
</tr>
<tr>
<td>Hydronic boiler</td>
<td></td>
</tr>
<tr>
<td>Single-family</td>
<td>120 000</td>
</tr>
<tr>
<td>Multifamily, per unit</td>
<td>75 000</td>
</tr>
<tr>
<td><strong>Water Heating Appliances</strong></td>
<td></td>
</tr>
<tr>
<td>Water heater, automatic storage</td>
<td></td>
</tr>
<tr>
<td>30 to 40 gallon tank</td>
<td>35 000</td>
</tr>
<tr>
<td>Water heater, automatic storage</td>
<td></td>
</tr>
<tr>
<td>50 gallon tank</td>
<td>50 000</td>
</tr>
<tr>
<td>Water heater, automatic instantaneous</td>
<td></td>
</tr>
<tr>
<td>Capacity at 2 gallons per minute</td>
<td>142 800</td>
</tr>
<tr>
<td>Capacity at 4 gallons per minute</td>
<td>285 000</td>
</tr>
<tr>
<td>Capacity at 6 gallons per minute</td>
<td>428 400</td>
</tr>
<tr>
<td>Water heater, domestic, circulating or side-arm</td>
<td>35 000</td>
</tr>
<tr>
<td><strong>Cooking Appliances</strong></td>
<td></td>
</tr>
<tr>
<td>Range, freestanding, domestic</td>
<td>65 000</td>
</tr>
<tr>
<td>Built-in oven or broiler unit, domestic</td>
<td>25 000</td>
</tr>
<tr>
<td>Built-in top unit, domestic</td>
<td>40 000</td>
</tr>
<tr>
<td><strong>Other Appliances</strong></td>
<td></td>
</tr>
<tr>
<td>Refrigerator</td>
<td>3000</td>
</tr>
<tr>
<td>Clothes dryer, Type 1 (domestic)</td>
<td>35 000</td>
</tr>
<tr>
<td>Gas fireplace direct-vent</td>
<td>40 000</td>
</tr>
<tr>
<td>Gas log</td>
<td>80 000</td>
</tr>
<tr>
<td>Barbecue</td>
<td>40 000</td>
</tr>
<tr>
<td>Gas light</td>
<td>2500</td>
</tr>
</tbody>
</table>

For SI units: 1000 British thermal units per hour = 0.293 kW
### TABLE 1208.6.9.2
**SPECIFICATIONS FOR THREADING METALLIC PIPE**

<table>
<thead>
<tr>
<th>IRON PIPE SIZE (inches)</th>
<th>APPROXIMATE LENGTH OF THREADED PORTION (inches)</th>
<th>APPROXIMATE NUMBER OF THREADS TO BE CUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>½</td>
<td>¾</td>
<td>10</td>
</tr>
<tr>
<td>¾</td>
<td>¾</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>7/8</td>
<td>10</td>
</tr>
<tr>
<td>1¼</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>1½</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2½</td>
<td>1½</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>1½</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>1⅜</td>
<td>13</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

### TABLE 1208.14
**MANUAL GAS VALVE STANDARDS**

<table>
<thead>
<tr>
<th>SHUTOFF VALVE APPLICATION</th>
<th>STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliance shutoff valve up to ½ psi</td>
<td>ANSI Z21.15/CSA 9.1</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.44</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32</td>
</tr>
<tr>
<td>Valve up to ½ psi</td>
<td>ANSI/ASME B16.44</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32</td>
</tr>
<tr>
<td>Valve up to 2 psi</td>
<td>ANSI/ASME B16.44 labeled 2G</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.44 labeled 2G or labeled 5G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td>Valve up to 5 psi</td>
<td>ANSI/ASME B16.44 labeled 5G</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.44 marked 5G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td>Valve up to 125 psi</td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.33 marked 125 G</td>
</tr>
</tbody>
</table>

For SI Units: 1 pound-force per square inch = 6.8947 kPa
### TABLE 1210.3.5.1
SUPPORT OF PIPING
[NFPA 54: TABLE 7.2.6.2]

<table>
<thead>
<tr>
<th>STEEL PIPE, NOMINAL SIZE OF PIPE (inches)</th>
<th>SPACING OF SUPPORTS (feet)</th>
<th>NOMINAL SIZE OF TUBING SMOOTH-WALL SMOOTH WALL (inches O.D.)</th>
<th>SPACING OF SUPPORTS (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½</td>
<td>6</td>
<td>½</td>
<td>4</td>
</tr>
<tr>
<td>¾ or 1</td>
<td>8</td>
<td>½ or ¾</td>
<td>6</td>
</tr>
<tr>
<td>1¼ or larger (horizontal)</td>
<td>10</td>
<td>7/8 or 1 (horizontal)</td>
<td>8</td>
</tr>
<tr>
<td>1¼ or larger (vertical)</td>
<td>Every floor level</td>
<td>1 or larger (vertical)</td>
<td>Every floor level</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

### TABLE 1215.2(27)
SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.3.1(d)]

<table>
<thead>
<tr>
<th>GAS: UNDILUTED PROPANE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INLET PRESSURE: 11.0 in. w.c.</td>
</tr>
<tr>
<td>PRESSURE DROP: 0.5 in. w.c.</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY: 1.50</td>
</tr>
</tbody>
</table>

**INTENDED USE:** PIPE SIZING BETWEEN SINGLE- OR SECOND-STAGE (LOW-PRESSURE) REGULATOR AND APPLIANCE

<table>
<thead>
<tr>
<th>PIPE SIZE (inch)</th>
<th>NOMINAL INSIDE: ½</th>
<th>¾</th>
<th>1</th>
<th>1¼</th>
<th>1½</th>
<th>2</th>
<th>2½</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTUAL:</td>
<td>0.622</td>
<td>0.824</td>
<td>1.049</td>
<td>1.380</td>
<td>1.610</td>
<td>2.067</td>
<td>2.469</td>
<td>3.068</td>
<td>4.026</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LENGTH (feet)</th>
<th>CAPACITY IN THOUSANDS OF BTU PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>291 608 1150 2350 3520 6790 10 800 19 100 39 000</td>
</tr>
<tr>
<td>20</td>
<td>200 418 787 1620 2420 4660 7430 13 100 26 800</td>
</tr>
<tr>
<td>30</td>
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For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 inch water column = 0.249 kPa

* Table entries are rounded to 3 significant digits.

### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>ASME B16.33-2012 (R2017)</td>
<td>Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 175 psi (Sizes NPS 1/2 through NPS 2)</td>
<td>Valves</td>
<td>Table 1208.14</td>
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<td>ASME B16.44-2012 (R2017)</td>
<td>Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems up to 5 psi</td>
<td>Valves</td>
<td>Table 1208.14</td>
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*(portions of table not shown remain unchanged)*

### TABLE 1701.2
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

<table>
<thead>
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<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
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<tr>
<td>ASME B16.33-2012 (R2017)</td>
<td>Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 175 psi (Sizes NPS 1/2 through NPS 2)</td>
<td>Valves</td>
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<tr>
<td>CSA Z21.15b-2013 (R2014)</td>
<td>Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves (same as CSA 9.1b)</td>
<td>Fuel Gas</td>
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</tbody>
</table>

*(portions of table not shown remain unchanged)*

**SUBSTANTIATION:**
The above sections have been revised to correlate with NFPA 54-2021 (latest version) in accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines).

**COMMITTEE ACTION:** ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

**CHAPTER 12**
**FUEL GAS PIPING**
1208.3 Interconnections Separate Users. Where two or more meters, or two or more service regulators where meters are not provided, are located on the same premises and supply separate users, the gas piping systems shall not be interconnected on the outlet side of the meters or service regulators. [NFPA 54:5.2.1]

1208.3.1 Interconnections for Standby Fuels. Where a supplementary gas for standby use is connected downstream from a meter or a service regulator where a meter is not provided, equipment to prevent backflow shall be installed. A three-way valve installed to admit the standby supply and at the same time shut off the regular supply shall be permitted to be used for this purpose. [NFPA 54:5.2.2.1 – 5.2.2.2]

1208.4 Sizing of Gas Piping Systems. Gas piping systems shall be of such size and so installed as to provide a supply of gas sufficient to meet the maximum demand and supply gas to each appliance inlet at not less than the minimum supply pressure required by the appliance. [NFPA 54:5.3.1]

1208.4.1 Maximum Gas Demand. The volumetric flow rate of gas to be provided shall be the sum of the maximum input of the appliances served. The volumetric flow rate of gas to be provided shall be adjusted for altitude where the installation is above 2000 feet (610 m). [NFPA 54:5.3.2.1 – 5.3.2.2] Where the input rating is not indicated, the gas supplier, appliance manufacturer, or a qualified agency shall be contacted, or the rating from Table 1208.4.1 shall be used for estimating the volumetric flow rate of gas to be supplied. The total connected hourly load shall be used as the basis for piping sizing, assuming all appliances are operating at full capacity simultaneously. Exception: Sizing shall be permitted to be based upon established load diversity factors. [NFPA 54:5.3.2.3]

1208.4.2 Sizing Methods. Gas piping shall be sized in accordance with one of the following:

(1) Pipe sizing tables or sizing equations in this chapter.
(2) Sizing tables included in a listed piping system manufacturer’s installation instructions.
(3) Engineering methods. [NFPA 54:5.3.3]

1208.4.3 Allowable Pressure Drop. The design pressure loss in a piping system from the point of delivery to the inlet connection of all appliances served shall be such that the supply pressure at each appliance inlet is greater than or equal to the minimum pressure required by the appliance. [NFPA 54:5.3.4]

1208.5 Maximum Operating Pressure in Buildings. The maximum operating pressure for any piping systems located inside buildings shall not exceed 5 psi (34 kPa) unless one or more of the following conditions are met:

(1) The piping joints are welded or brazed.
(2) The piping is joined by fittings listed to ANSI LC 4/CSA 6.32 and installed according to the manufacturer’s installation instructions.
(3) The piping joints are flanged and all pipe-to-flange connections are made by welding or brazing.
(4) The piping is located in a ventilated chase or otherwise enclosed for protection against accidental gas accumulation.
(5) The piping is located inside buildings or separate areas of buildings used exclusively for one of the following:
   (a) Industrial processing or heating
   (b) Research
   (c) Warehousing
   (d) Boiler or mechanical rooms
(6) The piping is a temporary installation for buildings under construction.
(7) The piping serves appliances or equipment used for agricultural purposes.
(8) The piping system is an LP-Gas piping system with an operating pressure greater than 20 psi (138 kPa) and complies with NFPA 58. [NFPA 54:5.4.4]

1208.5.1 LP-Gas Systems Operating Below -5°F (-21°C). LP-Gas systems designed to operate below -5°F (-21°C) or with butane or a propane-butane mix shall be designed to either accommodate liquid LP-Gas or to prevent LP-Gas vapor from condensing back into a liquid. [NFPA 54:5.4.5]

1208.6 Acceptable Piping Materials and Joining Methods. Materials used for piping systems shall either comply with the requirements of this chapter or be acceptable to the Authority Having Jurisdiction. [NFPA 54:5.5.1.1]

1208.6.1 Used Materials. Pipe, fittings, valves, or other materials shall not be used again unless they are free of foreign materials and have been ascertained to be adequate for the service intended. [NFPA 54:5.5.1.2]

1208.6.2 Metallic Pipe. Metallic pipe shall be in accordance with the Section 1208.6.3.1 through Section 1208.6.3.4.

1208.6.3 Cast Iron. Cast-iron pipe shall not be used. [NFPA 54:5.5.2.1]

1208.6.3.2 Steel, Stainless Steel, and Wrought-Iron Pipe. Steel, stainless steel, and wrought-iron pipe shall be at least Schedule 40 and shall comply with the dimensional standards of ASME B36.10M and one of the following:

(1) ASTM A53
(2) ASTM A106
(3) ASTM A312 [NFPA 54:5.5.2.2]

1208.6.3.3 Copper and Copper Alloy Pipe. Copper and copper alloy pipe shall not be used if the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 standard cubic feet (scf) of gas (0.7 mg/100 L). Threaded copper, copper alloy, or aluminum alloy pipe shall not be used with gases corrosive to such material. [NFPA 54:5.5.2.3 – 5.5.2.4]

1208.6.3.4 Aluminum Alloy Pipe. Aluminum alloy pipe shall comply with ASTM B241 (except that the use of alloy 5056 is prohibited), and shall be marked at each end of each length indicating compliance. Aluminum alloy pipe shall be coated to protect against external corrosion where it is in contact with masonry, plaster, or insulation or is subject to repeated wettings by such liquids as water, detergents, or sewage. [NFPA 54:5.5.2.5]

Aluminum alloy pipe shall not be used in exterior locations or underground. [NFPA 54:5.5.2.6]

1208.6.4 Metallic Tubing. Tubing shall not be used with gases corrosive to the tubing material. [NFPA 54:5.5.3.1]
1208.6.1 Steel Tubing. Steel tubing shall comply with ASTM A254. [NFPA 54:5.5.3.2]

1208.6.2 Stainless Steel. Stainless steel tubing shall comply with one of the following:

1. ASTM A268
2. ASTM A269 [NFPA 54:5.5.3.3]

1208.6.3 Copper and Copper Alloy Tubing. Copper and copper alloy tubing shall not be used if the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 scf of gas (0.7 mg/100 L). Copper tubing shall comply with standard Type K or Type L of ASTM B88 or ASTM B280. [NFPA 54:5.5.3.4]

1208.6.4 Aluminum Alloy Tubing. Aluminum alloy tubing shall comply with ASTM B210 or ASTM B241. Aluminum alloy tubing shall be coated to prevent against external corrosion where it is in contact with masonry, plaster, or insulation or is subject to repeated wettings by such liquids as water, detergent, or sewage. Aluminum alloy tubing shall not be used in exterior locations or underground. [NFPA 54:5.5.3.5]

1208.6.5 Corrugated Stainless Steel Tubing. Corrugated stainless steel tubing shall be listed in accordance with CSA LC 1. [NFPA 54:5.5.3.6]

1208.6.5 Plastic Pipe, Tubing, and Fittings. Polyethylene plastic pipe, tubing, and fittings used to supply fuel gas shall conform to ASTM D2513. Pipe to be used shall be marked “gas” and “ASTM D2513.” Polyamide pipe, tubing, and fittings shall be identified in and conform to ASTM F2945. Polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) plastic pipe, tubing, and fittings shall not be used to supply fuel gas. [NFPA 54:5.5.4.1.1 – 5.5.4.1.3]

1208.6.6 Regulator Vent Piping. Plastic pipe and fittings used to connect regulator vents to remote vent terminations shall be PVC conforming to UL 651 (Schedule 40 and 80). PVC vent piping shall not be installed indoors. [{NFPA 54:5.5.4.2}]

1208.6.7 Factory-Assembled Anodeless Risers. Factory-assembled anodeless risers shall be recommended by the manufacturer for the gas used and shall be leak tested by the manufacturer in accordance with written procedures. [NFPA 54:5.5.4.3(1)]

1208.6.7.2 Service Head Adapters and Field-Assembled Anodeless Risers. Service head adapters and field-assembled anodeless risers incorporating service head adapters shall be recommended by the manufacturer for the gas used and shall be design-certified to meet the requirements of Category I of ASTM D2513 and 49 CFR 192.281(e). The manufacturer shall provide the user qualified installation instructions as prescribed by 49 CFR 192.283(b). [NFPA 54:5.5.4.3(2)]

1208.6.7.3 Undiluted Liquified Petroleum Gas Piping. The use of plastic pipe, tubing, and fittings in undiluted LP-Gas piping systems shall be in accordance with NFPA 58. [NFPA 54:5.5.4.3(3)]

1208.6.8 Workmanship and Defects. Gas pipe, tubing, and fittings shall be clear and free from cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip and scale blown. Defects in pipe, tubing, and fittings shall not be repaired. Defective pipe, tubing, and fittings shall be replaced. [NFPA 54:5.5.5]

1208.6.9 Metallic Pipe Threads. Metallic pipe and fitting threads shall be taper pipe threads and shall comply with ASME B1.20.1. [NFPA 54:5.5.6.1]

1208.6.9.1 Damaged Threads. Pipe with threads that are stripped, chipped, corroded, or otherwise damaged shall not be used. Where a weld opens during the operation of cutting or threading, that portion of the pipe shall not be used. [NFPA 54:5.5.6.2]

1208.6.9.2 Number of Threads. Field threading of metallic pipe shall be in accordance with Table 1208.6.9.2. [NFPA 54:5.5.6.3]

1208.6.9.3 Thread Joint Sealing. Threaded joints shall be made using a thread joint sealing material. [NFPA 54:5.5.6.4.1] Thread joint sealing materials shall be compatible with the pipe and fitting material on which the compounds are used. [NFPA 54:5.5.6.4.2] Thread joint sealing materials shall be resistant to the chemical constituents of the gases to be conducted through the piping. [NFPA 54:5.5.6.4.3]

1208.6.10 Metallic Piping Joints and Fittings. The type of piping joint used shall be suitable for the pressure and temperature conditions and shall be selected giving consideration to joint tightness and mechanical strength under the service conditions. The joint shall be able to sustain the maximum end force due to the internal pressure and any additional forces due to temperature expansion or contraction, vibration, fatigue, or the weight of the pipe and its contents. [NFPA 54:5.5.7]

1208.6.10.1 Pipe Joints. Schedule 40 and heavier pipe joints shall be threaded, flanged, brazed, welded, or assembled with press-connect fittings listed to CSA LC 4.

1. Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1000°F (538°C).
2. Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.5.7.1]

1208.6.10.2 Copper Tubing Joints. Copper tubing joints shall be assembled with approved gas tubing fittings, shall be brazed with a material having a melting point in excess of 1000°F (538°C), or shall be assembled with press-connect fittings listed to CSA LC 4. Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.5.7.2]

1208.6.10.3 Stainless Steel Tubing Joints. Stainless steel joints shall be welded, assembled with approved tubing fittings, brazed with a material having a melting point in excess of 1000°F (538°C), or assembled with press-connect fittings listed to CSA LC 4. Brazing alloys and fluxes shall be recommended by the manufacturer for use on stainless steel alloys. [NFPA 54:5.5.7.3]

1208.6.10.4 Flared Joints. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing where experience or tests have demonstrated that the joint is suitable for the conditions and where provisions are made in the design to prevent separation of the joints. [NFPA 54:5.5.7.4]

1208.6.10.5 Metallic Pipe Fittings. Metallic fittings shall comply with the following:

1. Threaded fittings in sizes larger than 4 inches (100 mm) shall not be used.
2. Fittings used with steel, stainless steel, or wrought-iron pipe shall be steel, stainless steel, copper alloy, malleable...
iron, or cast iron.
(3) Fittings used with copper or copper alloy pipe shall be copper or copper alloy.
(4) Fittings used with aluminum alloy pipe shall be aluminum alloy.
(5) Cast-iron fittings shall comply with the following:
   (a) Flanges shall be permitted.
   (b) Bushings shall not be used.
   (c) Fittings shall not be used in systems containing flammable gas-air mixtures.
   (d) Fittings in sizes 4 inches (100 mm) and larger shall not be used indoors unless approved by the Authority Having Jurisdiction.
   (e) Fittings in sizes 6 inches (150 mm) and larger shall not be used unless approved by the Authority Having Jurisdiction.
(6) Aluminum alloy fitting threads shall not form the joint seal.
(7) Zinc-aluminum alloy fittings shall not be used in systems containing flammable gas-air mixtures.
(8) Special fittings such as couplings, proprietary-type joints, saddle tees, gland-type compression fittings, and flared, flareless, or compression-type tubing fittings shall be as follows:
   (a) Used within the fitting manufacturer’s pressure-temperature recommendations.
   (b) Used within the service conditions anticipated with respect to vibration, fatigue, thermal expansion, or contraction.
   (c) Acceptable to the Authority Having Jurisdiction.
(9) When pipe fittings are drilled and tapped in the field, the operation shall be in accordance with the following:
   (a) The operation shall be performed on systems having operating pressures of 5 psi (34 kPa) or less.
   (b) The operation shall be performed by the gas supplier or their designated representative.
   (c) The drilling and tapping operation shall be performed in accordance with written procedures prepared by the gas supplier.
   (d) The fittings shall be located outdoors.
   (e) The tapped fitting assembly shall be inspected and proven to be free of leaks. [NFPA 54:5.5.7.5]

1208.6.11 Plastic Piping Joints and Fittings. Plastic pipe, tubing, and fittings shall be joined in accordance with the manufacturers’ instructions. Section 1208.6.11.1 through Section 1208.6.11.4 shall be observed when making such joints. [NFPA 54:5.5.8]

1208.6.11.1 Joint Design. The joint shall be designed and installed so that the longitudinal pullout resistance of the joint will be at least equal to the tensile strength of the plastic piping material. [NFPA 54:5.5.8(1)]

1208.6.11.2 Heat Fusion Joint. Heat fusion joints shall be made in accordance with qualified procedures that have been established and proven by test to produce gastight joints at least as strong as the pipe or tubing being joined. Joints shall be made with the joining method recommended by the pipe manufacturer. Polyethylene heat fusion fittings shall be marked “ASTM D2513.” Polyamide heat fusion fittings shall be marked “ASTM F2945.” [NFPA 54:5.5.8(2)]

1208.6.11.3 Compression-Type Mechanical Joints. Where compression-type mechanical joints are used, the gasket material in the fitting shall be compatible with the plastic piping and with the gas distributed by the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting. The stiffener shall be flush with the end of the pipe or tubing and shall extend at least to the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force fit in the plastic. Split tubular stiffeners shall not be used. [NFPA 54:5.5.8(3)]

1208.6.11.4 Liquefied Petroleum Gas Piping Systems. Plastic piping joints and fittings for use in LP-Gas piping systems shall be in accordance with NFPA 58. [NFPA 54:5.5.8(4)]

1208.6.12 Cast Iron Flanges. Cast iron flanges shall be in accordance with ASME B16.1. [NFPA 54:5.5.9.1.1]

1208.6.12.2 Steel Flanges. Steel flanges shall be in accordance with the following:
(1) ASME B16.5 or
(2) ASME B16.47. [NFPA 54:5.5.9.1.2]

1208.6.12.3 Non-Ferrous Flanges. Non-ferrous flanges shall be in accordance with ASME B16.24. [NFPA 54:5.5.9.1.3]

1208.6.12.4 Ductile Iron Flanges. Ductile iron flanges shall be in accordance with ASME B16.42. [NFPA 54:5.5.9.1.4]

1208.6.12.5 Dissimilar Flange Connections. Raised-face flanges shall not be joined to flat-faced cast iron, ductile iron or nonferrous material flanges. [NFPA 54:5.5.9.2]

1208.6.12.6 Flange Facings. Standard facings shall be permitted for use under this code. Where 150 psi (1034 kPa) steel flanges are bolted to Class 125 cast-iron flanges, the raised face on the steel flange shall be removed. [NFPA 54:5.5.9.3]

1208.6.12.7 Lapped Flanges. Lapped flanges shall be used only aboveground or in exposed locations accessible for inspection. [NFPA 54:5.5.9.4]

1208.6.13 Flange Gaskets. The material for gaskets shall be capable of withstanding the design temperature and pressure of the piping system and the chemical constituents of the gas being conducted without change to its chemical and physical properties. The effects of fire exposure to the joint shall be considered in choosing the material. [NFPA 54:5.5.10]

1208.6.13.1 Flange Gasket Materials. Acceptable materials shall include the following:
(1) Metal (plain or corrugated)
(2) Composition
(3) Aluminum “O” rings
(4) Spiral-wound metal gaskets
(5) Rubber-faced phenolic
(6) Elastomeric [NFPA 54:5.5.10.1]

1208.6.13.2 Metallic Flange Gaskets. Metallic flange gaskets shall be in accordance with ASME B16.20. [NFPA 54:5.5.10.2.1]
1208.6.13.3 Non-Metallic Flange Gaskets. Non-metallic flange gaskets shall be in accordance with ASME B16.21. [NFPA 54:5.5.10.2.2]

1208.6.13.4 Full-Face Flange Gasket. Full-face flange gaskets shall be used with all non-steel flanges. [NFPA 54:5.5.10.3]

1208.6.13.5 Separated Flanges. When a flanged joint is separated, the gasket shall be replaced. [NFPA 54:5.5.10.4]

1208.7 Gas Meters. Gas meters shall be selected for the maximum expected pressure and permissible pressure drop. [NFPA 54:5.6.1]

1208.7.1 Location. Gas meters shall be located in ventilated spaces readily accessible for examination, reading, replacement, or necessary maintenance. [NFPA 54:5.6.2.1]

1208.7.1.1 Protection from Damage. Gas meters shall not be placed where they will be subjected to damage, such as adjacent to a driveway, under a fire escape, in public passages, halls, or where they will be subject to excessive corrosion or vibration. [NFPA 54:5.6.2.2]

1208.7.1.2 Extreme Temperatures. Gas meters shall not be located where they will be subjected to extreme temperatures or sudden extreme changes in temperature or in areas where they are subjected to temperatures beyond those recommended by the manufacturer. [NFPA 54:5.6.2.3]

1208.7.2 Supports. Gas meters shall be supported or connected to rigid piping so as not to exert a strain on the meters. Where flexible connectors are used to connect a gas meter to downstream piping at mobile homes in mobile home parks, the meter shall be supported by a post or bracket placed in a firm footing or by other means providing equivalent support. [NFPA 54:5.6.3]

1208.7.3 Meter Protection. Meters shall be protected against overpressure, backpressure, and vacuum. [NFPA 54:5.6.4]

1208.7.4 Identification. Gas piping at multiple meter installations shall be marked by a metal tag or other permanent means designating the building or the part of the building being supplied and attached by the installing agency. [NFPA 54:5.6.5]

1208.8 Gas Pressure Regulators. A line pressure regulator shall be installed where the gas supply pressure exceeds the maximum allowable inlet pressure of the appliance served. [NFPA 54:5.7.1]

1208.8.1 Listing. Line pressure regulators shall be listed in accordance with CSA Z21.80 where the outlet pressure is set to 2 psi (14 kPa) or less. [NFPA 54:5.7.2]

1208.8.2 Location. The gas pressure regulator shall be accessible for servicing. [NFPA 54:5.7.3]

1208.8.3 Regulator Protection. Pressure regulators shall be protected against physical damage. [NFPA 54:5.7.4]

1208.8.4 Regulator Vents. Regulator vents shall be in accordance with Section 1208.16. [NFPA 54:5.7.5]

1208.8.8 Identification. Line pressure regulators at multiple regulator installations shall be marked by a metal tag or other permanent means designating the building or the part of the building being supplied. [NFPA 54:5.7.6]

1208.9 Overpressure Protection Required. Where the serving gas supplier delivers gas at a pressure greater than 2 psi (14 kPa) for piping systems serving appliances designed to operate at a gas pressure of 14 inches water column (3.5 kPa) or less, overpressure protection devices shall be installed. Piping systems serving equipment designed to operate at inlet pressures greater than 14 inches water column (3.5 kPa) shall be equipped with overpressure protection devices as required by the appliance manufacturer’s installation instructions. [NFPA 54:5.8.1]

1208.10 Overpressure Protection Devices. Overpressure protection devices shall be of the following:

(1) Pressure relief valve.
(2) Monitor regulator.
(3) Series regulator installed upstream from the line regulator and set to continuously limit the pressure on the inlet of the line regulator to the maximum values specified by Section 1208.11 or less.
(4) Automatic shutoff device installed in series with the line pressure regulator and set to shut off when the pressure on the downstream piping system reaches the maximum values specified by Section 1208.11 or less. This device shall be designed so that it will remain closed until manually reset. [NFPA 54:5.8.3.1]

1208.10.1 Separate Devices. The devices in Section 1208.10 shall be installed either as an integral part of the service line or pressure regulator or as separate units. Where separate overpressure protection devices are installed, they shall comply with Section 1208.10.2 through Section 1208.10.7. [NFPA 54:5.8.3.2]

1208.10.2 Construction and Installation. All overpressure protection devices shall meet the following requirements:

(1) Be constructed of materials so that the operation of the device is not impaired by corrosion of external parts by the atmosphere or of internal parts by the gas.
(2) Be designed and installed so they can be operated to determine whether the valve is free. The devices shall also be designed and installed so they can be tested to determine the pressure at which they operate and be examined for leakage when in the closed position. [NFPA 54:5.8.4]

1208.10.3 External Control Piping. External control piping shall be designed and installed so that damage to the control piping of one device does not render both the regulator and the overpressure protective device inoperative. [NFPA 54:5.8.5]

1208.10.4 Setting. Each pressure limiting or pressure relieving device shall be set so that the gas pressure supplied to the connected appliance(s) does not exceed the limits specified in Section 1208.11 and Section 1208.11.1. [NFPA 54:5.8.6]

1208.10.5 Unauthorized Operation. Where unauthorized operation of any shutoff valve could render a pressure relieving valve or pressure limiting device inoperative, one of the following shall be accomplished:

(1) The valve shall be locked in the open position. Instruct authorized personnel in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises.
(2) Duplicate relief valves shall be installed, each having adequate capacity to protect the system, and arrange the isolating valves or three-way valve so that only one relief valve can be rendered inoperative at a time. [NFPA 54:5.8.7]

1208.10.6 Discharge of Vents. The discharge stacks, vents, or outlet parts of all pressure relieving and pressure...
limiting devices shall be located so that gas is safely discharged to the outdoors. Discharge stacks or vents shall be
designed to prevent the entry of water, insects, or other foreign material that could cause blockage.
The discharge stack or vent line shall be at least the same size as the outlet of the pressure relieving device. [NFPA 54:5.8.8.1 – 5.8.8.2]

1208.10.7 Size of Fittings, Pipe, and Openings. The fittings, pipe, and openings located between the system to be
protected and the pressure relieving device shall be sized to prevent hammering of the valve and to prevent impairment of
relief capacity. [NFPA 54:5.8.9]

1208.11 Pressure Limitation Requirements. Where piping systems serving appliances designed to operate with a gas
supply pressure of 14 inches water column (3.5 kPa) or less are required to be equipped with overpressure protection
by Section 1208.9, each overpressure protection device shall be adjusted to limit the gas pressure to each connected appliance
to 2 psi (14 kPa) or less upon a failure of the line pressure regulator. [NFPA 54:5.8.2.1]

1208.10 Overpressure Protection Required. Where piping systems serving appliances designed to operate with a
gas supply pressure greater than 14 inches water column (3.5 kPa) are required to be equipped with overpressure
protection by Section 1208.9, each overpressure protection device shall be adjusted to limit the gas pressure to each
connected appliance as required by the appliance manufacturer’s installation instructions. [NFPA 54:5.8.2.2]

1208.11.2 Overpressure Protection Devices. Each overpressure protection device installed to meet the requirements
of this section shall be capable of limiting the pressure to its connected appliance(s) as required by this section
independently of any other pressure control equipment in the piping system. [NFPA 54:5.8.2.3]

1208.11.3 Detection of Failure. Each gas piping system for which an overpressure protection device is required by this
section shall be designed and installed so that a failure of the primary pressure control device(s) is detectable. [NFPA 54:5.8.2.4]

1208.11.4 Flow Capacity. If a pressure relief valve is used to meet the requirements of this section, it shall have a flow
capacity such that the pressure in the protected system is maintained at or below the limits specified in Section 1208.11
under the following conditions:
(1) The line pressure regulator for which the relief valve is providing overpressure protection has failed wide open.
(2) The gas pressure at the inlet of the line pressure regulator for which the relief valve is providing overpressure
protection is not less than the regulator’s normal operating inlet pressure. [NFPA 54:5.8.2.5]

1208.12 Backpressure Protection. Protective devices shall be installed as close to the equipment as practical where
the design of equipment connected is such that air, oxygen, or standby gases could be forced into the gas supply
system.
Gas and air combustion mixers incorporating double diaphragm “zero” or “atmosphere” governors or regulators shall
require no further protection unless connected directly to compressed air or oxygen at pressures of 5 psi (34 kPa) or
more. [NFPA 54:5.9.1.1 – 5.9.1.2]

1208.12.1 Protective Devices. Protective devices shall include but not be limited to the following:
(1) Check valves
(2) Three-way valves (of the type that completely closes one side before starting to open the other side)-
(3) Reverse flow indicators controlling positive shutoff valves
(4) Normally closed air-actuated positive shutoff pressure regulators [NFPA 54:5.9.2]

1208.13 Low-Pressure Protection. A protective device shall be installed between the meter and the appliance or
equipment if the operation of the appliance or equipment is such that it could produce a vacuum or a dangerous
reduction in gas pressure at the meter. Such protective devices include, but are not limited to, mechanical, diaphragm-
operated, or electrically operated low-pressure shutoff valves. [NFPA 54:5.10]

1208.14 Shutoff Valves. Shutoff valves shall be selected in accordance with Table 1208.14. Shutoff valves of size 1
inch (25 mm) National Pipe Thread and smaller shall be listed and labeled. Where used outdoors, such use shall be in
accordance with the manufacturer's recommendation. [NFPA 54:5.11]

1208.15 Expansion and Flexibility. Piping systems shall be designed to prevent failure from thermal expansion or
contraction. [NFPA 54:5.13.1]

1208.15.1 Special Local Conditions. Where local conditions include earthquake, tornado, unstable ground, or flood
hazards, special consideration shall be given to increased strength and flexibility of piping supports and connections.
[NFPA 54:5.13.2]

1208.16 Pressure Regulator and Pressure Control Venting. The venting of the atmospheric side of diaphragms in
line pressure regulators, gas appliance regulators, and gas pressure limit controls shall be in accordance with all of the
following:
(1) An independent vent pipe to the outdoors, sized in accordance with the device manufacturer's instructions, shall be
provided where the location of a device is such that a discharge of fuel gas will cause a hazard. For devices other than
appliance regulators, vents are not required to be independent where the vents arc connected to a common manifold
designed in accordance with engineering methods to minimize backpressure in the event of diaphragm failure and such
design is approved.

Exceptions:
(1) A regulator and vent limiting means combination listed as complying with ANSI Z21.80/CSA 6.22, shall not be
required to be vented to the outdoors.
(2) A listed gas appliance regulator factory equipped with a vent limiting device is not required to be vented to the
outdoors.
(3) Materials for vent piping shall be in accordance with Section 1208.6 through Section 1208.6.13.5.
(4) The vent terminus shall be designed to prevent the entry of water, insects, and other foreign matter that could cause
blockage.
(4) Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas
pressure control devices.
(5) Vents shall terminate not less than 3 feet (914 mm) from a possible source of ignition.
(6) At locations where a vent termination could be submerged during floods or snow accumulations, an antiflood-type breather vent fitting shall be installed, or the vent terminal shall be located above the height of the expected flood waters or snow.

(7) Vent piping from pressure regulators and gas pressure controls shall not be connected to a common manifold that serves a bleed line from a diaphragm-type gas valve. [NFPA 54:5.14]

1209.1 General. Where automatic excess flow valves are installed, they shall be listed in accordance with ANSI Z21.93/CSA 6.30 and shall be sized and installed in accordance with the manufacturers’ instructions. [NFPA 54:5.12]

1210.1 Piping Underground. Underground gas piping shall be installed with sufficient clearance from any other underground structure to avoid contact therewith, to allow maintenance, and to protect against damage from proximity to other structures. Underground plastic piping shall be installed with sufficient clearance or shall be insulated from any source of heat so as to prevent the heat from impairing the serviceability of the pipe. [NFPA 54:7.1.1.1 – 7.1.1.2]

1210.1.1 Cover Requirements. Underground piping systems shall be installed with a minimum of 12 inches (305 mm) of cover. The minimum cover shall be increased to 18 inches (457 mm) if external damage to the pipe or tubing from external forces is likely to result. Where a minimum of 12 inches (305 mm) of cover cannot be provided, the piping shall be installed in conduit. [NFPA 54:7.1.2.1 – 7.1.2.1(B)]

1210.1.5 Piping through Foundation Wall. Piping through a foundation wall shall comply with all of the following:
(1) Underground piping, where installed through the outer foundation or basement wall of a building, shall be encased in a protective sleeve or protected by an approved device or method.
(2) The spaces between the gas piping and the sleeve and between the sleeve and the wall shall be sealed to prevent entry of gas and water.
(3) Sealing materials shall be compatible with the piping and sleeve. [NFPA 54:7.1.5]

1210.1.7 Connections of Plastic Piping. Plastic piping shall be installed outdoors, underground only. Exceptions:
(1) Plastic piping shall be permitted to terminate aboveground where an anodeless riser is used.
(2) Plastic piping shall be permitted to terminate with a wall head adapter aboveground in buildings, including basements, where the plastic piping is inserted in a piping material permitted for use in buildings. [NFPA 54:7.1.7.1]

1210.3 Installation of Aboveground Piping. Piping installed aboveground shall comply with all of the following:
(1) Piping shall be securely supported and located where it will be protected from physical damage.
(2) Where passing through an exterior wall, the piping shall also be protected from corrosion by coating or wrapping with an inert material approved for such applications.
(3) The piping shall be sealed around its circumference at the point of the exterior penetration to prevent the entry of water, insects, and rodents.
(4) Where piping is encased in a protective pipe sleeve, the annular spaces between the gas piping and the sleeve and between the sleeve and the wall opening shall be sealed.
(5) Piping installed outdoors shall be elevated not less than 3½ inches (89 mm) above the ground.
(6) Sealing materials shall be compatible with the piping and sleeve. [NFPA 54:7.2.1]

1210.3.5.3 Piping on Roofs. Gas piping installed on the roof surfaces shall be supported in accordance with Table 1210.3.5.1. Gas piping shall be elevated not less than 3½ inches (89 mm) above the roof surface. [NFPA 54:7.2.6.4.1, 7.2.6.4.2]

1210.4.4 Industrial Occupancies. In industrial occupancies, gas piping in solid floors such as concrete shall be laid in channels in the floor and covered to permit access to the piping with a minimum of damage to the building. Where piping in floor channels could be exposed to excessive moisture or corrosive substances, the piping shall be protected in an approved manner. [NFPA 54:7.3.5.1]

1210.4.5 Other Occupancies. In other than industrial occupancies and where approved by the Authority Having Jurisdiction, gas piping embedded in concrete floor slabs constructed with portland cement shall be surrounded with a minimum of 1½ inches (38 mm) of concrete and shall not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. All piping, fittings, and risers shall be protected against corrosion in accordance with Section 1210.3.1. Piping shall not be embedded in concrete slabs containing quickset additives or cinder aggregate. [NFPA 54:7.3.5.2]

1210.9 Manual Gas Shutoff Valves. An accessible gas shutoff valve shall be provided upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve shall not be required at the second regulator. [NFPA 54:7.8.2]

1210.9.1 Accessibility of Gas Valves. System shutoff valves shall be readily accessible for operation and installed so as to be protected from physical damage. System shutoff valves shall be marked with a metal tag or other permanent means attached by the installing agency so that the gas piping systems supplied through them can be readily identified. [NFPA 54:7.8.1.1 – 7.8.1.2]

1210.9.2 Shutoff Valves for Multiple House Lines. In multiple-tenant buildings supplied through a master meter, through one service regulator where a meter is not provided, or where meters or service regulators are not readily accessible from the appliance or equipment location, an individual shutoff valve for each apartment or tenant line shall be provided at a convenient point of general accessibility. In a common system serving a number of individual buildings, shutoff valves shall be installed at each building. [NFPA 54:7.8.3.1]
1210.9.3 Emergency Shutoff Valves. An exterior shutoff valve to permit turning off the gas supply to each building in an emergency shall be provided. The emergency shutoff valves shall be plainly marked as such and their locations posted as required by the Authority Having Jurisdiction. [NFPA 54:7.8.3.2]

1210.9.4 Shutoff Valve for Laboratories. Each laboratory space containing two or more gas outlets installed on tables, benches, or in hoods in educational, research, commercial and industrial occupancies shall have a single shutoff valve through which all such gas outlets are supplied. The shutoff valve shall be accessible, located within the laboratory or adjacent to the laboratory’s egress door, and identified. [NFPA 54:7.8.3.3]

1210.9.5 System Shutoff Valves. Where a system shutoff valve is installed, the valve shall comply with Section 1208.14. [NFPA 54:7.8.4]

1210.12.5 Installation of Gas-Mixing Machines. Installation of gas-mixing machines shall comply with Section 1210.12.5.1 through Section 1210.12.5.5.

1210.12.5.1 Location. The gas-mixing machine shall be located in a well-ventilated area or in a detached building or cutoff room provided with room construction and explosion vents in accordance with engineering methods. Such rooms or below-grade installations shall have adequate positive ventilation. [NFPA 54:7.11.5.1]

1210.12.5.2 Electrical Requirements. Where gas-mixing machines are installed in well-ventilated areas, the type of electrical equipment shall be in accordance with NFPA 70 for general service conditions unless other hazards in the area prevail. Where gas-mixing machines are installed in small detached buildings or cutoff rooms, the electrical equipment and wiring shall be installed in accordance with NFPA 70 for hazardous locations (Articles 500 and 501, Class I, Division 2). [NFPA 54:7.11.5.2]

1210.12.5.3 Air Intakes. Air intakes for gas-mixing machines using compressors or blowers shall be taken from outdoors whenever practical. [NFPA 54:7.11.5.3]

1210.12.5.4 Controls. Controls for gas-mixing machines shall include interlocks and a safety shutoff valve of the manual reset type in the gas supply connection to each machine arranged to automatically shut off the gas supply in the event of high or low gas pressure. Except for open burner installations only, the controls shall be interlocked so that the blower or compressor stops operating following a gas supply failure. Where a system employs pressurized air, means shall be provided to shut off the gas supply in the event of air failure. [NFPA 54:7.11.5.4]

1210.12.5.5 Installation in Parallel. Centrifugal gas-mixing machines in parallel shall be reviewed by the user and equipment manufacturer before installation, and means or plans for minimizing the effects of downstream pulsation and equipment overload shall be prepared and utilized as needed. [NFPA 54:7.11.5.5]

1210.12.6 Use of Automatic Firechecks, Safety Blowouts, or Backfire Preventers. Automatic firechecks and safety blowouts or backfire preventers shall be provided in piping systems distributing flammable air-gas mixtures from gas-mixing machines to protect the piping and the machines in the event of flashback, in accordance with the following:

1. Approved automatic firechecks shall be installed upstream as close as practical to the burner inlets following the firecheck manufacturers’ instructions.

2. A separate manually operated gas valve shall be provided at each automatic firecheck for shutting off the flow of the gas-air mixture through the firecheck after a flashback has occurred. The valve shall be located upstream as close as practical to the inlet of the automatic firecheck.

Caution: These valves shall not be reopened after a flashback has occurred until the firecheck has cooled sufficiently to prevent re-ignition of the flammable mixture and has been reset properly.

3. A safety blowout or backfiring preventer shall be provided in the mixture line near the outlet of each gas-mixing machine where the size of the piping is larger than 2 ½ inches (65 mm) NPS, or equivalent, to protect the mixing equipment in the event of an explosion passing through an automatic firecheck. The manufacturers’ instructions shall be followed when installing these devices, particularly after a disc has burst. The discharge from the safety blowout or backfire preventer shall be located or shielded so that particles from the ruptured disc cannot be directed toward personnel. Wherever there are interconnected installations of gas-mixing machines with safety blowouts or backfire preventers, provision shall be made to keep the mixture from other machines from reaching any ruptured disc opening. Check valves shall not be used for this purpose.

4. Large-capacity premix systems provided with explosion heads (rupture discs) to relieve excessive pressure in pipelines shall be located at and vented to a safe outdoor location. Provisions shall be provided for automatically shutting off the supply of the gas-air mixture in the event of rupture. [NFPA 54:7.11.6]

1210.9.5 System Shutoff Valves. Where a system shutoff valve is installed, the valve shall comply with Section 1208.14. [NFPA 54:7.8.4]

1212.1 Connecting Appliances and Equipment. Appliances and equipment shall be connected to the building piping in compliance with Section 1212.6 through Section 1212.8 by one of the following:

1. Rigid metallic pipe and fittings.

2. Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing shall not be used in exterior locations.

3. A connector for gas appliances listed in accordance with ANSI Z21.24/CSA 6.27. The connector shall be used in accordance with the manufacturer’s installation instructions and shall be in the same room as the appliance. Only one connector shall be used per appliance.

4. A connector for outdoor gas appliances and manufactured homes listed in accordance with ANSI Z21.75/CSA 6.27. Only one connector shall be used per appliance.

5. CSST where installed in accordance with the manufacturer’s installation instructions. CSST shall not be directly routed into a metallic appliance enclosure where the appliance is connected to a metallic vent that terminates above a roofline. CSST shall connect only to appliances that are fixed in place.

6. Listed nonmetallic gas hose connectors in accordance with Section 1212.3.

7. Unlisted gas hose connectors for use in laboratories and educational facilities in accordance with Section 1212.4. [NFPA 54:9.6.1]
1212.1.1 Food Service Appliance Connectors. Connectors used with food service appliances that are moved for cleaning and sanitation purposes shall be installed in accordance with the connector manufacturer’s installation instructions. Such connectors shall be listed in accordance with ANSI Z21.69/CSA 6.16. [NFPA 54:9.6.1.3]

1212.7 Quick-Disconnect Devices. Quick-disconnect devices used to connect appliances to the building piping shall be listed in accordance with ANSI Z21.41/CSA 6.9. Where installed indoors, an approved manual shutoff valve with a nondisplaceable valve member shall be installed upstream of the quick-disconnect device. [NFPA 54:9.6.6.1 – 9.6.6.2]

**TABLE 1208.4.1 APPROXIMATE GAS INPUT FOR TYPICAL APPLIANCES**

<table>
<thead>
<tr>
<th>APPLIANCE</th>
<th>INPUT (Btu/h approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Space Heating Units</strong></td>
<td></td>
</tr>
<tr>
<td>Warm air furnace</td>
<td></td>
</tr>
<tr>
<td>Single family</td>
<td>100 000</td>
</tr>
<tr>
<td>Multifamily, per unit</td>
<td>60 000</td>
</tr>
<tr>
<td>Hydronic boiler</td>
<td></td>
</tr>
<tr>
<td>Single family</td>
<td>100 000</td>
</tr>
<tr>
<td>Multifamily, per unit</td>
<td>60 000</td>
</tr>
<tr>
<td><strong>Space and Water Heating Units</strong></td>
<td></td>
</tr>
<tr>
<td>Hydronic boiler</td>
<td></td>
</tr>
<tr>
<td>Single-family</td>
<td>120 000</td>
</tr>
<tr>
<td>Multifamily, per unit</td>
<td>75 000</td>
</tr>
<tr>
<td><strong>Water Heating Appliances</strong></td>
<td></td>
</tr>
<tr>
<td>Water heater, automatic storage</td>
<td></td>
</tr>
<tr>
<td>30 to 40 gallon tank</td>
<td>35 000</td>
</tr>
<tr>
<td>Water heater, automatic storage</td>
<td></td>
</tr>
<tr>
<td>50 gallon tank</td>
<td>50 000</td>
</tr>
<tr>
<td>Water heater, automatic instantaneous</td>
<td></td>
</tr>
<tr>
<td>Capacity at 2 gallons per minute</td>
<td>142 800</td>
</tr>
<tr>
<td>Capacity at 4 gallons per minute</td>
<td>285 000</td>
</tr>
<tr>
<td>Capacity at 6 gallons per minute</td>
<td>428 400</td>
</tr>
<tr>
<td>Water heater, domestic, circulating or side-arm</td>
<td>35 000</td>
</tr>
<tr>
<td><strong>Cooking Appliances</strong></td>
<td></td>
</tr>
<tr>
<td>Range, freestanding, domestic</td>
<td>65 000</td>
</tr>
<tr>
<td>Built-in oven or broiler unit, domestic</td>
<td>25 000</td>
</tr>
<tr>
<td>Built-in top unit, domestic</td>
<td>40 000</td>
</tr>
<tr>
<td><strong>Other Appliances</strong></td>
<td></td>
</tr>
<tr>
<td>Refrigerator</td>
<td>3000</td>
</tr>
<tr>
<td>Clothes dryer, Type 1 (domestic)</td>
<td>35 000</td>
</tr>
<tr>
<td>Gas fireplace direct-vent</td>
<td>40 000</td>
</tr>
<tr>
<td>Gas log</td>
<td>80 000</td>
</tr>
<tr>
<td>Barbecue</td>
<td>40 000</td>
</tr>
<tr>
<td>Gas light</td>
<td>2500</td>
</tr>
</tbody>
</table>

For SI units: 1000 British thermal units per hour = 0.293 kW
### TABLE 1208.6.9.2
SPECIFICATIONS FOR THREADING METALLIC PIPE
[NFPA 54: TABLE 5.5.6.3]

<table>
<thead>
<tr>
<th>IRON PIPE SIZE (inches)</th>
<th>APPROXIMATE LENGTH OF THREADED PORTION (inches)</th>
<th>APPROXIMATE NUMBER OF THREADS TO BE CUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>½</td>
<td>¾</td>
<td>10</td>
</tr>
<tr>
<td>¾</td>
<td>¾</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>7/8</td>
<td>10</td>
</tr>
<tr>
<td>1¼</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>1½</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2½</td>
<td>1½</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>1½</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>1⁵/₈</td>
<td>13</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

### TABLE 1208.14
MANUAL GAS VALVE STANDARDS
[NFPA 54: TABLE 5.11]

<table>
<thead>
<tr>
<th>SHUTOFF VALVE APPLICATION</th>
<th>STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliance shutoff valve up to ½ psi</td>
<td>ANSI Z21.15/CSA 9.1</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.44</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32</td>
</tr>
<tr>
<td>Valve up to ½ psi</td>
<td>ANSI/ASME B16.44</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32</td>
</tr>
<tr>
<td>Valve up to 2 psi</td>
<td>ANSI/ASME B16.44 labeled 2G</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B 16.44 labeled 2G or labeled 5G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td>Valve up to 5 psi</td>
<td>ANSI/ASME B16.44 labeled 5G</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.44 marked 5G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td>Valve up to 125 psi</td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.33 marked 125 G</td>
</tr>
</tbody>
</table>

For SI Units: 1 pound-force per square inch = 6.8947 kPa
### TABLE 1210.3.5.1
SUPPORT OF PIPING
[NFPA 54: TABLE 7.2.6.2]

<table>
<thead>
<tr>
<th>STEEL PIPE, NOMINAL SIZE OF PIPE (inches)</th>
<th>SPACING OF SUPPORTS (feet)</th>
<th>NOMINAL SIZE OF TUBING SMOOTH WALL (inches O.D.)</th>
<th>SPACING OF SUPPORTS (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½</td>
<td>6</td>
<td>½</td>
<td>4</td>
</tr>
<tr>
<td>¾ or 1</td>
<td>8</td>
<td>⅞ or ⅝</td>
<td>6</td>
</tr>
<tr>
<td>1¼ or larger (horizontal)</td>
<td>10</td>
<td>⅞ or ⅝ (horizontal)</td>
<td>8</td>
</tr>
<tr>
<td>1¼ or larger (vertical)</td>
<td>Every floor level</td>
<td>1 or larger (vertical)</td>
<td>Every floor level</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

### TABLE 1215.2(27)
SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.3.1(d)]*

| GAS: UNDILUTED PROPANE | INLET PRESSURE: 11.0 in. w.c. | PRESSURE DROP: 0.5 in. w.c. | SPECIFIC GRAVITY: 1.50 |

** INTENDED USE: PIPE SIZING BETWEEN SINGLE- OR SECOND-STAGE (LOW-PRESSURE) REGULATOR AND APPLIANCE **

<table>
<thead>
<tr>
<th>PIPE SIZE (inch)</th>
<th>NOMINAL INSIDE: ½</th>
<th>¼</th>
<th>1</th>
<th>1¼</th>
<th>1½</th>
<th>2</th>
<th>2½</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>NOMINAL INSIDE: ½</td>
<td>291</td>
<td>418</td>
<td>624</td>
<td>892</td>
<td>1340</td>
<td>2570</td>
<td>4100</td>
<td>7250</td>
<td>14 800</td>
</tr>
<tr>
<td>ACTUAL: 0.622</td>
<td>608</td>
<td>827</td>
<td>1150</td>
<td>1620</td>
<td>2420</td>
<td>4660</td>
<td>7430</td>
<td>13 100</td>
<td>26 800</td>
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<td>LENGTH (feet)</td>
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<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
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<tr>
<td>CAPACITY IN THOUSANDS OF BTU PER HOUR</td>
<td>200</td>
<td>418</td>
<td>624</td>
<td>892</td>
<td>1340</td>
<td>2570</td>
<td>4100</td>
<td>7250</td>
<td>14 800</td>
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<td>10</td>
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<td>200</td>
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</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm
TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME B16.33-2012 (R2017)</td>
<td>Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 175 psi (Sizes NPS 1/2 through NPS 2)</td>
<td>Valves</td>
<td>Table 1208.14</td>
</tr>
<tr>
<td>ASME B16.44-2012 (R2017)</td>
<td>Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems up to 5 psi</td>
<td>Valves</td>
<td>Table 1208.14</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

COMMITTEE STATEMENT:
UL 651 is a standard for electric conduit and not vent piping. The reference to UL 651 is being removed to avoid confusion and to avoid the use of an incorrect fuel gas vent piping. Furthermore, the reference to the PVC "Schedule 40 and 80" is needed to prevent the use of thinner materials.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 246, Section 1208.6.6 (Regulator Vent Piping) and UPC Table 1701.1 (Referenced Standards); and Section 1212.2 (Suspended Low-Intensity Infrared Tube Heaters) and UPC Section 1212.1 (Connecting Appliances and Equipment) resulted in conflicting language between the code. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL-651-2014</td>
<td>Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings (with revisions through June 15, 2016)</td>
<td>-Piping</td>
<td>1208.6.6</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)
1212.2 Suspended Low-Intensity Infrared Tube Heaters. Suspended low-intensity infrared tube heaters shall be connected to the building piping system with a connector listed for the application in accordance with ANSI Z21.24/CSA 6.27 CSA-Z21.24 as follows:
(1) The connector shall be installed in accordance with the tube heater installation instructions and shall be in the same room as the appliance.
(2) Only one connector shall be used per appliance. [NFPA 54:9.6.1.5]

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT:
The UL 651 standard is being stricken from UPC Table 1701.1 (Referenced Standards) to correlate with the actions taken by the UPC TC for Item # 246, Section 1208.6.6 (Regulator Vent Piping) with regards to striking the reference to the UL 651 standard from the section.

Additionally, the language in UPC Section 1212.2 (Suspended Low-Intensity Infrared Tube Heaters) is being revised to correlate with the action taken by the UPC TC for Item # 246, Section 1212.1 (Connecting Appliances and Equipment) regarding the designation of the CSA standards.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Table 1701.1 by striking the UL 651 standard, and Section 1212.2 by updating the designation of the CSA standard.
Proposals

Item #: 247
UPC 2024  Section: 1208.6

SUBMITTER: Phillip H Ribbs  
PHR Consultants  

RECOMMENDATION:  
Revise text  

1208.0 Gas Piping System Design, Materials, and Components.

1208.6 Acceptable Piping Materials and Joining Methods: Materials used for piping systems shall either comply with the requirements of this chapter Section 1208.6.1 through Section 1208.6.7.3 or be acceptable to the Authority Having Jurisdiction. [NFPA 54:5.5.1.1]

SUBSTANTIATION:  
The phrase “this chapter” is being changed to “Section 1208.6.1 through Section 1208.6.7.3” to clarify that the piping material requirements from those subsections of Section 1208.6 shall comply to aid the code official in approving piping materials. The last part of the sentence is being removed as the AHJ is already authorized by Chapter 1 and 3 to approve/accept materials.

COMMITTEE ACTION: ACCEPT AS SUBMITTED  

TOTAL ELIGIBLE TO VOTE: 26  

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 248
UPC 2024  Section: 1208.6.4.5, Table 1701.1

SUBMITTER: Robert Torbin
OmegaFlex

RECOMMENDATION: Revise text

1208.6.4 Metallic Tubing. (remaining text unchanged)

1208.6.4.5 Corrugated Stainless Steel Tubing. Corrugated stainless steel tubing shall be listed in accordance with CSA LC 1. [NFPA 54:5.6.3.6] Corrugated stainless steel tubing shall also comply with IAPMO IGC 201 when a listed encasement system is required.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 201-2018</td>
<td>Polyethylene Sleeved-Corrugated Stainless-Steel Tubing for use in Fuel Gas Piping Systems</td>
<td>Gas Tubing</td>
<td>1208.6.4.5</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION: The proposed standard covers polyethylene sleeved-corrugated stainless steel tubing (CSST) which is used in fuel gas systems. PE sleeved CSST have been tested and installed for over 10 years and continues to be installed today. Reference to the proper standard for this product will ensure public health and safety by clearly identifying products that are approved for this application assisting to the installers, inspectors, and other end users of the code.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT: The term "encasement" may be misinterpreted to be a conduit and its application is not clear.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 Daniels

EXPLANATION OF AFFIRMATIVE: BALLANCO: The standard has technical merit. The text needs to clarify the application of the standard.

EXPLANATION OF NEGATIVE: WHITE: This standard provides solutions to specific gas installations and should be included in the code.
Item #: 249

UPC 2024  Section: 1210.1.3.2

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

1210.0 Gas Piping Installation.
1210.1 Piping Underground. (remaining text unchanged)

1210.1.3 Protection Against Corrosion. (remaining text unchanged)

1210.1.3.2 Underground Piping. Underground piping shall comply with one or more of the following unless approved technical justification is provided to demonstrate that protection is unnecessary:

(1) The piping shall be made of corrosion-resistant material that is suitable for the environment in which it will be installed.
(2) Pipe shall have a factory-applied, electrically insulating coating. Fittings and joints between sections of coated pipe shall be coated in accordance with the coating manufacturer’s instructions.
(3) The piping shall have a cathodic protection system installed, and the system shall be maintained in accordance with Section 1210.1.3.3 or Section 1210.1.3.6. [NFPA 54:7.1.3.2]

1210.1.3.2 Underground Piping. Underground metallic gas piping shall be protected from corrosion by approved coatings or wrapping materials. Gas pipe protective coatings shall be in accordance with the following:

(1) Approved types, factory-applied, and conform to approved standards.
(2) Field wrapping shall provide equivalent protection and is restricted to those sections and fittings that are necessarily stripped for threading or welding.
(3) Risers shall be coated or wrapped to a point at least 6 inches (152 mm) above ground.

SUBSTANTIATION:
The above recommended language gives specific direction on how to protect underground gas piping. The current section is not clear as to what requirements are required.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The existing extracted language sufficiently states the intent of the section with regards to corrosion control of underground gas pipe.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 250
UPC 2024 Section: 1210.4.1

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

1210.0 Gas Piping Installation.

1210.4 Concealed Piping in Buildings. (remaining text unchanged)

1210.4.1 Connections. Where gas piping is to be concealed, connections shall be of the following type:
(1) Pipe fittings such as elbows, tees, couplings, and right/left nipple/couplings.
(2) Joining tubing by brazing (see Section 1208.6.10.1).
(3) Press-connect fittings listed to CSA LC 4.
(4) CSST fittings listed to CSA LC 1.
(5) Where necessary to insert fittings into a gas pipe system that has been installed in a concealed location, the pipe shall be reconnected by welding, flanges, or the use of a right/left nipple/coupling.

SUBSTANTIATION:
This change will clarify that fittings are inserted into “systems” not into gas pipes.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 251

UPC 2024  Section: 1215.2.1, 1215.2.2

SUBMITTER: Jonathan D Sargeant  
Omegaflex

RECOMMENDATION:  
Revise text

1215.0 Required Gas Piping Size.

1215.2 Sizing of Gas Piping Systems. (remaining text unchanged)
1215.2.1 Natural Gas Piping Systems. Table 1215.2(1) through Table 1215.2(23) or sizing tables included in a listed piping system manufacturers' installation instructions shall be used in conjunction with one of the methods described in Section 1215.1.1 through Section 1215.1.3 for piping materials other than non-corrugated stainless steel tubing. Section 1215.3 shall be used in conjunction with one of the methods described in Section 1215.1.1 through Section 1215.1.3 for non-corrugated stainless steel tubing. [NFPA 54:6.2.1, 6.2.2]

1215.2.2 Propane Piping Systems. Table 1215.2(24) through Table 1215.2(36) or sizing tables included in a listed piping system manufacturers' installation instructions shall be used in conjunction with one of the methods described in Section 1215.1.1 through Section 1215.1.3 for piping materials other than non-corrugated stainless steel tubing. Section 1215.3 shall be used in conjunction with one of the methods described in Section 1215.1.1 through Section 1215.1.3 for non-corrugated stainless steel tubing. [NFPA 54:6.3.1, 6.3.2]

(for information only)
1208.4.2 Sizing Methods. Gas piping shall be sized in accordance with one of the following:
(1) Pipe sizing tables or sizing equations in this chapter.
(2) Other approved engineering methods.
(3) Sizing tables included in a listed piping system manufacturer's installation instructions. [NFPA 54:5.4.3]

SUBSTANTIATION:  
To make Section 1215.2.1 and Section 1215.2.2 consistent with Section 1208.4.2. Sizing Methods Include the tables in CSST manufacturers' design and installation guides.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:  
The code contains a nationally recognized sizing table for fuel gas. The proposed change will allow any fuel gas sizing table to be used, which may not be equivalent to the minimum requirements in the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  
AFFIRMATIVE: 23  NEGATIVE: 2  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:  
BALLANCO: Some manufacturers provide more accurate sizing tables that are a part of their listings. The use of these tables should be allowed in the code.

WHITE: Specific manufacturer's systems could have specific sizing information and should be allowed by the code when it is a listed system.
Proposals

Item #: 252

UPC 2024  Section: Chapter 13

SUBMITTER: IAPMO Staff - Update Extracts
NFPA 99 Extract Update

RECOMMENDATION:
Revise text

205.0   – C –
Category 1. Activities, systems, or equipment whose failure is likely to cause major injury or death to patients, staff, or visitors. [NFPA 99:3.3.158.1-3.3.162.1]
Category 2. Activities, systems, or equipment whose failure is likely to cause minor injury to patients, staff, or visitors. [NFPA 99:3.3.158.2-3.3.162.2]
Category 3. Activities, systems, or equipment whose failure is not likely to cause injury to patients, staff, or visitors, but can cause discomfort. [NFPA 99:3.3.158.3-3.3.162.3]
Category 3 Vacuum System. A Category 3 vacuum distribution system that can be either a wet system designed to remove liquids, air-gas, or solids from the treated area; or a dry system designed to trap liquid and solids before the service inlet and to accommodate air-gas only through the service inlet. [NFPA 99:3.3.158.4-3.3.162.4]

209.0   – G –
General Anesthesia and Levels of Sedation/Analgesia.
Deep Sedation/Analgesia. A drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained. [NFPA 99:3.3.66.2-3.3.68.2]
General Anesthesia. A drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired. [NFPA 99:3.3.66.1-3.3.68.1]
Minimal Sedation (Anxiolysis). A drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected. [NFPA 99:3.3.66.4-3.3.68.4]
Moderate Sedation/Analgesia (Conscious Sedation). A drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained. [NFPA 99:3.3.66.3-3.3.68.3]

210.0   – H –
Health Care Facility’s Governing Body. The person or persons who have the overall legal responsibility for the operation of a health care facility. [NFPA 99:3.3.72-3.3.74]

215.0   – M–
Medical Air. For the purposes of this code, medical air is air supplied from cylinders, bulk containers, or medical air compressors, or reconstituted from oxygen USP and oil-free, dry nitrogen NF. [NFPA 99:3.3.96-3.3.106]
Medical Gas. A patient medical gas or medical support gas. (See also Patient Medical Gas, and Medical Support Gas) [NFPA 99:3.3.104-3.3.108]

Manifold. A device for connecting the outlets of one or more gas cylinders to the central piping system for that specific gas. [NFPA 99:3.3.99-3.3.103]

Medical Gas System. An assembly of equipment and piping for the distribution of nonflammable medical gases such as oxygen, nitrous oxide, compressed air, carbon dioxide, and helium. [NFPA 99:3.3.106-3.3.109]

Medical Support Gas. Nitrogen or instrument air used for any medical support purpose (e.g., to remove excess moisture from instruments before further processing, or to operate medical-surgical tools, air-driven booms, pendants, or similar applications) and, if appropriate to the procedures, used in laboratories and are not respired as part of any treatment. Medical support gas falls under the general requirements for medical gases. [NFPA 99:3.3.107-3.3.111]

Medical-Surgical Vacuum. A method used to provide a source of drainage, aspiration, and suction in order to remove body fluids from patients. [NFPA 99:3.3.108-3.3.112]

Medical-Surgical Vacuum System. An assembly of central vacuum-producing equipment and a network of piping for patient suction in medical, medical-surgical, and waste anesthetic gas disposal (WAGD) applications. [NFPA 99:3.3.109-3.3.113]

216.0  — N —

Nitrogen, NF. Nitrogen complying as a minimum; with nitrogen NF. [NFPA 99:3.3.109.1-3.3.119.1]

218.0  — P —

Patient Care Space. Any space of a health care facility wherein patients are intended to be examined or treated. [NFPA 99:3.3.140-3.3.144]

Category 1 Space. Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [NFPA 99:3.3.140.1-3.3.140.2]

Category 2 Space. Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [NFPA 99:3.3.140.3-3.3.140.4]

Category 3 Space. Space in which the failure of equipment or a system is not likely to cause injury to patients, staff, or visitors but can cause discomfort. [NFPA 99:3.3.140.5-3.3.140.6]

Category 4 Space. Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [NFPA 99:3.3.140.7-3.3.140.8]

Patient Medical Gas. Piped gases such as oxygen, nitrous oxide, helium, carbon dioxide, and medical air that are used in the application of human respiration and the calibration of medical devices used for human respiration. [NFPA 99:3.3.144-3.3.148]

Proportioning System for Medical Air USP. A central supply that produces medical air (USP) reconstituted from oxygen USP and nitrogen NF by means of a mixer or blender. [NFPA 99:3.3.106.1-3.3.106.2]

221.0  — S —

Scavenging. Evacuation of exhaled mixtures of oxygen and nitrous oxide. [NFPA 99:3.3.163-3.3.169]

Standard Cubic Feet per Minute (SCFM). Volumetric flow rate of gas in units of standard cubic feet per minute. [NFPA 99:3.3.172-3.3.173]

Station Inlet. An inlet point in a piped medical/surgical vacuum distribution system at which the user makes connections and disconnections. [NFPA 99:3.3.173-3.3.174]

Station Outlet. An outlet point in a piped medical gas distribution system at which the user makes connections and disconnections. [NFPA 99:3.3.174-3.3.175]

225.0  — W —

Wet Procedure Locations. The area in a patient care space where a procedure is performed that is normally subject to wet conditions while patients are present, including standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. [NFPA 99:3.3.187-3.3.188]

1301.4 Where Required. Construction and equipment requirements shall be applied only to new construction and new equipment, except as modified in individual sections of this chapter. [NFPA 99:1.3.2]
1309.1 Oxygen Concentrator Components. The components that make up the oxygen concentrator unit shall be as follows:

(1) The manufacturer of the concentrator unit shall be permitted to use such components and arrangement of such components as needed to produce oxygen complying with Section 1309.1 in the quantity as required by the facility, except where otherwise specifically defined in this code.

(2) Air receivers and oxygen accumulators, where used, shall comply with Section VIII, “Unfired Pressure Vessels,” of the ASME Boiler and Pressure Vessels Code and be provided with overpressure relief valves. [NFPA 99:5.1.3.6.4.3.1.3.3.1.5]

1309.2 Particulate Size. Output shall have less than or equal to 1.686 x 10^-6 pounds per cubic yard (1 mg/m³) of permanent particulates sized 1 micron or larger at normal atmospheric pressure. [NFPA 99:5.1.3.5.11.2.5.1.3.9.1.2]

1309.3 Suitability. Materials of construction on the air side of the oxygen concentrator unit shall be suitable for the service as determined by the manufacturer. [NFPA 99:5.1.3.5.11.3.5.1.3.9.1.3]

1309.4 Compatible Materials. Materials of construction on the oxygen side of the oxygen concentrator unit shall comply with Section 1307.4. [NFPA 99:5.1.3.6.4.4.1.3.9.1.4]

1309.5 Oxygen Concentrator Components. The components that make up the oxygen concentrator unit shall be as follows:

(1) The manufacturer of the concentrator unit shall be permitted to use such components and arrangement of such components as needed to produce oxygen complying with Section 1309.1 in the quantity as required by the facility, except where otherwise specifically defined in this code.

(2) Air receivers and oxygen accumulators, where used, shall comply with Section VIII, “Unfired Pressure Vessels,” of the ASME Boiler and Pressure Vessels Code and be provided with overpressure relief valves. [NFPA 99:5.1.3.6.4.3.1.3.3.1.5]

1309.6 Supply Air Quality. The supply air to the concentrator(s) shall be of a quality to ensure the oxygen concentrator unit can produce oxygen complying with Section 1309.1 and shall not be subject to normally anticipated contamination (e.g., vehicle or other exhausts, gas leakage, discharge from vents, flooding, and so forth). [NFPA 99:5.1.3.6.4.6.5.1.3.9.1.6]

1309.7 Electrical Components. The oxygen concentrator supply unit and any associated electrical equipment shall be provided, with, at a minimum, with the following electrical components:

(1) Either a disconnect switch for each major electrical component or a single disconnect that deactivates all electrical components in the concentrator unit.

(2) Motor starting devices with overload protection for any component with an electrical motor over 2 hp (1.5 kW). [NFPA 99:5.1.3.6.4.6.7.5.1.3.9.1.7]

1309.8 Vent Valve. A vent valve shall be provided as follows:

(1) Located on the source side of the concentrator outlet isolation valve to permit the operation of the oxygen concentrator unit for validation, calibration, and testing while the unit is isolated from the pipeline system.

(2) Sized to allow for at least 25 percent of the oxygen concentrator unit flow.

(3) Vented to a location compliant with Section 1309.8.1. [NFPA 99:5.1.3.6.4.8.5.1.3.9.1.8]

1309.9 Valved Sample Port. A DN8 (NPS 1/4) valved sample port shall be provided near the oxygen concentration monitor sensor connection for sampling of the gas from the oxygen concentrator unit. [NFPA 99:5.1.3.6.4.6.9.5.1.3.9.1.9]

1309.10 Suitable Filter. At least one 0.1 micron filter suitable for oxygen service shall be provided at the outlet of the oxygen concentrator supply unit. [NFPA 99:5.1.3.6.4.10.5.1.3.9.1.10]

1309.11 Check Valve. A check valve shall be provided at the outlet of the oxygen concentrator supply unit to prevent backflow into the oxygen concentrator supply unit and to allow service to the unit. [NFPA 99:5.1.3.6.4.11.5.1.3.9.1.11]
**1309.12 Outlet Valve.** An outlet valve shall be provided to isolate all components of the oxygen concentrator from the pipeline with the following characteristics:

1. The valve shall have both manual and automatic actuation with visual indication of open or closed.
2. The valve shall close automatically whenever the oxygen concentrator unit is not producing oxygen of a concentration equal to that in Section 1309.1.
3. Continuing operation of the oxygen concentrator supply unit through the vent mode shall be permitted with the isolating valve closed.
4. The isolating valve, when automatically closed due to low concentration, shall require manual reset to ensure the oxygen concentrator supply unit is examined prior to return to service.
5. Closing the isolating valve, whether automatically or manually, shall activate an alarm signal at the master alarms (see Section 1317.1.1) indicating that the oxygen concentrator supply unit is disconnected. [NFPA 99: 5.1.3.9.1.12]

**1309.13 Oxygen Concentration Monitor.** The oxygen concentrator supply unit shall be provided with an oxygen concentration monitor with the following characteristics:

1. The monitor shall be capable of monitoring 99 percent oxygen concentration with 1 percent accuracy.
2. The monitor shall continuously display the oxygen concentration and shall activate local alarm and master alarms per NFPA 99 when a concentration lower than 91 percent is observed.
3. The monitor shall continuously display the oxygen concentration.
4. It shall be permitted to insert the monitor into the pipeline without a demand check. [NFPA 99: 5.1.3.9.1.13]

**1311.4 Location.** Medical air intakes shall be located as follows:

1. The medical air intake shall be located a minimum of 25 feet (7620 mm) from ventilating system exhausts, fuel storage vents, combustion vents, plumbing vents, and WAGD discharges, or areas that can collect vehicular exhausts or other noxious fumes.
2. The medical air intake shall be located a minimum of 20 feet (6096 mm) above ground level.
3. The medical air intake shall be located a minimum of 10 feet (3048 mm) from any door, window, or other opening in the building. [NFPA 99: 5.1.3.6.3.11(B-D)]

**1312.4 Vacuum Filtration.** Central supply systems for vacuum other than liquid ring pumps shall be provided with inlet filtration with the following characteristics:

1. Filtration shall be at least duplex to allow one filter to be exchanged without impairing the vacuum system.
2. Filtration shall be located on the patient side of the vacuum producer.
3. Filters shall be efficient to $0.03 \mu$ and 99.97 percent HEPA or better, per DOE-STD-3020.
4. Filtration shall be sized for 100 percent of the peak calculated demand while one filter or filter bundle is isolated.
5. It shall be permitted to group multiple filters into bundles to achieve the required capacities.
6. The system shall be provided with isolation valves on the source side of each filter or filter bundle and isolation valves on the patient side of each filter or filter bundle, permitting the filters to be isolated without shutting off flow to the central supply system.
7. A means shall be available to allow the user to observe any accumulations of liquids.
8. A vacuum relief petcock shall be provided to allow vacuum to be relieved in the filter canister during filter replacement.
9. Filter elements and canisters shall be permitted to be constructed of materials as deemed suitable by the manufacturer.
10. In normal operation, one filter or filter bundle shall be isolated from the system to be available for service should a blockage in the operating filter occur or rotation of the filters be desired after filter element exchange. [NFPA 99: 5.1.3.7.4]

**1313.4 Dips and Loops.** The exhaust shall be free of dips and loops that might trap condensate or oil or provided with a drip leg and valved drain at the bottom of the low point. [NFPA 99: 5.1.3.7.7.4-5.1.3.7.7.5]

**1313.5 Multiple Pumps.** Vacuum exhausts from multiple pumps shall be permitted to be joined together to one common exhaust where the following conditions are met:

1. The common exhaust is sized to minimize backpressure in accordance with the pump manufacturer’s recommendations.
2. Each pump can be isolated by manual or check valve, blind flange, or tube cap to prevent open exhaust piping when the pump(s) is removed for service from consequent flow of exhaust air into the room. [NFPA 99: 5.1.3.7.7.6]

**1314.5 Valve Types.** New or replacement valves shall be permitted to be of any type as long as they meet the following conditions:

1. They have a minimum Cv factor in accordance with Table 1314.5(a) or Table 1314.5(b).
They use a quarter turn to off.
(3) They are constructed of materials suitable for the service.
(4) They are provided with copper tube extensions by the manufacturer for brazing or with corrugated medical tubing (CMT) fittings.
(5) They indicate to the operator if the valve is open or closed.
(6) They permit in-line serviceability.
(7) They are cleaned for oxygen service by the manufacturer if used for any positive-pressure service.
(8) They have threaded purge ports on the patient side and the source side.
(9) They have a minimum working pressure equal to or greater than the relief valve protecting the piping system on which the valve is installed for any positive-pressure service. [NFPA 99:5.1.4.1.6]

1314.10.1 Readily Accessible. A zone valve in each medical gas or vacuum line shall be provided for each Category 1 space and anesthetizing location for moderate sedation, deep sedation, or general anesthesia specific for the occupancy. These zone valves and shall be located as follows:
(1) They are installed immediately outside the area controlled.
(2) They are readily-installed where they are visible and accessible in an emergency at all times. [NFPA 99:5.1.4.6.2]

1317.1 Category 1. All master, area, and local alarm systems used for medical gas and vacuum systems shall include the following:
(1) Separate visual indicators for each condition monitored, except as permitted in Section 1317.1.2 for local alarms that are displayed on master alarm panels.
(2) Visual indicators that remain in alarm until the situation that has caused the alarm is resolved.
(3) Cancelable audible indication of each alarm condition that produces a sound with a minimum level of 80 dBA at 3 feet (914 mm).
(4) Means to indicate a lamp or LED failure and audible failure.
(5) Visual and audible indication that the communication with an alarm-initiating device is disconnected.
(6) Labeling of each indicator, indicating the condition monitored.
(7) Labeling of each alarm panel for its area of surveillance.
(8) Reinitiation of the audible signal if another alarm condition occurs while the audible alarm is silenced.
(9) Power for master alarms, area alarms, sensors, and switches from the life safety branch of the essential electrical system as described in NFPA 99.
(10) Power for local alarms, dew point sensors, and carbon monoxide sensors permitted to be from the same essential electrical branch as is used to power the air compressor system.
(11) Where used for communications, wiring from switches or sensors that is supervised or protected as required by NFPA 70 for life safety and critical branches circuits in which protection is any of the following types:
(a) Conduit
(b) Free air
(c) Wire
(d) Cable tray
(e) Raceways
(12) Communication devices that do not use electrical wiring for signal transmission will be and are supervised such that failure of communication shall initiates an alarm.
(13) Assurance by the responsible authority of the facility that the labeling of alarms, where room numbers or designations are used, is accurate and up-to-date.
(14) Provisions for automatic restart after a power loss of 10 seconds (e.g., during generator start-up) without giving false signals or requiring manual reset.
(15) Alarm switches/sensors installed so as to be removable and accessible for service and testing. [NFPA 99:5.1.9.1]

1320.2.1 Medical Vacuum Systems. Vacuum systems and WAGD systems fabricated from copper tubing shall be permitted to have branch connections made using mechanically formed, drilled, and extruded tee-branch connections that are formed in accordance with the tool manufacturer's instructions. Such branch connections shall be joined by brazing, as described in Section 1321.0. [NFPA 99:5.1.10.3.3]

1321.7.2 Cut Ends. The cut ends of the tube shall be permitted to be rolled smooth or deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube. [NFPA 99:5.1.10.4.2.3]

1321.8.7 On-Site Recleaning. The interior surfaces of tube ends, fittings, and other components that were cleaned for oxygen service by the manufacturer, but that became contaminated prior to being installed, shall be permitted to be recleaned on-site by the installer by thoroughly scrubbing the interior surfaces with a clean, hot water–alkaline solution, such as sodium carbonate or trisodium phosphate, using a solution of 1 pound (0.5 kg) of sodium carbonate or trisodium phosphate to 3 gallons (11 L) of potable water, and thoroughly rinsing them with clean, hot, potable water.
Other aqueous cleaning solutions shall be permitted to be used for on-site recleaning permitted in this section, provided that they are as recommended in accordance with the mandatory requirements of CGA G-4.1. [NFPA 99:5.1.10.4.3.10, 5.1.10.4.3.11]

1322.4 Axially Swaged Fittings. Axially swaged, elastic strain preload fittings providing metal-to-metal seals, having suitable for service at 300 psig (2070 kPa) and able to withstand a temperature of rating not less than 1000°F (538°C) and a pressure rating not less than 300 psi (2068 kPa), and that, when complete, are permanent and nonseparable, shall be permitted to be used to join copper or stainless steel tube. Axially swaged, elastic strain preload fittings shall be installed by qualified technicians in accordance with the manufacturer’s instructions. [NFPA 99:5.1.10.7.1, 5.1.10.7.2]

1323.13.1 Pipe Labeling. Piping shall be labeled by stenciling or adhesive markers that identify the patient medical gas, the medical support gas, or the vacuum system and include the following:
(1) Name of the gas or vacuum system or the chemical symbol per Table 1305.1.
(2) Gas or vacuum system color code per Table 1305.1.
(3) Where positive pressure gas piping systems operate at pressures other than the standard gauge pressure in Table 1305.1, the operating pressure in addition to the name of the gas. [NFPA 99:5.1.11.1.1]

1323.13.2 Pipe Pressure Labeling. Where positive pressure gas piping systems operate at pressures other than the standard gauge pressure in Table 1305.1, the operating pressure in addition to the name of the gas shall be labeled. [NFPA 99:5.1.11.1.2]

1323.13.3 Location of Pipe Labeling. Pipe labels shall be located as follows:
(1) At intervals of not more than 20 feet (6096 mm).
(2) At least once in or above every room.
(3) On both sides of walls or partitions penetrated by the piping.
(4) At least once in every story height traversed by risers. [NFPA 99:5.1.11.1.2]

1323.13.4 Paint. Medical gas piping shall not be painted. [NFPA 99:5.1.11.1.3]

1323.14 Identification of Shutoff Valves. Shutoff valves shall be identified with the following:
(1) Name or chemical symbol for the specific medical gas or vacuum system.
(2) Gas or vacuum system color code in accordance with Table 1305.1.
(3) Room or areas served.
(4) Caution to not close or open the valve except in emergency. [NFPA 99:5.1.11.2.1]

1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:
SOURCE VALVE
FOR THE (SOURCE NAME)
[NFPA 99:5.1.11.2.3]

1323.14.3 Main Line Valves. Main line valves shall be labeled in substance as follows:
MAIN LINE VALVE FOR THE
(GAS/VACUUM NAME)
SERVING (NAME OF THE BUILDING)
[NFPA 99:5.1.11.2.5]

1323.14.4 Riser Valves. The riser valve(s) shall be labeled in substance as follows:
RISER FOR THE (GAS/VACUUM NAME)
SERVING (NAME OF THE AREA/BUILDING SERVED BY THE PARTICULAR RISER)
[NFPA 99:5.1.11.2.6]

1323.14.5 Service Valves. The service valve(s) shall be labeled in substance as follows:
SERVICE VALVE FOR THE
(GAS/VACUUM NAME)
SERVING (NAME OF THE AREA/BUILDING SERVED BY THE PARTICULAR VALVE)
[NFPA 99:5.1.11.2.7]

1323.14.6 Zone Valve Box. Zone valve box assemblies shall be labeled with the rooms, areas, or spaces that they control as follows:
ZONE VALVES FOR THE
(GAS/VACUUM NAME)
SERVING (NAME OF ROOMS OR SPACES SERVED BY THE PARTICULAR VALVE)
Labeling shall either be visible from outside the zone valve box assembly through the cover or be replicated on the outside, but not affixed to the removable cover. [NFPA 99:5.1.11.2.7 – 5.1.11.2.8]

1323.15 Identification. Station outlets and inlets shall be identified as to the name or chemical symbol for the specific medical gas or vacuum provided, and shall include the following:
1. Name of the gas or vacuum system or the chemical symbol in accordance with Table 1305.1
2. Gas or vacuum system color code in accordance with Table 1305.1

In sleep labs, where the outlet is downstream of a flow control device, the station outlet identification shall include a warning not to use the outlet for ventilating patients.

Where medical gas systems operate at pressures other than the standard gauge pressure of 50 psi to 55 psi (345 kPa to 380 kPa) or a gauge pressure of 160 psi to 185 psi (1103 kPa to 1275 kPa) for nitrogen, the station outlet identification shall include the nonstandard operating pressure in addition to the name of the gas. [NFPA 99:5.1.11.3.1 – 5.1.11.3.2]

1324.5.4.1 Time Frame for Testing. Tests shall be conducted after the final installation of station outlet valve bodies, faceplates, and all other distribution system components (e.g., pressure alarm devices, pressure indicators, line pressure relief valves, manufactured assemblies, hose). [NFPA 99:5.1.12.2.6.1]

1324.5.4.5 Conclusion of Test. The leakage over the 24-hour test shall not exceed 0.5 percent of the starting pressure [e.g., 0.3 psi (2 kPa) starting at 60 psig (414 kPa), 0.125 inch (3.2 mm) HgV starting at 25 inches (635 mm) HgV] except that attributed to specific changes of in ambient temperature. [NFPA 99:5.1.12.2.7.5]

1324.5.5.2 Length of Testing. The piping systems shall be subjected to a 24-hour standing vacuum test. [NFPA 99:5.1.12.2.7.2]

1324.5.5.5 Conclusion of Test. At the conclusion of the test, there shall be no change in the vacuum other than the leakage over the 24-hour test shall not exceed 0.5 percent of the starting pressure [e.g., 0.125 inch (0.3 mm) HgV starting at 25 inches (635 mm) HgV] except that attributed to specific changes of in ambient temperature. [NFPA 99:5.1.12.2.7.5]

1324.5.5.6 Proof of Testing. The 24-hour standing pressure test of the vacuum system shall be witnessed by the Authority Having Jurisdiction or its designee. A form indicating that this test has been performed and witnessed shall be provided to the verifier at the start of the tests required in Section 1324.5.7 through Section 1324.5.11. [NFPA 99:5.1.12.2.7.6]

1325.1 General. Category 2 piped gas or piped vacuum system requirements shall be permitted when all of the following criteria are met:
1. Only moderate sedation; (as defined in Chapter 2), minimal sedation; (as defined in Chapter 2); or no sedation is performed. Deep sedation and general anesthesia shall not be permitted.
2. The loss of the piped gas or piped vacuum systems is likely to cause minor injury to patients, staff, or visitors.
3. The facility piped gas or piped vacuum systems are intended for Category 2 patient care space as defined in Chapter 2. [NFPA 99:5.2.1.2]

1325.10 Warning Systems (Category 2). Warning systems associated with Category 2 systems shall provide the master, area, and local alarm functions of a Category 1 system as required in Section 1317.0, except as follows:
1. Warning systems shall be permitted to be a single alarm panel.
2. The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.
3. Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel. [NFPA 99:5.2.9]

1325.11 Category 2 Distribution. Level Category 2 systems shall comply with Section 1318.0 through Section 1323.12. [NFPA 99:5.2.10]

1325.13 Performance Criteria and Testing — Category 2 (Gas, Medical–Surgical and Vacuum, and WAGD). Category 2 systems shall comply with Section 1324.0. [NFPA 99:5.2.12]

1326.1 General. Category 3 piped gas and vacuum systems shall be permitted when all of the following criteria are met:
1. Only moderate sedation; minimal sedation, as defined in Chapter 2; or no sedation is performed. Deep sedation, moderate sedation, and general anesthesia are not performed.
2. The loss of the piped gas and vacuum systems is not likely to cause injury to patients, staff, or visitors, but can cause discomfort.
3. The facility piped gas and vacuum systems are intended for Category 3 or Category 4 patient care rooms as defined in Chapter 2. [NFPA 99:5.3.1.2]
1326.3 Medical Air Supply Systems. Category 3 central supply systems shall comply with Section 1311.6, except as follows:
(1) Medical air compressors, dryers, after coolers, filters, and regulators shall be permitted to be simplex.
(2) The facility staff shall develop their emergency plan to deal with the loss of medical air.
(1) Gas cylinder or cryogenic liquid container headers in accordance with NFPA 99
(2) Oxygen concentrator supply units in accordance with NFPA 99
(3) Cylinder manifolds for gas cylinders in accordance with NFPA 99
(4) Manifolds for cryogenic liquid containers in accordance with NFPA 99
(5) Cryogenic fluid central supply systems in accordance with NFPA 99
(6) Medical air compressor systems in accordance with NFPA 99
(7) Proportioning air systems in accordance with NFPA 99
(8) Medical-surgical vacuum systems in accordance with NFPA 99
(9) Waste anesthetic gas disposal systems (WAGDs) in accordance with NFPA 99
(10) Instrument air compressor systems in accordance with NFPA 99

1326.4 Oxygen Central Supply Systems Using Concentrators. Category 3 oxygen supply systems using concentrators shall be permitted to consist of two sources, one of which shall be a cylinder header with sufficient cylinder connections for one average day’s supply. [NFPA 99:5.3.3.6]

1326.5 Medical–Surgical Vacuum Systems. Category 3 systems shall comply with Section 1307.3 through Section 1312.0 through Section 1313.5, except as follows:
(1) Medical–surgical vacuum systems shall be permitted to be simplex.
(2) The facility staff shall develop their emergency plan to deal with the loss of medical–surgical vacuum.
(3) Emergency electrical service shall conform to the requirements of Section 6.6 of NFPA 99 and NFPA 70. [NFPA 99:5.3.3.7]

1326.6 Valves. Category 3 systems shall comply with Section 1314.0. [NFPA 99:5.3.4]

1326.7-1326.6 Station Outlets and Inlets. Category 3 systems shall comply with Section 1315.0. [NFPA 99:5.3.5]

1326.8-1326.7 Pressure and Vacuum Indicators. Category 3 systems shall comply with Section 1316.2. [NFPA 99:5.3.8]

1326.9-1326.8 Warning Systems. Warning systems associated with Category 3 systems shall provide the master, area, and local alarm functions of a Category 1 system as required in Section 1317.0, except as follows:
(1) Warning systems shall be permitted to be a single alarm panel (i.e., a combination master/area alarm panel).
(2) The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.
(3) Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel.
(4) Electrical power for warning systems shall be in accordance with Section 6.6 of NFPA 99 for Category 3 and Category 4 spaces. [NFPA 99:5.3.9]

1326.10-1326.9 Distribution. Category 3 systems shall comply with Section 1318.0 through Section 1323.12. [NFPA 99:5.3.10]

1326.11-1326.10 Labeling and Identification. Category 3 systems shall comply with Section 1323.13 through Section 1323.15. [NFPA 99:5.3.11]

1327.2 Emergency Shutoff Valves (Oxygen and Nitrous Oxide). Emergency shutoff valves shall be provided in accordance with the following:
(1) Where a central Category 2 medical gas supply is remote from a single treatment facility, the main supply line shall be provided with emergency shutoff valve located in the single treatment facility so as to be accessible from all use-point locations in an emergency.
(2) Where a central medical gas supply system supplies two treatment facilities, each facility shall be provided with an emergency shutoff valve located in that treatment facility so as to be accessible from all use-point locations in an emergency.
(3) Emergency shutoff valves shall be labeled to indicate the gas controlled by the shutoff valve and shall shut off only the gas to the treatment facility that they serve.
(4) A remotely activated shutoff valve at a gas supply manifold shall not be used for emergency shutoff. For clinical purposes, such a remote valve actuator shall not fail-close in the event of loss of electric power. Where remote actuators are the type that fail-open, it shall be mandatory that cylinder shutoff valves be closed whenever the system is not in use. [NFPA 99:15.4.2.6.1 – 15.4.2.6.4.2]
### TABLE 1305.1
STANDARD DESIGNATION COLORS AND OPERATING PRESSURES FOR GAS AND VACUUM SYSTEMS
[NFPA 99: TABLE 5.1.11]

<table>
<thead>
<tr>
<th>GAS SERVICE</th>
<th>ABBREVIATED NAME</th>
<th>COLORS (BACKGROUND/ TEXT)</th>
<th>STANDARD GAUGE PRESSURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical air</td>
<td>Med Air</td>
<td>Yellow/black</td>
<td>50–55 psi</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>CO2</td>
<td>Gray/black or gray/white</td>
<td>50–55 psi</td>
</tr>
<tr>
<td>Helium</td>
<td>He</td>
<td>Brown/white</td>
<td>50–55 psi</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N2</td>
<td>Black/white</td>
<td>50–55 psi</td>
</tr>
<tr>
<td>Nitrous oxide</td>
<td>N2O</td>
<td>Blue/white</td>
<td>50–55 psi</td>
</tr>
<tr>
<td>Oxygen</td>
<td>O2</td>
<td>Green/white or white/green</td>
<td>50–55 psi</td>
</tr>
<tr>
<td>Oxygen/carbon dioxide mixtures</td>
<td>O2/CO2 n% (n = % of CO2)</td>
<td>Green/white</td>
<td>50–55 psi</td>
</tr>
<tr>
<td>Medical–surgical vacuum</td>
<td>Med Vac</td>
<td>White/black</td>
<td>15 inch to 30 inch HgV</td>
</tr>
<tr>
<td>Waste anesthetic gas disposal</td>
<td>WAGD</td>
<td>Violet/white</td>
<td>Varies with system type</td>
</tr>
<tr>
<td>Medical-surgical vacuum/ WAGD combination</td>
<td>Med-surg/ WAGD</td>
<td>White/black and violet/white</td>
<td>15 inch to 30 inch HgV</td>
</tr>
<tr>
<td>Other mixtures</td>
<td>Gas A% / Gas B%</td>
<td>Colors as above; major gas for back- ground/minor gas for text</td>
<td>None</td>
</tr>
<tr>
<td>Nonmedical air (Category 3 gas-powered device) and dental air</td>
<td>—</td>
<td>Yellow and white-Yellow and white diagonal stripe/black</td>
<td>None</td>
</tr>
<tr>
<td>Nonmedical vacuum and Category 3 dental vacuum</td>
<td>—</td>
<td>White and black-White and black diagonal stripe/black boxed</td>
<td>None</td>
</tr>
<tr>
<td>Laboratory air</td>
<td>—</td>
<td>Yellow and white-checker board-Yellow and white checkerboard/black</td>
<td>None</td>
</tr>
<tr>
<td>Laboratory vacuum</td>
<td>—</td>
<td>White and black-White and black checkerboard/black boxed</td>
<td>None</td>
</tr>
<tr>
<td>Instrument air</td>
<td>—</td>
<td>Red/white</td>
<td>160–50–185 psi</td>
</tr>
</tbody>
</table>

For SI units: 1 pound-force per square inch = 6.8947 kPa, 1 inch of mercury vacuum (HgV) = 3.386 kPa

### TABLE 1314.5(a)
POSITIVE PRESSURE GASES
[NFPA 99: Table 5.1.4.1.6(a)]

<table>
<thead>
<tr>
<th>VALVE SIZE (inch)</th>
<th>MINIMUM Cv (full open)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>17</td>
</tr>
<tr>
<td>3/4</td>
<td>31</td>
</tr>
<tr>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>1 1/4</td>
<td>110</td>
</tr>
<tr>
<td>1 1/2</td>
<td>169</td>
</tr>
<tr>
<td>2</td>
<td>357</td>
</tr>
<tr>
<td>2 1/2</td>
<td>390</td>
</tr>
<tr>
<td>3</td>
<td>912</td>
</tr>
<tr>
<td>4</td>
<td>1837</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm
### TABLE 1314.5(b)
VACUUM AND WAGD
[NFPA 99: Table 5.1.4.1.6(b)]

<table>
<thead>
<tr>
<th>VALVE SIZE (inch)</th>
<th>MINIMUM Cv (full open)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>17</td>
</tr>
<tr>
<td>3/4</td>
<td>31</td>
</tr>
<tr>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>1 1/4</td>
<td>110</td>
</tr>
<tr>
<td>1 1/2</td>
<td>169</td>
</tr>
<tr>
<td>2</td>
<td>357</td>
</tr>
<tr>
<td>2 1/2</td>
<td>196</td>
</tr>
<tr>
<td>3</td>
<td>302</td>
</tr>
<tr>
<td>4</td>
<td>600</td>
</tr>
<tr>
<td>5</td>
<td>1022</td>
</tr>
<tr>
<td>6</td>
<td>1579</td>
</tr>
<tr>
<td>8</td>
<td>3136</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

### TABLE 1323.4.4
MAXIMUM PIPE SUPPORT SPACING
[NFPA 99: TABLE 5.1.10.11.4.6]

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>HANGER SPACING (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN8 (NPS 1/4)</td>
<td>(3/8 of an inch O.D.)</td>
</tr>
<tr>
<td>DN10 (NPS 3/8)</td>
<td>(1/2 of an inch O.D.)</td>
</tr>
<tr>
<td>DN15 (NPS 1/2)</td>
<td>(5/8 of an inch O.D.)</td>
</tr>
<tr>
<td>DN20 (NPS 3/4)</td>
<td>(7/8 of an inch O.D.)</td>
</tr>
<tr>
<td>DN25 (NPS 1)</td>
<td>(11/8 of an inch O.D.)</td>
</tr>
<tr>
<td>DN32 (NPS 11/4)</td>
<td>(13/8 of an inch O.D.)</td>
</tr>
<tr>
<td>DN40 and larger</td>
<td>(NPS 11/2) (15/8 of an inch O.D.)</td>
</tr>
<tr>
<td>Vertical risers, all sizes, every floor, but not to exceed:</td>
<td>15</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm
## TABLE 1327.5
### MAXIMUM COPPER TUBE SUPPORT SPACING

[NFPA 99: TABLE 15.4.5.6.5]

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>HANGER SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN8 (NPS 1/4)</td>
<td>3/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN10 (NPS 3/8)</td>
<td>1/2 of an inch O.D.</td>
</tr>
<tr>
<td>DN15 (NPS 1/2)</td>
<td>5/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN20 (NPS 3/4)</td>
<td>7/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN25 (NPS 1)</td>
<td>11/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN32 (NPS 11/4)</td>
<td>13/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN40 and larger (NPS 11/2)</td>
<td>15/8 of an inch O.D.</td>
</tr>
</tbody>
</table>

Vertical risers, all sizes, every floor, but not to exceed: 15

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

## TABLE 1327.6
### MAXIMUM PLASTIC PIPE SUPPORT SPACING

[NFPA 99: TABLE 15.4.5.6.6]

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>HANGER SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN15 (NPS 1/2)</td>
<td>5/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN20 (NPS 3/4)</td>
<td>7/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN25 (NPS 1)</td>
<td>11/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN32 (NPS 11/4)</td>
<td>13/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN40 (NPS 11/8)</td>
<td>15/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN50 (NPS 2)</td>
<td>23/8 of an inch O.D.</td>
</tr>
<tr>
<td>DN65 and larger (NPS 21/2)</td>
<td>27/8 of an inch O.D.</td>
</tr>
</tbody>
</table>

Vertical risers, all sizes, every floor, but not to exceed: 10

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

**SUBSTANTIATION:**
The above sections have been revised to correlate with NFPA 99-2021 (latest version) in accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines).

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 253
UPC 2024  Section: 1303.9

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Revise text

1303.0 Health Care Facilities.

1303.9 Work Performed in Occupied Healthcare Facilities. In existing, occupied, inpatient healthcare facilities, all plumbing systems installation and remodel work shall be performed by personnel certified in accordance with ASSE/IAPMO 12010, ASSE/IAPMO 12030 and ASSE/IAPMO 12040.

SUBSTANTIATION:
ASSE 12010, ASSE 12030 and ASSE 12040 have been combined into one ASSE standard 12010.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
1318.0 Piping Materials for Field-Installed Positive Pressure Medical Gas Systems.

1318.4 Tubes for Medical Gas Systems. Tubes shall be one of the following:

(1) Hard-drawn seamless copper in accordance with ASTM B819, medical gas tube, Type L, except Type K shall be used where operating pressures are above a gauge pressure of 185 psi (1276 kPa) and the pipe sizes are larger than DN80 [(NPS 3) \((31/8 \text{ inches O.D.})\)].

(2) Listed corrugated medical tubing (CMT) fabricated from copper alloy No. 5100 strip, meeting ASTM B103/B103M, with a design margin of 3.5, externally coated with nonmetallic sheath marked with the manufacturer’s marking. The listing shall include testing to demonstrate that CMT systems can be consistently gas-purged with results equivalent to comparable medical gas copper tubing. {{NFPA 99:5.1.10.1.4}}

1318.4.1 Flame Spread Index. CMT shall have a flame spread index of 25 or less and a smoke developed index of 50 or less as determined by ASTM E84. {{NFPA 99:5.1.10.1.5}}

1318.4.2 CMT, Manufacturer Markings. CMT shall be identified by the manufacturer as suitable for oxygen service at a minimum of every 3 feet (914 mm). {{NFPA 99:5.1.10.1.6}}

1319.0 Piping Materials for Field-Installed Medical-Surgical Vacuum Systems.

1319.1 Tubes for Medical Vacuum Systems. Piping for vacuum systems shall be constructed of any of the following:

(1) Hard-drawn seamless copper tube in accordance with the following:
   (a) ASTM B88, copper tube (Type K, Type L, or Type M)
   (b) ASTM B280, copper ACR tube
   (c) ASTM B819, copper medical gas tubing (Type K or Type L)

(2) Stainless steel tube in accordance with the following:
   (a) ASTM A269 TP304L or 316L
   (b) ASTM A312 TP304L or 316L
   (c) ASTM A312 TP 304L/316L, Schedule 5S pipe, and ASTM A403 WP304L/316L, Schedule 5S fittings

(3) CMT meeting the requirements of 1318.4(2). {{NFPA 99:5.1.10.2.1}}

1319.1.1 Vacuum Tube Marking Where Required. If copper or CMT vacuum tubing is installed along with any medical gas tubing, the vacuum tubing shall, prior to installation, be prominently labeled or otherwise identified to preclude using materials or installation procedures in the medical gas system that are not suitable for oxygen service. {{NFPA 99:5.1.10.2.2.1}}

(renumber remaining sections)

1320.0 Joints and Connections.

1320.2 Changes in Direction. (remaining text unchanged)

1320.2.1 CMT, Changes in Direction. Positive pressure patient gas systems, medical support gas systems, vacuum systems, and WAGD systems constructed of CMT shall have turns, offsets, and other changes in direction...
made by bending the tubing up to the minimum bend radius or by fittings in accordance with Section 1320.2 [NFPA 99:5.1.10.3.2]

**1320.2.4** Medical Vacuum Systems. (remaining text unchanged)

**1320.2.3** CMT. Prohibited Connections. Branch connections made using mechanically formed, drilled, and extruded tee-branch connections shall be prohibited in CMT systems. [NFPA 99:5.1.10.3.4]

1323.0 Installation of Piping and Equipment.

1323.4 Pipe Support. (remaining text unchanged)

**1323.4.3** CMT. Supports for CMT shall be in accordance with the CMT manufacturer’s installation instructions. [NFPA 99:5.1.10.11.4.4]

(renumber remaining sections)

1323.10 Qualifications of Installers. (remaining text unchanged)

**1323.10.1** CMT. CMT systems shall be installed by ASSE 6010-qualified installers using the CMT manufacturer’s instructions. [NFPA 99:5.1.10.11.10.3]

(renumber remaining sections)

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>REFERENCED STANDARDS</td>
</tr>
<tr>
<td><strong>STANDARD NUMBER</strong></td>
</tr>
<tr>
<td>ASSE 6010-2018</td>
</tr>
<tr>
<td>ASTM B103/B103M-2019</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: ASSE 6010, ASTM B103/B103M, and ASTM E84 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:

Corrugated medical tubing (CMT) is a listed product that significantly reduces the number of fittings required to install medical gas systems and improves the seismic resiliency of those systems. This proposal will add CMT language that currently exists in the 2018 and 2021 editions of the NFPA 99 Health Care Facilities Code to Chapter 13, and add corrugated medical tubing to the list of products available for use in constructing medical gas systems. The proposal also requires CMT installation be performed by an ASSE qualified installer.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change is being rejected as the purging characteristics of Corrugated Medical Tubing (CMT) have not been proven and it does not purge like smooth bore piping. There are safety concerns that if it is not purged properly, the pipe will not be completely clean when brazed, which is a health concern to the patient.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 19 NEGATIVE: 6 NOT RETURNED: 1 Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: These sections are direct extracts from NFPA 99. For consistency with NFPA 99, this change should have been accepted.

GORSUCH: I see no reason to reject the language approved in NFPA 99.

KREITENBERG: Medical Gas systems are primarily governed by NFPA 99 and locally by OSHPD. Those entities accept this language.

NIELSEN: I agree with Charles White and Julius Ballanco, and believe this code change should have been accepted.
SOSKIN: There is no reason to not accept NFPA 99 language.

WHITE: Section 1318.4(2) states: "The listing shall include testing to demonstrate that CMT systems can be consistently gas-purged with results equivalent to comparable medical gas copper tubing." This requirement should satisfy the opposition to purging voiced by the committee if the product complies with the requirements; it should be accepted by the code.
1501.3 Permit. It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered an alternate water source system in a building or on a premise without first obtaining a permit to do such work from the Authority Having Jurisdiction.

Exception: For single family dwellings a construction permit shall not be required for a clothes washer only system meeting the requirements of Section 1501.3.1. A written notification shall be provided to the Authority Having Jurisdiction in accordance with Section 1501.3.1.

1501.3.1 Clothes Washer System. A clothes washer system in compliance with all of the following is exempt from the construction permit specified in Section 1501.3 and shall be permitted to be installed or altered without a construction permit:

1. Where required, notification has been provided to the enforcing agency regarding the proposed location and installation of a gray water irrigation or disposal system.
2. The design shall allow the user to direct the flow to the irrigation or disposal field or the building sewer. The direction control of the gray water shall be clearly labeled and readily accessible to the user.
3. The installation, change, alteration, or repair of the system does not include a potable water connection or a pump and does not affect other building, plumbing, electrical, or mechanical components including structural features, egress, fire-life safety, sanitation, potable water supply piping, or accessibility. The pump in a clothes washer shall not be considered part of the gray water system.
4. The gray water shall be contained on the site where it is generated.
5. Gray water shall be directed to and contained within an irrigation or disposal field.
6. Ponding or runoff is prohibited and shall be considered a nuisance.
7. Gray water shall be permitted to be released above the ground surface provided at least 2 inches (51 mm) of mulch, rock, or soil, or a solid shield covers the release point. Other methods which provide equivalent separation are also acceptable.
8. Gray water systems shall be designed to minimize contact with humans and domestic pets.
9. Water used to wash diapers or similarly soiled or infectious garments shall not be used and shall be diverted to the building sewer.
10. Gray water shall not contain hazardous chemicals derived from activities such as cleaning car parts, washing greasy or oily rags, or disposing of waste solutions from home photo labs or similar hobbyist or home occupational activities.
11. Exemption from construction permit requirements of this code shall not be deemed to grant authorization for any gray water system to be installed in a manner that violates other provisions of this code or any other laws or ordinances of the Authority Having Jurisdiction.
12. An operation and maintenance manual shall be provided to the owner. Directions shall indicate that the manual is to remain with the building throughout the life of the system and upon change of ownership or occupancy.
13. Gray water discharge from a clothes washer system through a standpipe shall be properly trapped in accordance with the plumbing code.
1501.6 Operation and Maintenance Manual. An operation and maintenance manual for gray water and on-site treated water systems required to have a permit in accordance with Section 1501.3 shall be supplied to the building owner by the system designer. The operation and maintenance manual shall include the following:
(1) Detailed diagram of the entire system and the location of system components.
(2) Instructions for operating and maintaining the system.
(3) Details on maintaining the required water quality for onsite nonpotable water systems.
(4) Details on deactivating the system for maintenance, repair, or other purposes.
(5) Applicable testing, inspection, and maintenance frequencies in accordance with Table 1501.5.
(6) A method of contacting the manufacturer(s).
(7) Directions to the owner or occupant that the manual shall remain with the building throughout the life of the structure.

1503.0 Gray Water Systems.
1503.1 General. The provisions of this section shall apply to the construction, alteration, and repair of gray water systems.
1503.2 Gray Water Collection Piping. New single-family dwellings shall have a separate waste piping system for all gray water fixtures in accordance with this code. The separate piping system shall be piped to outside the building and terminate into an approved gray water diverter valve in accordance with Section 1503.2.2 before connecting to the waste system from non-gray water fixtures.

Exception: Where ground conditions do not provide percolation or where prohibited by this code.

1503.2.1 Diverter. The diverter valve shall be connected and installed in the open position to the building sewer. The gray water diversion port shall remain capped off for future use until a gray water irrigation/reuse system is installed.

1503.2.2 Access. The diverter and sewer connection shall be readily accessible for connection, inspection, maintenance, and servicing.

1503.2.3 Regulatory. Gray water reuse and irrigation system components shall meet local, and state code and regulatory requirements.

(renumber remaining sections)

1503.2 System Requirements. Gray water shall be permitted to be diverted away from a sewer or private sewage disposal system of single family and multifamily dwellings, and discharge to a subsurface irrigation or subsoil irrigation system, or to a mulch basin, or disposal field. The gray water shall be permitted to discharge to a mulch basin for single-family and multi-family dwellings. Gray water shall not be used to irrigate root crops or food crops intended for human consumption that comes in contact with soil.

1503.2.1 Surge Capacity. Gray water systems shall be designed to have the capacity to accommodate peak flow rates and distribute the total amount of estimated gray water on a daily basis to a subsurface irrigation field, subsoil irrigation field, or mulch basin without surfacing, ponding, or runoff. A surge tank is required for systems that are unable to accommodate peak flow rates and distribute the total amount of gray water by gravity drainage. The water discharge for gray water systems shall be determined in accordance with Section 1503.8.1 or Section 1503.8.2. Systems that produce more gray water than needed by the landscape shall discharge excess water into the sewer or private sewage disposal system.

1503.2.2 Diversion. The gray water system shall connect to the sanitary drainage system downstream of fixture traps and vent connections through a gray water diverter valve(s) approved by the Authority Having Jurisdiction. The gray water diverter valve shall comply with IAPMO PS-59 and be installed in an accessible location and clearly indicate the direction of flow.

Exception: A clothes washer system in compliance with Section 1501.3.1.
### TABLE 1503.4
LOCATION OF GRAY WATER SYSTEM

| MINIMUM HORIZONTAL DISTANCE IN CLEAR REQUIRED FROM: | SURGE TANK
| (feet) | SUBSURFACE AND SUBSOIL IRRIGATION FIELD AND MULCH BED
| (feet) |
| --- | --- | --- |
| Building structures\(^1\) | 52, 9 | 23, 8 |
| Property line adjoining private property | 5 | 58 |
| Water supply wells\(^4\) | 50 | 100 |
| Streams and lakes\(^4\) | 50 | 505 |
| Sewage pits or cesspools | 5 | 5 |
| Sewage disposal field\(^10\) | 5 | 46 |
| Septic tank | 0 | 5 |
| On-site domestic water service line | 5 | 5 |
| Pressurized public water main | 10 | 10\(^7\) |

For SI units: 1 foot = 304.8 mm

**Note:** Where irrigation or disposal fields are installed in sloping ground, the minimum horizontal distance between any part of the distribution system and the ground surface shall be 15 feet (4572 mm).

\(^1\) Including porches and steps, whether covered or uncovered, breezeways, roofed carports, roofed patios, carports, covered walks, covered drive- ways, and similar structures or appurtenances.

\(^2\) The distance shall be permitted to be reduced to 0 feet for aboveground tanks when first approved by the Authority Having Jurisdiction.

\(^3\) Reference to a 45 degree (0.79 rad) angle from foundation.

\(^4\) Where special hazards are involved, the distance required shall be increased as directed by the Authority Having Jurisdiction.

\(^5\) These minimum clear horizontal distances shall also apply between the irrigation or disposal field and the ocean mean high high tide line.

\(^6\) Add 2 feet (610 mm) for each additional foot of depth in excess of 1 foot (305 mm) below the bottom of the drain line.

\(^7\) For parallel construction or for crossings, approval by the Authority Having Jurisdiction shall be required.

\(^8\) The distance shall be permitted to be reduced to 11/2 feet (457 mm) for drip and mulch basin irrigation systems.

\(^9\) The distance shall be permitted to be reduced to 0 feet for surge tanks of 75 gallons (284 L) or less.

\(^10\) Where irrigation or disposal fields are installed in the sloping ground, the minimum horizontal distance between a part of the distribution system and the ground surface shall be 15 feet (4572 mm).

#### 1503.8.1 Single Family Dwellings and Multi-Family Dwellings.

The gray water discharge for single family and multi-family dwellings shall be calculated by water use records, calculations of local daily per person interior water use, or the following procedure:

1. The number of occupants of each dwelling unit shall be calculated as follows:

   | First bedroom | 2 occupants |
   | Each additional bedroom | 1 occupant |

2. The estimated gray water flows of each occupant shall be calculated as follows:

   | Showers, bathtubs, and lavatories | 25 13 gallons (96 50 L) per day/occupant |
   | Lavatories | 4 gallons (15 L) per day/occupant |
   | Laundry | 46 10 gallons (67 38 L) per day/occupant |

(3) (remaining text unchanged)
1503.9.4 Subsurface Irrigation Field and Mulch Basin Supply Line Materials. Materials for gray water piping outside the building for non-pressure gravity systems shall be ABS, polyethylene, or PVC or other approved DWV pipe. Pressure systems shall be pressure rated polyethylene or PVC or other approved pressure rated pipe. Drip feeder lines shall be PVC or polyethylene tubing.

### TABLE 1504.2
**DESIGN OF SIX TYPICAL SOILS ABSORPTION CAPACITY**

<table>
<thead>
<tr>
<th>TYPE OF SOIL</th>
<th>MINIMUM SQUARE FEET OF IRRIGATION AREA PER 100 Gallons of Estimated Gray Water Discharge per Day</th>
<th>MAXIMUM ABSORPTION CAPACITY IN Gallons per Square Foot of Irrigation/Leaching Area for a 24-Hour Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse sand or gravel</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Fine sand</td>
<td>25</td>
<td>4.0</td>
</tr>
<tr>
<td>Sandy-loam</td>
<td>40</td>
<td>2.6</td>
</tr>
<tr>
<td>Sandy-clay</td>
<td>60</td>
<td>1.7</td>
</tr>
<tr>
<td>Clay with considerable sand or gravel</td>
<td>90</td>
<td>1.1</td>
</tr>
<tr>
<td>Clay with small amounts of sand or gravel</td>
<td>120</td>
<td>0.8</td>
</tr>
</tbody>
</table>

### TABLE 1504.2
**SOIL CLASS AND TEXTURES MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FOOT OF IRRIGATION/LEACHING AREA FOR A 24-HOUR PERIOD**

<table>
<thead>
<tr>
<th>SOIL CLASS AND TEXTURES</th>
<th>MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FOOT OF IRRIGATION/LEACHING AREA FOR A 24-HOUR PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy Loam (Group A) (Textures: sand, loamy sand, sandy loam)</td>
<td>11.9</td>
</tr>
<tr>
<td>Loam (Group B) (Textures: loam, silt loam)</td>
<td>4.5</td>
</tr>
<tr>
<td>Sandy Clay Loam (Group C) (Textures: Sandy clay loam)</td>
<td>3.0</td>
</tr>
<tr>
<td>Clay Loam (Group D) (Textures: clay loam, silty clay loam, sandy clay, silty clay, clay)</td>
<td>0.9</td>
</tr>
</tbody>
</table>

For SI units: 1 square foot = 0.0929 m², 1 gallon per day = 0.000043 L/s

1504.5.4 Emitter Size. Emitters shall be installed in accordance with the manufacturer’s installation instructions. Emitters shall have a flow path of not less than 1200 microns (µ) (1200 µm) and shall not have a coefficient of manufacturing variation (Cv) exceeding 7 percent. Irrigation system design shall be such that emitter flow variation shall not exceed 10 percent.

1504.5.7 Maximum Pressure. Where pressure at the discharge side of the pump exceeds 20 pounds-force per square inch (psi) (138 kPa), a pressure-reducing valve able to maintain downstream pressure no greater than the maximum operating pressure of the installed tubing, emitters, or other components not exceeding 20 psi (138 kPa) shall be installed downstream from the pump and before an emission device.

1504.6 Mulch Basin Design and Construction. A mulch basin shall comply with Section 1504.6.1 through Section 1504.6.34.  
1504.6.1 Single Family and Multi-Family Dwellings. The gray water discharge to a mulch basin is limited to single family and multi-family dwellings.
The proposed changes to Chapter 15 are updates to harmonize to the latest edition of the WeStand. These updates include provisions for clothes washer only systems. Clothes washer only systems that do not alter the existing plumbing (and follow basic health and safety guidelines) are extremely low risk and should be allowed to be installed with no permit. California has had great success with many incentive programs across the state for the clothes washer graywater system due to its permit-exempt status. For Section 1501.6(7), this addition should be added so the system owner knows they must pass on the Operation and Maintenance (O&M) manual to future owners. For Section 1503.2, the installation of a total gray water system in a single family dwelling would save each dwelling considerable water, far more water than the low flow shower heads and conversion to ultra-low flow toilets save. These provisions give guidance to piping these gray water systems. For Table 1504.2: The existing Table 1504.2 “Design of Six Typical Soils” does not appear to come from a referenced source and the names of the soils are not typical soils. If someone were to send their soil into a laboratory for testing, or perform an on-site test using standard soil texture identification methods (jar test or soil ribbon test) the soil names they would get would most likely not match this chart. We have not been able to find the original source for the information in this table. The information doesn't appear to come from septic design or irrigation system design: it appears the original creators of this table used some unknown infiltration rate and applied an unknown factor to come up with the provided coefficients for infiltration graywater into various types of soil. This new proposed table uses steady state infiltration rates from the Minnesota Stormwater Manual 2013. This manual compiled infiltration rates and recommendations based on a review of 30 guidance manuals and other stormwater references. Other agencies, like the San Francisco Public Utilities Commission, use the same table in their stormwater system sizing manuals. The table uses steady state infiltration rates and is based on the assumption that the soil is very deeply wetted below (or at field capacity), which builds in a safety factor into the numbers. (Graywater systems are typically shut off during the rainy season so the soil would not be at field capacity during irrigation time.) By adopting this new table, the UPC would be using a soil infiltration table that is aligned with actual, published references that are used by stormwater, civil engineers, and landscape professionals. The proposed table includes both hydrologic groups, which a person could look up the property's hydrologic group on a GIS map or NRCS map, as well as soil textures which an on-site soil test could verify. The proposed table is more conservative for clay soil types, and so would have less potential for overloading slower draining soils than the existing table. The proposed table has higher infiltration rates for sandy and loam soils, which are soils that are verified by studies (see references for Stormwater Manual) to infiltrate much much more water than the current table permits. To create the new table we converted the units provided in the referenced table from inches/hour to gallons/day as shown in the reference material. This is the source for the steady state infiltration rates: Minnesota Stormwater Manual 2013 -thirty guidance manuals and many other stormwater references were reviewed to compile recommended infiltration rates. All of these sources use the following studies as the basis for their recommended infiltration rates: (1) Rawls, Brakensiek and Saxton (1982); (2) Rawls, Gimenez and Grossman (1998); (3) Bouwer and Rice (1984); and (4) Urban Hydrology for Small Watersheds (NRCS). SWWD, 2005, provides field documented data that supports the proposed infiltration rates. (view reference list here https://stormwater.pca.state.mn.us/index.php?title=References) The Full Minnesota Stormwater Manual is available on-line here: https://stormwater.pca.state.mn.us/index.php?title=Main_Page

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposed change contains unenforceable language such as "minimize contact with humans and domestic pets." The provisions are unclear. Additionally, section 1501.3 is confusing as it requires a permit then exempts it.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 22  NEGATIVE: 3  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: The proposed change would harmonize the code with WE-Stand. This change was properly substantiated and should have been accepted as submitted.

GORSUCH: I agree the code should allow sustainability-minded people options to practice their beliefs in their own houses. Perhaps this can go into an appendix.

WHITE: This language adds options for ecologically-minded individuals and should be allowed in the code.
CHAPTER 15 - ALTERNATE WATER SOURCES FOR NONPOTABLE APPLICATIONS

1501.7 Minimum Water Quality Requirements. The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, for on-site treated nonpotable systems, the water quality requirements of EPA/600/R-12/618-2012, IAPMO IGC 324 or NSF 350 shall apply. The EPA/625/R-04/108 contains recommended water reuse guidelines to assist regulatory agencies to develop, revise, or expand alternate water source water quality standards.

Exception: Water treatment is not required for gray water used for subsurface irrigation.

1506.7 On-Site Treated Nonpotable Water Devices and Systems. Devices or equipment used to treat on-site treated nonpotable water to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) or approved for the intended application. Devices or equipment used to treat on-site treated nonpotable water for use in the water closet and urinal flushing, surface irrigation, and similar applications shall comply with IAPMO IGC 324, NSF 350 or approved by the Authority Having Jurisdiction.

CHAPTER 16 - NONPOTABLE RAINWATER CATCHMENT SYSTEMS

1603.5 Minimum Water Quality. The minimum water quality for harvested rainwater shall meet the applicable water quality requirements for the intended applications as determined by the Authority Having Jurisdiction. In the absence of water quality requirements determined by the Authority Having Jurisdiction, the minimum treatment and water quality shall be in accordance with Table 1603.5, EPA/600/R-12/618-2012, IAPMO IGC 324 or NSF 350.

Exception: No treatment is required for rainwater used for subsurface or nonsprinkled surface irrigation where the maximum storage volume is less than 360 gallons (1363 L).

1603.5.1 Treatment. If the quality of the tested water cannot consistently be maintained at the minimum levels specified in Table 1603.5, then the system shall be equipped with an appropriate treatment device meeting applicable NSF standards referenced in Chapter 17.
TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA/600/R-12/618-2012</td>
<td>Guidelines for Water Reuse</td>
<td>Miscellaneous</td>
<td>1501.7</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: IAPMO IGC 324 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

Note: EPA/600/R-12/618-2012 does not meet the requirements for a mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA/600/R-12/618-2012</td>
<td>Guidelines for Water Reuse</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
The 2019 edition of the IAPMO IGC 324 has been greatly improved. There was input from the San Francisco Department of Public Health (SFDPH) in developing this latest edition.

In addition to the below substantiation, please see support letter from LADWP for the Technical Committee review.

IAPMO IGC 324 covers residential, multi-family, and commercial use applications intended to process water from alternate water sources such as greywater, rainwater, stormwater air conditioning condensate, cooling tower makeup, vehicle wash and other non-potable reuse applications not specifically listed, for use in subsurface and/or surface irrigation and toilet/urinal flushing applications, and specifies requirements for materials, physical characteristics, performance testing, and markings. The standard also covers test plans and safety check (failure modes effects) that ensures the safety of the treated water.

Additionally, Section 1603.5.1 is being stricken as appropriate references are being proposed for inclusion in Section 1603.5. The proposed text in Section 1603.5 will provide guidance to the standards that apply to water treatment as options for harvested rainwater.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

CHAPTER 15 - ALTERNATE WATER SOURCES FOR NONPOTABLE APPLICATIONS

1501.7 Minimum Water Quality Requirements. The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, for on-site treated nonpotable systems, the water quality requirements of EPA/600/R-12/618-2012, IAPMO IGC 324 or NSF 350 shall apply.

Exception: Water treatment is not required for gray water used for subsurface irrigation.
1506.7 On-Site Treated Nonpotable Water Devices and Systems. Devices or equipment used to treat on-site treated nonpotable water to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) or approved for the intended application. Devices or equipment used to treat on-site treated nonpotable water for use in the water closet and urinal flushing, surface irrigation, and similar applications shall comply with IAPMO IGC 324, NSF 350 or approved by the Authority Having Jurisdiction.

CHAPTER 16 - NONPOTABLE RAINWATER CATCHMENT SYSTEMS

1603.5 Minimum Water Quality. The minimum water quality for harvested rainwater shall meet the applicable water quality requirements for the intended applications as determined by the Authority Having Jurisdiction. In the absence of water quality requirements determined by the Authority Having Jurisdiction, the minimum treatment and water quality shall be in accordance with Table 1603.5, EPA/600/R-12/618-2012, IAPMO IGC 324 or NSF 350.

Exception: No treatment is required for rainwater used for subsurface or nonsprinkled surface irrigation where the maximum storage volume is less than 360 gallons (1363 L).

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA/600/R-12/618-2012</td>
<td>Guidelines for Water Reuse</td>
<td>Miscellaneous</td>
<td>1501.7</td>
</tr>
</tbody>
</table>

COMMITTEE STATEMENT:
The modification removes reference to EPA/600/R-12/618-2012 as it is not written in mandatory language. EPA/600/R-12/618-2012 will remain as a reference guide in Table 1701.2. Also, in Section 1506.7, the phrase “listed or labeled” is being updated to “listed and labeled” for consistency in the code.

The 2019 edition of the IAPMO IGC 324 has been greatly improved. There was input from the San Francisco Department of Public Health (SFDPH) in developing this latest edition.

In addition to the below substantiation, please see support letter from the Los Angeles Department of Water and Power (LADWP) for the Technical Committee review.

IAPMO IGC 324 covers residential, multi-family, and commercial use applications intended to process water from alternate water sources such as greywater, rainwater, stormwater air conditioning condensate, cooling tower makeup, vehicle wash and other non-potable reuse applications not specifically listed, for use in subsurface and/or surface irrigation and toilet/urinal flushing applications, and specifies requirements for materials, physical characteristics, performance testing, and markings. The standard also covers test plans and safety check (failure modes effects) that ensures the safety of the treated water.

Additionally, Section 1603.5.1 is being stricken as appropriate references are being proposed for inclusion in Section 1603.5. The proposed text in Section 1603.5 will provide guidance to the standards that apply to water treatment as options for harvested rainwater.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
1501.7 Minimum Water Quality Requirements. The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, for on-site treated nonpotable systems, the water quality requirements of NSF 350 shall apply. The EPA/625/R-04/108 EPA/600/R-12/618 contains recommended water reuse guidelines to assist regulatory agencies to develop, revise, or expand alternate water source water quality standards.

Exception: Water treatment is not required for gray water used for subsurface irrigation.

K 101.7 Minimum Water Quality Requirements. The minimum water quality for potable rainwater catchment systems shall comply with the applicable water quality requirements as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, the guidelines EPA/625/R-04/108 EPA/600/R-12/618 contains recommended water reuse guidelines to assist regulatory agencies develop, revise, or expand alternate water source water quality standards.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
<th>REFERENCED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
<td>STANDARD TITLE</td>
</tr>
</tbody>
</table>

(Portions of table not shown remain unchanged)

Note: EPA/600/R-12/618-2012 does not meet the requirements for a mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.
SUBSTANTIATION:
The above revisions reflect the latest edition (title) to the EPA standard (Guidelines for Water Reuse) that is referenced in Table 1701.1 and Table 1701.2. EPA/600/R-12/618-2012 is the latest edition of EPA/625/R04-108-2004. Since the latest standard edition is being updated in Table 1701.1 and being removed from Table 1701.2 since it is used in the body of the code. Additionally, two sections (1501.7 and K 101.7) are being revised to show the latest edition of the Guidelines for Water Reuse standard. All provisions remain the same, this is just a clean up for the latest document.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

1501.7 Minimum Water Quality Requirements. The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, for on-site treated nonpotable systems, the water quality requirements of NSF 350 shall apply. The EPA/600/R-12/618 contains recommended water reuse guidelines to assist regulatory agencies to develop, revise, or expand alternate water source water quality standards.

Exception: Water treatment is not required for gray water used for subsurface irrigation.

K 101.7 Minimum Water Quality Requirements. The minimum water quality for potable rainwater catchment systems shall comply with the applicable water quality requirements as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, the guidelines EPA/600/R-12/618 contains recommended water reuse guidelines to assist regulatory agencies develop, revise, or expand alternate water source water quality standards.

<table>
<thead>
<tr>
<th>TABLE 1701.1 REFERENCE STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>EPA/600/R-12/618-2012</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

<table>
<thead>
<tr>
<th>TABLE 1701.2 STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCUMENT NUMBER</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>EPA/600/R-12/618-2012</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

COMMITTEE STATEMENT:
The modification removes reference to EPA/600/R-12/618-2012 from Section 1501.7 as it is not written in mandatory language. The reference for EPA/600/R-12/618-2012 will remain in that appendix in Section K 101.7 and in Table 1701.2.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 256, Section 1501.7 (Minimum Water Quality Requirements) and UPC Item # 257, Section 1501.7 (Minimum Water Quality Requirements) resulted in conflicting language within the code. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:
1501.7 Minimum Water Quality Requirements. The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, for on-site treated nonpotable systems, the water quality requirements of IAPMO IGC 324 or NSF 350 shall apply.

Exception: Water treatment is not required for gray water used for subsurface irrigation.

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT: The language in UPC Item # 257, Section 1501.7 (Minimum Water Quality Requirements) is being revised to correlate with the action taken by the UPC TC for Item # 256, Section 1501.7 (Minimum Water Quality Requirements) regarding the reference standards for on-site treated nonpotable systems.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section 1501.7 regarding the reference standards for on-site treated nonpotable systems.
Proposals

Item #: 258
UPC 2024  Section: 1502.4

SUBMITTER: Shane Peters
City of Santa Monica

RECOMMENDATION:
Revise text

1502.0 Inspection and Testing.

1502.4 Separation Requirements. Underground alternate water source service piping other than gray water shall be separated from the building sewer in accordance with this code. Treated nonpotable water pipes carrying treated nonpotable water shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where horizontal piping materials do not comply with this requirement, the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the treated nonpotable water piping.

SUBSTANTIATION:
The change clarifies that pipes are not “treated non potable water.” They carry/distribute treated non-potable water. This change is needed to remove ambiguous language and add clarity to the intent of the section.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
Proposals

Item #: 259
UPC 2024 Section: 1603.21

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Revise text

1603.0 Design and Installation.

1603.21 Rainwater Diversion Valves. Rainwater diversion valves ranging from 6 inches (150 mm) to 12 inches (300 mm) in diameter shall comply with IAPMO IGC 352. Valves shall be accessible and include a filter located upstream of the valve when required.

SUBSTANTIATION:
Section 1503.2.4 should be moved to Chapter 16 as a sub-section of Section 1603.0 because it provides testing standards and installation requirements specifically for rainwater diversion valves. It does not address non-potable gray water or reclaimed water installations.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

1603.0 Design and Installation.

1603.21 Rainwater Diversion Valves. Rainwater diversion valves ranging from 2 inches (50 mm) through 4 inches (100 mm) in diameter shall comply with IAPMO PS 59. Rainwater diversion valves ranging from 6 inches (150 mm) to 12 inches (300 mm) in diameter shall comply with IAPMO IGC 352. Valves shall be accessible and include a filter located upstream of the valve when required.

COMMITTEE STATEMENT:
The modification adds the rainwater diversion valve standard IAPMO PS 59 for the smaller pipe size applications. The modification also takes the intent of Item #267 and combines it into this proposal.

The IAPMO IGC 352 and IAPMO PS 59 standards cover valves designed to divert rainwater or storm water. IAPMO PS 59 covers valves ranging from 2-inches through 4-inches in diameter. IAPMO IGC 352 covers rainwater systems ranging from 6-inches through 12-inches in diameter and addresses the need for large diameter valves for use with alternate water source systems, which is not addressed in IAPMO PS 59.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 260

UPC 2024  Section: 1505.5

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Add new text

1505.0 Reclaimed (Recycled) Water Systems.

1505.5 Water Pressure. Reclaimed (recycled) water systems supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than 15 pounds-force per square inch (psi) (103 kPa) residual pressure at the highest and most remote outlet served. Where the water pressure in the reclaimed water supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve reducing the pressure to 80 psi (552 kPa) or less to water outlets in the building shall be installed.

(renumber remaining sections)

SUBSTANTIATION:
The Code does not address a minimum or maximum water pressure in Chapter 15, Section 1505.0 for off-site treated reclaimed water. These systems are used to supply water to water closets and urinals, and in some cases exterior hose bibbs and should be required to meet the same requirements as those found in Chapter 6 for potable water systems.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 261
UPC 2024  Section: 1506.1

SUBMITTER: Garry Sato
Greensmart Sustainable Concepts

RECOMMENDATION:
Revise text

1506.0 On-Site Treated Nonpotable Water Systems.
1506.1 General. The provisions of this section shall apply to the installation, construction, alteration, and repair of
onsite treated nonpotable water systems intended to supply uses such as water closets, urinals, trap primers for
floor drains and floor sinks, above and belowground irrigation, industrial or commercial cooling or air
conditioning, and other uses approved by the Authority Having Jurisdiction.

Nonpotable water sources that shall be permitted for collection for re-use in on-site treated nonpotable water
systems, include rainwater, air conditioner condensate, cooling tower blow-down water, fire pump test water,
foundation drainage, swimming pool backwash, steam system condensate, fluid cooler discharge water, ice maker
discharge water, food steamer discharge water, combination oven discharge water, industrial process water, and
other sources approved by the Authority Having Jurisdiction.

SUBSTANTIATION:
The proposed revision will give updated clarity and uniformity, as there have been new codes and regulations put in
place in various other regions specifically relating to sources and uses of "on-site treated nonpotable water" since
the last publication.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
There is a concern that the list may not be all-inclusive regarding water sources permitted for collection for re-use.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 262
UPC 2024  Section: 1506.5

SUBMITTER: Bruce A Pfeiffer
Retired - City of Topeka

RECOMMENDATION:
Add new text

1506.0 On-Site Treated Nonpotable Water Systems.

1506.5 Water Pressure. On-site treated non-potable water systems supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than 15 pounds-force per square inch (psi) (103 kPa) residual pressure at the highest and most remote outlet served. Where the water pressure in the on-site treated non-potable water supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve reducing the pressure to 80 psi (552 kPa) or less to water outlets in the building shall be installed.

(renumber remaining sections)

SUBSTANTIATION:
The Code does not address a minimum or maximum water pressure in Chapter 15, Section 1506.0 for on-site treated non-potable water systems. These systems are used to supply water to water closets and urinals and should be required to meet the same requirements as those found in Chapter 6 for potable water systems.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 263
UPC 2024  Section: 1506.7, 1603.16, K 101.4.1, K 104.4

SUBMITTER: Karan Kapila  
Self

RECOMMENDATION:  
Revise text

1506.7 On-Site Treated Nonpotable Water Devices and Systems. Devices or equipment used to treat on-site treated nonpotable water to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or and labeled (third-party certified) by a listing agency (accredited conformity assessment body) or approved for the intended application. Devices or equipment used to treat on-site treated nonpotable water for use in the water closet and urinal flushing, surface irrigation, and similar applications shall comply with NSF 350 or approved by the Authority Having Jurisdiction.

1603.16 Water Quality Devices and Equipment. Devices and equipment used to treat rainwater to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or and labeled (third-party certified) by a listing agency (accredited conformity assessment body) and approved for the intended application.

K 101.4.1 Plumbing Materials and Systems. Pipe, pipe fittings, traps, fixtures, material, and devices used in a potable rainwater system shall be listed or and labeled (third-party certified) by a listing agency (accredited conformity assessment body) and shall be in accordance with approved applicable recognized standards referenced within this code, and shall be free from defects. Unless otherwise provided for in this appendix, materials, fixtures, or devices used or entering into the construction of plumbing systems, or parts thereof shall be submitted to the Authority Having Jurisdiction for approval.

K 104.4 Water Quality Devices and Equipment. Devices and equipment used to treat rainwater to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or and labeled (third-party certified) by a listing agency (accredited conformity assessment body) and approved for the intended application.

SUBSTANTIATION:  
This proposal changes "listed or labeled" to "listed and labeled" to clarify the intention of the language. The phrase "listed and labeled" is found 6 other times in the UPC. This will avoid confusion and conflict within the code.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:  
The proposed change being rejected as the intent is already addressed for Section 1506.7 in Item # 256.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  
AFFIRMATIVE: 25  
NOT RETURNED: 1  
Daniels
1507.0 Onsite Blackwater Treatment Systems.  
1507.1 General. The provisions of this section shall apply to the water quality, monitoring, design, construction, alteration, repair, and operation requirements of onsite blackwater treatment systems for nonpotable reuse.  
1507.2 Allowable Use of Blackwater. Where approved or required by the Authority Having Jurisdiction, blackwater shall be permitted to be used in lieu of potable water for uses such as, but not limited, to water closets, urinals, clothes washers, ornamental plant irrigation, and dust suppression.  
1507.3 Design and Construction Requirements. Onsite blackwater treatment systems shall meet the design, construction, and performance requirements of Section 1507.3.1 or Section 1507.3.2.  
1507.3.1 Listed Blackwater Treatment Systems. Onsite blackwater treatment systems shall be listed to NSF 350, installed according to the manufacturer's instructions, and commissioned in accordance with Section 1507.13.  
1507.3.2 Alternative Design Systems. Where approved by the Authority Having Jurisdiction, onsite blackwater treatment systems for residential and commercial applications shall comply with the provisions of Section 1507.4 through Section 1507.15.  
1507.4 Permit. It shall be unlawful for any person to construct, install, alter, or cause to be constructed, installed, or altered any blackwater treatment system in a building or on a premise without first obtaining a permit to do such work from the Authority Having Jurisdiction.  
1507.5 Component Identification. System components shall be properly identified as to the manufacturer.  
1507.6 Material Compatibility. Blackwater treatment systems shall be constructed of materials that are compatible with the type of pipe and fitting materials, water treatment, and water conditions in the system.  

**TABLE 1507.7**  
**LOG REDUCTION TARGETS FOR 10^-4 INFECTIONS PER PERSON PER YEAR**  
**BENCHMARKS FOR BLACKWATER TREATMENT SYSTEMS**

<table>
<thead>
<tr>
<th>WATER USE SCENARIO</th>
<th>ENTERIC VIRUSES</th>
<th>PARASITIC PROTOZOA</th>
<th>ENTERIC BACTERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ornamental plant irrigation* / dust suppression</td>
<td>8.0</td>
<td>7.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Indoor Use</td>
<td>8.5</td>
<td>7.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>

* Non-food  

1507.7 Log Reduction Targets. Blackwater treatment systems shall be designed to meet the log reduction targets as set forth in Table 1507.7. To meet the log reduction targets in Table 1507.7, treatment processes used in blackwater systems shall comply with Section 1507.9 for validation or be operated according to conditions approved by the Authority Having Jurisdiction.  
1507.8 Effluent Water Quality Parameters. Blackwater treatment systems shall be designed to meet the effluent water quality parameters for water closet and urinal fixture use listed in Table 1507.8.
### TABLE 1507.8
**EFFLUENT WATER QUALITY PARAMETERS FOR WATER CLOSET AND URINAL FIXTURE USE**

<table>
<thead>
<tr>
<th></th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkalinity mg/L</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>TDS mg/L</td>
<td>0</td>
<td>500</td>
</tr>
<tr>
<td>Turbidity NTU</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>pH</td>
<td>6.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Odor</td>
<td>Non-Offensive</td>
<td></td>
</tr>
<tr>
<td>Oily Film and Foam</td>
<td>Visual Non-detectable</td>
<td></td>
</tr>
<tr>
<td>Free Chlorine Residual ppm</td>
<td>NA</td>
<td>4</td>
</tr>
<tr>
<td>Combined Chlorine ppm</td>
<td>NA</td>
<td>4</td>
</tr>
<tr>
<td>Chloramines mg/L</td>
<td>NA</td>
<td>4</td>
</tr>
</tbody>
</table>

**1507.9 Validation.** Where required by the Authority Having Jurisdiction, treatment processes shall be tested to verify the pathogen reduction performance. The treatment processes shall be validated through third-party component validation or field verification using the challenge testing. The results of the third-party component validation and/or challenge testing shall be summarized in a validation report prepared by a Registered Design Professional. The validation report shall document the treatment technology’s log reduction performance, including information on the operating conditions and surrogate parameters.

**1507.10 Health and Safety.** Treated blackwater shall not create a nuisance or odor, nor threaten human health, or damage the quality of surface water or groundwater.

**1507.11 Monitoring Requirements.** Monitoring of blackwater treatment systems shall be based on the risk level in accordance with Table 1507.11(1). The parameters listed in Table 1507.11(2) shall be monitored by sensors placed in the effluent of the system and connected to a smart controller. The smart controller shall activate an alarm when the parameters in Table 1507.11(2) are outside the specifications and shall shut the system down when the alarm is not acknowledged after a period of 8 hours has elapsed. For Category 2, quarterly grab samples shall be taken out of the effluent and analyzed by an accredited lab. The sensors' accuracy and response shall be validated upon commissioning of the system by an independent third party.

**TABLE 1507.11(1) RISK LEVELS**

<table>
<thead>
<tr>
<th>RISK LEVEL</th>
<th>TREATED WATER USAGE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ornamental plant irrigation and dust suppression</td>
</tr>
<tr>
<td>2</td>
<td>Water closets, urinals, clothes washers</td>
</tr>
</tbody>
</table>

*See Section 1507.2 for other uses approved by the Authority Having Jurisdiction.

**TABLE 1507.11(2) MONITORING PARAMETERS**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>PARAMETERS TO BE MONITORED</th>
<th>VALIDATION PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Turbidity, ORP, UV intensity (if used)</td>
<td>IGC 324 -Sensor validation procedure using 5.4.1.1 (a), (b), (c), and (d), as applicable</td>
</tr>
<tr>
<td>2</td>
<td>Turbidity, ORP, UV intensity (if used), pH, Quarterly lab Sample for Total Coliform</td>
<td></td>
</tr>
</tbody>
</table>

**1507.12 Design and Installation.** The design and installation of onsite blackwater treatment systems shall meet the requirements of Section 1507.12.1 through Section 1507.12.6.

**1507.12.1 Connections to Potable or Reclaimed (Recycled) Water Systems.** Blackwater treatment systems shall have no direct connection to any potable water supply or reclaimed (recycled) water source system. Potable water or reclaimed (recycled) water shall be permitted to be used as makeup water for a blackwater treatment system provided the potable or reclaimed (recycled) water supply connection is protected by an airgap.

**1507.12.2 Bypass Connection.** A bypass shall be provided for the input connection to the blackwater treatment system.
The bypass shall be a diverter valve normally open to the blackwater treatment system. The normally closed port of the diverter valve shall be connected directly to the plumbing drainage system in accordance with this code.

1507.12.3 Overflow Connection. Blackwater treatment overflow shall be connected directly to the plumbing drainage system. The overflow shall be provided with a backwater valve at the point of connection to the plumbing drainage system. The backwater valve shall be accessible for inspection and maintenance.

1507.12.4 Fail-Safe Mechanisms. Blackwater treatment systems shall be equipped with an automatic shutdown of the treatment process when a malfunction occurs.

1507.12.5 Flow Meter Totalizer. Buildings with blackwater treatment systems shall include a flow meter totalizer on the treated blackwater distribution system and a flow meter totalizer on the potable make-up water connection to the blackwater treatment system.

1507.12.6 Cross-Connection Inspection and Testing. A cross-connection test is required in accordance with Section 1502.0. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

1507.13 Commissioning. Onsite blackwater treatment systems shall be commissioned in accordance with the requirements of Section 1507.13.1 through Section 1507.13.4.

1507.13.1 Commissioning Requirements. Commissioning of blackwater treatment systems shall be included in the design and construction processes of the project. Commissioning shall be performed by a person who demonstrates competency in commissioning blackwater treatment systems as required by the Authority Having Jurisdiction.

1507.13.2 Commissioning Plan. The construction documents shall include the commissioning plan for the blackwater treatment system. The commissioning plan shall be approved by the Authority Having Jurisdiction prior to commissioning the blackwater treatment system. The commissioning plan shall include the following:

1. General project information.
2. Equipment to be tested, including the test methodology.
3. Processes to be tested.
4. Criteria or process for testing.
5. Criteria for acceptance.
6. Commissioning team contact information.
7. Commissioning process activities, schedules, and responsibilities.
8. Plans for the completion of functional performance testing, post construction documentation and training, and the commissioning report.

1507.13.3 Performance Testing. Performance tests shall verify that the installation and operation of the equipment of the blackwater treatment system is in accordance with the approved plans and specifications. The performance test report shall include the equipment tested, the testing methods utilized, and proof of proper calibration of the equipment.

1507.13.4 Commissioning Report. The commissioning report shall be submitted to the Authority Having Jurisdiction.

1507.14 Operation and Maintenance Manual. An operation and maintenance manual shall be provided in accordance with Section 1501.6 and shall also include the following:

1. Instructions on operating and maintaining the system, including treatment process operations, instrumentation and alarms, and chemicals storage and handling.
2. Site equipment inventory and maintenance notes.
3. Equipment/system warranty documentation and information.
4. As-built design drawings.
5. Details on training requirements and qualifications of personnel responsible for operating the system.

1507.15 Inspection. Field inspections shall take place during and after construction while the contractor is on-site to verify that the blackwater treatment system components have been properly supplied and installed according to the plans and specifications used for installation. Record drawings shall be maintained with changes to the approved plans by the contractor and available for periodic inspection as needed.

Chapter 2 Definitions

204.0 -B-
Blackwater. Waste water containing bodily or other biological wastes discharged from toilets and kitchen sink waste.

205.0 -C-
Challenge Test. The evaluation of a unit treatment process for pathogen log10 reduction performance using selected surrogate or indigenous constituents. This includes a detailed technology evaluation study conducted to challenge the treatment technology over a wide range of operational conditions.

Commissioning. The activities associated with bringing a new process into normal working condition.

208.0 -F-
Field Verification. Performance confirmation study conducted using challenge testing, including surrogate microorganisms and/or other non-biological surrogates, usually during startup and commissioning.
**Log Reduction.** The removal of a pathogen or surrogate in a unit process expressed in log_{10} units of the effluent concentration over the influent concentration (e.g., a 1-log reduction equates to 90% removal, 2-log reduction to 99% removal, 3-log reduction to 99.9% removal, and so on).

**Log Reduction Target (LRT).** The log_{10} reduction target for the specified pathogen group (e.g., viruses, bacteria, or protozoa) to achieve the identified level of risk to individuals (e.g., 10^{-4} infection per year).

**Surrogate.** A biological, chemical, or physical parameter used to verify pathogen reductions performances.

**Validation Report.** Report documenting the results of a challenge test conducted during field verification.

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 324-2019</td>
<td>Alternate Water Source Systems for Multi-Family, Residential, and Commercial Use</td>
<td>Miscellaneous</td>
<td>Table 1507.11(2)</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

*Note: IAPMO IGC 324 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.*

**SUBSTANTIATION:**

The Alternate Water Task Group (AWTG) proposes comprehensive requirements related to the water quality, monitoring, design, construction, commissioning, alteration, repair, and operation requirements of blackwater and stormwater systems for non-potable water reuse. These requirements for a properly designed system, together with appropriate construction, operation, and maintenance, will help ensure blackwater and stormwater systems will be implemented safely and reliably.

The AWTG proposes to incorporate health risk-based water quality requirements for blackwater and stormwater systems. The risk-based water quality approach was developed through recent research by the National Water Research Institute (NWRI) and the Water Research Foundation (WRF), culminating in the report Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems. Utilizing similar methodology as is employed in potable reuse and drinking water regulations, the risk-based LRTs align with the Water Safety Plan approach promoted by the World Health Organization. Blackwater and stormwater may contain pathogenic microorganisms that, if not properly treated, can cause infection due to exposure to these waters when recycled and used onsite. The intent of the risk-based framework is to determine the appropriate level of treatment for pathogens that is needed to protect public health, accounting for such factors as the source water quality, specific end use, and acceptable risk of infection from exposure to the treated water. The risk threshold used for this application is the same as has been previously applied in the context of municipal drinking water, i.e. exposure to this water via toilet flushing, irrigation, and other non-potable uses poses no greater risk than drinking municipally supplied drinking water. Because the amount of pathogen reduction for reuse usually spans orders of magnitude, pathogen treatment requirements are specified in terms of log_{10} reduction; 1-log_{10} reduction equates to 90% removal, 2-log_{10} reduction to 99% removal, 3-log_{10} reduction to 99.9% removal, and so on. The treatment requirements developed using the risk-based methodology in this case are called log reduction targets, or LRTs. The LRTs were developed using a Quantitative Microbial Risk Assessment (QMRA). QMRA is a scientific approach to estimating the potential human health risks associated with exposure to microbial hazards (in this case, human pathogenic viruses, bacteria, and protozoa). LRTs for blackwater and stormwater reuse for unrestricted irrigation and toilet flushing were developed based on the annual risk level of 10^{-4} infections per person per year. Unit treatment processes that are effective at removing and/or inactivating pathogens can be used to meet the LRTs. In most cases, several unit processes are needed in series to provide sufficient treatment. The ability of unit processes to provide a certain level of treatment is verified through the use of ongoing monitoring and, in some cases, validation. For some unit processes, validation is critical to determine how the process can be used to achieve the LRTs. The AWTG also proposes to incorporate a monitoring approach for blackwater and stormwater systems that aligns with the research. The framework for monitoring deviates from traditional approaches of monitoring fecal indicator organisms (FIOS) in grab samples because there are recognized limitations of using FIOS. The primary limitation of FIO monitoring is that it cannot be done continuously to ensure safe water is delivered to the end use at all times. Rather, the AWTG is proposing continuous water quality monitoring of surrogate parameters such as...
turbidity, residual chlorine, ultraviolet transmittance, and others to verify that treatment processes are operating as designed.

Discussion: The AWTG supports the use of a health risk-based approach to guide treatment and design requirements for blackwater and stormwater systems because it ensures that systems implemented using this framework are safe and reliable. The requirements being proposed are intended to ensure that public health is protected while still allowing for flexibility in design, as it does not prescribe that specific treatment processes must be used. It is timely that AWTG is proposing these requirements because several states have recently moved forward to adopt the risk-based framework at the state level. Much of this work has been driven by the work of the National Blue Ribbon Commission for Onsite Non-potable Water Systems, a coalition of public health agencies and water and wastewater utilities committed to advancing the safe, practical, and sustainable implementation of alternate water source systems. As a result of the Commission's work, several states including California, Colorado, Minnesota, Oregon, Washington, and Hawaii are proposing legislation to adopt the risk-based approach. Therefore, institutionalizing the risk-based approach in the UPC will create further consistency across the country by aligning plumbing and health code requirements for alternate water source systems. Resources: The AWTG used the following resources to develop the proposed text for both stormwater and blackwater treatment systems. These resources provided the AWTG with a technically sound template for the development of requirements for blackwater and stormwater treatment systems that fit well into the both the scope and format structure of model codes.


COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
There are concerns with onsite blackwater treatment systems. Such systems may be better dealt with at a local level by the health department. IAPMO IGC 324 does not cover black water. The language does not provide sufficient technical justification to warrant such change. The language does reference an appropriate NSF 350 standard that covers black water systems, however, the language needs additional work.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24  NEGATIVE: 1  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: The proposed change would harmonize the code with WE-Stand. This change was properly substantiated and should have been accepted as submitted.
Proposals

Item #: 265

UPC 2024  Section: 1508.0, Table 1701.1

SUBMITTER: Jim Kendzel
American Supply Association
Rep. Chairman of the Alternate Water Sources Task Group

RECOMMENDATION:
Add new text

1508.0 Onsite Stormwater Treatment Systems.
1508.1 General. The provisions of this section shall apply to the water quality, monitoring, design, construction, alteration, repair, and operation requirements of onsite stormwater treatment systems for nonpotable use.
1508.2 Allowable Use of Stormwater. Where approved or required by the Authority Having Jurisdiction, stormwater shall be permitted to be used in lieu of potable water for uses such as, but not limited to, water closets, urinals, clothes washers, ornamental plant irrigation, and dust suppression.
1508.3 Design and Construction Requirements. Onsite stormwater treatment systems shall meet the design, construction, and performance requirements of Section 1508.3.1 or Section 1508.3.2.
1508.3.1 Listed Stormwater Treatment Systems. Onsite stormwater treatment systems shall be listed to ASPE/ARCSA 78, installed according to the manufacturer’s instructions, and commissioned in accordance with Section 1508.13.
1508.3.2 Alternative Design Systems. Where approved by the Authority Having Jurisdiction, onsite stormwater treatment systems for residential and commercial applications shall comply with the provisions of Sections 1508.4 through Section 1508.15.
1508.4 Permit. It shall be unlawful for any person to construct, install, alter, or cause to be constructed, installed, or altered any stormwater treatment system in a building or on a premise without first obtaining a permit to do such work from the Authority Having Jurisdiction.
1508.5 Component Identification. System components shall be properly identified as to the manufacturer.
1508.6 Material Compatibility. Stormwater treatment systems shall be constructed of materials that are compatible with the type of pipe and fitting materials, water treatment, and water conditions in the system.
1508.7 Log Reduction Targets. Stormwater treatment systems shall be designed to meet the log reduction targets as set forth in Table 1508.7. To meet the log reduction in Table 1508.7, treatment processes used in stormwater systems shall comply with Section 1508.8 for validation or be operated according to conditions approved by the Authority HavingJurisdiction.
1508.8 Effluent Water Quality Parameters. Stormwater treatment systems shall be designed to meet the effluent water quality parameters for water closet and urinal fixture use listed in Table 1508.8.
1508.9 Validation. Where required by the Authority Having Jurisdiction, treatment processes shall be tested to verify the pathogen reduction performance. The treatment processes shall be validated through third-party component validation or field verification using challenge testing. The results of the third-party component validation and/or challenge testing shall be summarized in a validation report prepared by a registered design professional. The validation report shall document the treatment technology’s log reduction performance, including information on the operating conditions and surrogate parameters.
### TABLE 1508.7
**LOG REDUCTION TARGETS FOR $10^{-4}$ INFECTIONS PER PERSON PER YEAR BENCHMARKS FOR STORMWATER TREATMENT SYSTEMS**

<table>
<thead>
<tr>
<th>WATER USE SCENARIO</th>
<th>ENTERIC VIRUSES</th>
<th>PARASITIC PROTOZOA</th>
<th>ENTERIC BACTERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stormwater Greater Than 0.1% Fecal Contamination Contribution$^2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ornamental plant irrigation$^1$/dust suppression</td>
<td>5.0</td>
<td>4.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Indoor Use</td>
<td>5.5</td>
<td>5.5</td>
<td>5.0</td>
</tr>
<tr>
<td>Stormwater with less than or equal to 0.1% fecal contamination contribution$^2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ornamental plant irrigation$^1$/dust suppression</td>
<td>3.0</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Indoor Use</td>
<td>3.5</td>
<td>3.5</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Notes:**

1. Non-food
2. Stormwater can contain some quantity of fecal contamination. The extent of fecal contamination present will depend on site-specific conditions. The appropriate LRT to apply for a stormwater treatment system depend on the site-specific extent of likely contamination of Stormwater with fecal contamination.

### TABLE 1508.8
**EFFLUENT WATER QUALITY PARAMETERS FOR WATER CLOSET AND URINAL FIXTURE USE**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkalinity mg/L</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>TDS mg/L</td>
<td>0</td>
<td>500</td>
</tr>
<tr>
<td>Turbidity NTU</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>pH</td>
<td>6.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Odor</td>
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<td>Oily Film and Foam</td>
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</tr>
<tr>
<td>Free Chlorine Residual ppm</td>
<td>NA</td>
<td>4</td>
</tr>
<tr>
<td>Combined Chlorine ppm</td>
<td>NA</td>
<td>4</td>
</tr>
<tr>
<td>Chloramines mg/L</td>
<td>NA</td>
<td>4</td>
</tr>
</tbody>
</table>

**1508.10 Health and Safety.** Treated stormwater shall not create a nuisance or odor, nor threaten human health, or damage the quality of surface water or groundwater.

**1508.11 Monitoring Requirements.** Monitoring of stormwater treatment systems shall be based on the risk level in accordance with Table 1508.11(1). The parameters listed in Table 1508.11(2) shall be monitored by sensors placed in the effluent of the system and connected to a smart controller. The smart controller shall activate an alarm when the parameters in Table 1508.11(2) are outside the specifications and shall shut the system down when the alarm is not acknowledged after a period of 8 hours has elapsed. For Category 2, quarterly grab samples shall be taken out of the effluent and analyzed by an accredited lab. The sensors’ accuracy and response shall be validated upon commissioning of the system by an independent third party.

**1508.12 Design and Installation.** The design and installation of onsite stormwater treatment systems shall meet the requirements of Section 1508.12.1 through Section 1508.12.6.

**1508.12.1 Connections to Potable or Reclaimed (Recycled) Water Systems.** Stormwater treatment systems shall have no direct connection to any potable water supply or reclaimed (recycled) water source system. Potable water or reclaimed (recycled) water shall be permitted to be used as makeup water for a stormwater treatment system provided the potable or reclaimed (recycled) water supply connection is protected by an airgap.

**1508.12.2 Bypass Connection.** A bypass shall be provided for the input connection to the stormwater treatment system. The bypass shall be a diverter valve normally open to the stormwater treatment system. The normally closed port of the diverter valve shall be connected directly to the storm drainage system or combined sewer system in accordance with this code.
### TABLE 1508.11(1)
#### RISK LEVELS

<table>
<thead>
<tr>
<th>RISK LEVEL</th>
<th>TREATED WATER USAGE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ornamental plant irrigation and dust suppression</td>
</tr>
<tr>
<td>2</td>
<td>Water closets, urinals, clothes washers</td>
</tr>
</tbody>
</table>

* See Section 1508.2 for other uses approved by the Authority Having Jurisdiction.

### TABLE 1508.11(2)
#### MONITORING PARAMETERS

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>PARAMETERS TO BE MONITORED</th>
<th>VALIDATION PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Turbidity ORP UV intensity (if used)</td>
<td>IGC 324 - Sensor validation procedure using 5.4.1.1.(a),(b),(c), and (d), as applicable</td>
</tr>
<tr>
<td>2</td>
<td>Turbidity ORP UV intensity (if used) pH Quarterly lab Sample for Total Coliform</td>
<td></td>
</tr>
</tbody>
</table>

---

1508.12.3 **Overflow Connection.** Stormwater treatment overflow shall be connected directly to the storm drainage or combined sewer system in accordance with this code. The overflow shall be provided with a backwater valve at the point of connection to the storm drainage or combined sewer system. The backwater valve shall be accessible for inspection and maintenance.

1508.12.4 **Fail-Safe Mechanisms.** Stormwater treatment systems must be equipped with features that result in a controlled and non-hazardous automatic shutdown of the treatment process in the event of a malfunction.

1508.12.5 **Flow Meter Totalizer.** Buildings with stormwater treatment systems shall include a flow meter totalizer on the treated stormwater distribution system and a flow meter totalizer on the potable make-up water pipeline to the stormwater treatment system.

1508.12.6 **Cross-Connection Inspection and Testing.** A cross-connection test is required in accordance with Section 1502.0. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

1508.13 **Commissioning.** Onsite stormwater treatment systems shall be commissioned in accordance with the requirements of Section 1508.13.1 through Section 1508.13.4.

1508.13.1 **Commissioning Requirements.** Commissioning for stormwater treatment systems shall be included in the design and construction processes of the project. Commissioning shall be performed by a person who demonstrates competency in commissioning stormwater treatment systems as required by the Authority Having Jurisdiction.

1508.13.2 **Commissioning Plan.** The construction documents shall include the commissioning plan for the stormwater treatment system. The commissioning plan shall be approved by the Authority Having Jurisdiction prior to commissioning the stormwater treatment system. The commissioning plan shall include the following:

1. General project information.
2. Equipment to be tested, including the test methodology.
3. Processes to be tested.
4. Criteria or process for testing.
5. Criteria or process for acceptance.
6. Commissioning team contact information.
7. Commissioning process activities, schedules, and responsibilities.
8. Plans for the completion of functional performance testing, post construction documentation and training, and the commissioning report.

1508.13.3 **Performance Testing.** Performance tests shall verify that the installation and operation of the equipment of the stormwater treatment system is in accordance with the approved plans and specifications. The performance test report shall include the equipment tested, the testing methods utilized, and proof of proper calibration of the equipment.

1508.13.4 **Commissioning Report.** The commissioning report shall be submitted to the Authority Having Jurisdiction.

1508.14 **Operation and Maintenance Manual.** An operation and maintenance manual shall be provided in accordance with Section 1501.6 and shall also include the following;

---

453
Instructions on operating and maintaining the system, including treatment process operations, instrumentation and alarms, and chemicals storage and handling.

(2) Site equipment inventory and maintenance notes.

(3) Equipment/system warranty documentation and information.

(4) As-Built design drawings.

(5) Details on training requirements and qualifications of personnel responsible for operating the system.

(6) Maintenance schedule.

1508.15 Inspection. Field inspections shall take place during and after construction while the contractor is on-site to verify that the stormwater treatment system components have been properly supplied and installed according to the plans and specifications used for installation. Record drawings shall be maintained with changes to the approved plans by the contractor and available for periodic inspection as needed.

Chapter 2 Definitions

205.0 -C-

**Challenge Test.** The evaluation of a unit treatment process for pathogen log$_{10}$ reduction performance using selected surrogate or indigenous constituents. This includes a detailed technology evaluation study conducted to challenge the treatment technology over a wide range of operational conditions.

**Commissioning.** The activities associated with bringing a new process into normal working condition.

208.0 -F-

**Field Verification.** Performance confirmation study conducted using challenge testing, including surrogate microorganisms and/or other non-biological surrogates, usually during startup and commissioning.

214.0 -L-

**Log$_{10}$ Reduction.** The removal of a pathogen or surrogate in a unit process expressed in log$_{10}$ units of the effluent concentration over the influent concentration (e.g., a 1-log reduction equates to 90% removal, 2-log reduction to 99% removal, 3-log reduction to 99.9% removal, and so on).

**Log$_{10}$ Reduction Target (LRT).** The log$_{10}$ reduction target for the specified pathogen group (e.g., viruses, bacteria, or protozoa) to achieve the identified level of risk to individuals (e.g., $10^{-4}$ infection per year).

221.0 -S-

**Stormwater.** Natural precipitation that has contacted a surface at grade, below grade, or above ground parking surfaces.

**Surrogate.** A biological, chemical, or physical parameter used to verify pathogen reductions performances.

224.0 -V-

**Validation Report.** Report documenting the results of a challenge test conducted during field verification.

<table>
<thead>
<tr>
<th>TABLE 1701.1</th>
<th>REFERENCED STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD NUMBER</td>
<td>STANDARD TITLE</td>
</tr>
<tr>
<td>ASPE/ARCSA 78-2015</td>
<td>Stormwater Harvesting System Design for Direct End-Use Applications</td>
</tr>
<tr>
<td>IAPMO IGC 324-2019</td>
<td>Alternate Water Source Systems for Multi-Family, Residential, and Commercial Use</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

**Note:** ASPE/ARCSA 78 and IAPMO IGC 324 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

**SUBSTANTIATION:**
The Alternate Water Task Group (AWTG) proposes comprehensive requirements related to the water quality, monitoring, design, construction, commissioning, alteration, repair, and operation requirements of blackwater and stormwater systems for non-potable water reuse. These requirements for a properly designed system, together with appropriate construction, operation, and maintenance, will help ensure blackwater and stormwater systems will be implemented safely and reliably. The AWTG proposes to incorporate health risk-based water quality requirements for blackwater and stormwater systems. The risk-based water quality approach was developed through recent research by the National Water Research Institute (NWRI) and the Water Research Foundation (WRF), culminating
in the report Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems. Utilizing similar methodology as is employed in potable reuse and drinking water regulations, the riskbased LRTs align with the Water Safety Plan approach promoted by the World Health Organization. Blackwater and stormwater may contain pathogenic microorganisms that, if not properly treated, can cause infection due to exposure to these waters when recycled and used onsite. The intent of the risk-based framework is to determine the appropriate level of treatment for pathogens that is needed to protect public health, accounting for such factors as the source water quality, specific end use, and acceptable risk of infection from exposure to the treated water. The risk threshold used for this application is the same as has been previously applied in the context of municipal drinking water, i.e. exposure to this water via toilet flushing, irrigation, 55 and other nonpotable uses poses no greater risk than drinking municipally supplied drinking water. Because the amount of pathogen reduction for reuse usually spans orders of magnitude, pathogen treatment requirements are specified in terms of log10 reduction; 1-log10 reduction equates to 90% removal, 2-log10 reduction to 99% removal, 3-log10 reduction to 99.9% removal, and so on. The treatment requirements developed using the risk-based methodology in this case are called log reduction targets, or LRTs. The LRTs were developed using a Quantitative Microbial Risk Assessment (QMRA). QMRA is a scientific approach to estimating the potential human health risks associated with exposure to microbial hazards (in this case, human pathogenic viruses, bacteria, and protozoa). LRTs for blackwater and stormwater reuse for unrestricted irrigation and toilet flushing were developed based on the annual risk level of 10-4 infections per person per year. Unit treatment processes that are effective at removing and/or inactivating pathogens can be used to meet the LRTs. In most cases, several unit processes are needed in series to provide sufficient treatment. The ability of unit processes to provide a certain level of treatment is verified through the use of ongoing monitoring and, in some cases, validation. For some unit processes, validation is critical to determine how the process can be used to achieve the LRTs. The AWTG also proposes to incorporate a monitoring approach for blackwater and stormwater systems that aligns with the research. The framework for monitoring deviates from traditional approaches of monitoring fecal indicator organisms (FIOs) in grab samples because there are recognized limitations of using FIOs. The primary limitation of FIO monitoring is that it cannot be done continuously to ensure safe water is delivered to the end use at all times. Rather, the AWTG is proposing continuous water quality monitoring of surrogate parameters such as turbidity, residual chlorine, ultraviolet transmittance, and others to verify that treatment processes are operating as designed. Discussion: The AWTG supports the use of a health risk-based approach to guide treatment and design requirements for blackwater and stormwater systems because it ensures that systems implemented using this framework are safe and reliable. The requirements being proposed are intended to ensure that public health is protected while still allowing for flexibility in design, as it does not prescribe that specific treatment processes must be used. It is timely that AWTG is proposing these requirements because several states have recently moved forward to adopt the risk-based framework at the state level. Much of this work has been driven by the work of the National Blue Ribbon Commission for Onsite Nonpotable Water Systems, a coalition of public health agencies and water and wastewater utilities committed to advancing the safe, practical, and sustainable implementation of alternate water source systems. As a result of the Commission's work, several states including California, Colorado, Minnesota, Oregon, Washington, and Hawaii are proposing legislation to adopt the risk-based approach. Therefore, institutionalization of the risk based approach in UPC will create further consistency across the country by aligning plumbing and health code requirements for alternate water source systems. Resources: The AWTG used the following resources to develop the proposed text for both stormwater and blackwater treatment systems. These resources provided the AWTG with a technically sound template for the systems. Resources: The AWTG used the following resources to develop the proposed text for both stormwater and blackwater treatment systems. These resources provided the AWTG with a technically sound template for the systems. Resources: The AWTG used the following resources to develop the proposed text for both stormwater and blackwater treatment systems. These resources provided the AWTG with a technically sound template for the systems.


COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Several parts of the proposed language is written in unenforceable language such as Sections 1508.10, 1508.12.4, and 1508.13. Parts of the proposal reads like a guide and may be better suited in the Appendix and updated with enforceable language.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 24 NEGATIVE: 1 NOT RETURNED: 1 Daniels
EXPLANATION OF NEGATIVE:

BALLANCO: The proposed change would harmonize the code with WE-Stand. This change was properly substantiated and should have been accepted as submitted.
Proposals

Item #: 266

UPC 2024 Section: 1601.2, 1601.3, 1603.3, 1603.6, 1603.7, 1605.1, 1605.3.2

SUBMITTER: Jim Kendzel
American Supply Association
Rep. Chairman of the Alternate Water Sources Task Group

RECOMMENDATION:
Revise text

1601.0 General.

1601.2 System Design. Rainwater catchment systems shall be designed in accordance with this chapter by a licensed plumbing contractor or registered design professional. Components, piping, and fittings used in a rainwater catchment system shall be listed.

Exceptions:
1. A person registered or licensed to perform plumbing design work is not required to design rainwater catchment systems used for irrigation with a maximum storage capacity of 360 gallons (1363 L) where the tank is supported directly upon grade and the ratio of height to width (or diameter) does not exceed 2 to 1.
2. A person registered or licensed to perform plumbing design work is not required to design rainwater catchment systems for single family dwellings where outlets, piping, and system components are located on the exterior of the building.

1601.3 Permit. It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered a rainwater catchment system in a building or on a premise without first obtaining a permit to do such work from the Authority Having Jurisdiction.

Exceptions:
1. A permit is not required for exterior rainwater catchment systems used for outdoor drip and subsurface irrigation with a maximum storage capacity of 360 gallons (1363 L) where the tank is supported directly upon grade and the ratio of height to width (or diameter) does not exceed 2 to 1 and it does not require electrical power or a make-up water supply connection.
2. A plumbing permit is not required for rainwater catchment systems for single family dwellings where outlets, piping, and system components are located on the exterior of the building. This does not exempt the need for permits where required for electrical connections, tank supports, or enclosures.

1603.0 Design and Installation.

1603.3 Construction. Rainwater storage tanks shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight.

(renumber remaining sections)

1603.6 Rainwater Storage Tanks. Rainwater storage tanks shall be constructed and installed in accordance with Section 1603.3 and Section 1603.7 through Section 1603.14.

1603.7 Construction. Rainwater storage shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight. Storage tanks shall be approved by the Authority Having Jurisdiction, provided such tanks comply with approved applicable standards.

(renumber remaining sections)
1605.0 Inspection and Testing.
1605.1 General. Rainwater catchment systems shall be inspected and tested in accordance with Section 1605.2 and Section 1605.3. Irrigation systems not connected to a potable water system shall be exempt from testing requirements in Section 1605.3.

1605.3 Annual Cross-Connection Inspection and Testing. (remaining text unchanged)

1605.3.2 Cross-Connection Test. The procedure for determining cross-connection shall be followed by the applicant in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction to determine whether a cross-connection has occurred as follows:
(1) – (2) (remaining text unchanged)
(3) Fixtures, potable, and rainwater shall be tested and inspected for flow. The drain on the rainwater catchment system shall be checked for flow during the test and all fixtures, potable and alternate water source, shall be tested and inspected for flow. Flow from a rainwater catchment water system outlet shall indicate a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the rainwater system.
(4) The drain on the rainwater catchment water system shall be checked for flow during the test and at the end of the period.
(5) The potable water system shall then be depressurized and completely drained.
(6) – (49) (remaining text unchanged)

SUBSTANTIATION:
The proposed changes to Chapter 16 are updates to harmonize to the latest edition of the WeStand.

For Section 1601.2: The specific skills needed to install most non-potable rainwater catchment systems for irrigation are predominately landscape irrigation (the irrigation system) or roofing (if gutters are altered) type of work, not plumbing work. Landscape contractors install a lot more rainwater catchment systems than do plumbing contractors. This requirement in Section 1601.2 should be general to allow for the local experts from whatever field to be able to install the systems. The language being suggesting is consistent with the potable rainwater catchment systems. Rational: 360 gallons is very small, this water would be used up in a less than week to irrigate a 1,000 square foot lawn during the summer. There is no real difference in the complexity or design of a 360 gallon system versus a 5,000 gallons system, so long as the tank is stable on a stable foundation. By using the 5,000 gallons number this code would be consistent with most existing codes for water storage- no permit is needed so long as the tank is under 5,000 gallons. This would also be consistent with California’s rainwater code. Chapter 17 of the CA Plumbing Code provided for reference.

For Section 1601.3: Exempting permits from systems with the tanks smaller than 5,000 gallons would be consistent with most codes for water storage tanks as well as California’s rainwater code. If the tank is stable, upon grade, and doesn’t require power or make-up water it is a very safe and low-risk system and thus should not require permits.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The existing language should remain. Small systems are fine without having to be designed or have a permit. The maximum storage capacity of 360 gallons should remain. Systems of 5000 gallons require a permit as there is a concern with the size and structural design.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 23  NEGATIVE: 2  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: The proposed change would harmonize the code with WE-Stand. This change was properly substantiated and should have been accepted as submitted.

NIELSEN: I did not see any reason to reject it.
Proposals

Item #: 267
UPC 2024  Section: 1603.21

SUBMITTER: Garry Sato  
Greensmart Sustainable Concepts

RECOMMENDATION:
Add new text

1603.0 Design and Installation.

1603.21 Rainwater Diversion Valves. For gravity fed, non-pressurized rainwater collection systems. Rainwater diversion valves shall comply with IAPMO PS 59 or IAPMO IGC 352. The valve shall be accessible and include a filter located upstream of the valve when required.

Note: IAPMO IGC 352 and IAPMO PS 59 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The proposed IAPMO IGC 352 and IAPMO PS 59 standards cover valves designed to divert rainwater or storm water. IAPMO PS 59 covers valves ranging from 2-inches through 4-inches in diameter. IAPMO IGC 352 covers rainwater systems ranging from 6-inches through 12-inches in diameter and addresses the need for large diameter valves for use with alternate water source systems, which is not addressed in IAPMO PS 59. Third party tested and approved rainwater diversion valves fill a current unmet need in the commercial building industry.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the changes pertaining to rainwater diversion valves in this proposal are already being addressed in Item # 259.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 268

UPC 2024  Section: 1603.6, Table 1701.1

SUBMITTER: David Lentz
Infiltrator Water Technologies

RECOMMENDATION:
Revise text

1603.0 Design and Installation.

1603.3 Construction. Rainwater storage tanks shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight.

1603.43 Rainwater Catchment Collection Surfaces. (remaining text unchanged)
1603.54 Minimum Water Quality. (remaining text unchanged)
1603.65 Rainwater Storage Tanks. Rainwater storage tanks shall be constructed comply with IAPMO Z1002 and be installed in accordance with Section 1603.3 and Section 1603.76 through Section 1603.1312.
1603.76 Location. (remaining text unchanged)

(renumber remaining sections)

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTIONS</th>
</tr>
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<tr>
<td>IAPMO Z1002-2020</td>
<td>Rainwater Harvesting Tanks</td>
<td>Rainwater Tanks</td>
<td>1603.5</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: IAPMO Z1002 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The proposed changes add the appropriate standard for rainwater harvesting tanks in Section 1603.6. The current language in the UPC only covers installation provisions for the tanks. In contrast, IAPMO Z1002 contains material and performance requirements as well as testing procedures to ensure the tanks are safe for use in their intended application. Furthermore, the construction requirements in Section 1603.3 are being proposed for removal as these requirements are less stringent than the construction requirements for tanks specified in the proposed reference to IAPMO Z1002. Additionally, the requirements in Section 1603.3 become redundant with the addition of IAPMO Z1002.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 269
UPC 2024  Section: Table A 103.1

SUBMITTER: Bob Adler (Self), Thura Zin (Murray Company, ASPE - Los Angeles Chapter, IAPMO)

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>APPLIANCES, APPURTENEANCES, OR FIXTURES²</th>
<th>MINIMUM FIXTURE BRANCH PIPE SIZE¹,⁴ (inches)</th>
<th>PRIVATE</th>
<th>PUBLIC</th>
<th>ASSEMBLY⁶</th>
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</thead>
<tbody>
<tr>
<td>Sinks</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Bar</td>
<td>1/2</td>
<td>1.0</td>
<td>2.0</td>
<td>–</td>
</tr>
<tr>
<td>Clinical Faucet</td>
<td>1/2</td>
<td>–</td>
<td>3.0</td>
<td>–</td>
</tr>
<tr>
<td>Clinical Flushometer Valve with or without faucet</td>
<td>1</td>
<td>–</td>
<td>8.0</td>
<td>–</td>
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<tr>
<td>Kitchen, domestic with or without dishwasher</td>
<td>1/2</td>
<td>1.5</td>
<td>1.5</td>
<td>–</td>
</tr>
<tr>
<td>Laundry</td>
<td>1/2</td>
<td>1.5</td>
<td>1.5</td>
<td>–</td>
</tr>
</tbody>
</table>

(ports of table not shown remain unchanged)

SUBSTANTIATION:
Bob Adler:
If you take a look at Table 610.3, it lumps a domestic kitchen sink with or without a dishwasher together for 1.5 wsfu as well as having a load for an individual domestic dishwasher of 1.5. However, when using Appendix A, Table A 610.3 it does not have the option for a combined domestic kitchen sink and domestic dishwasher, it only has the domestic dishwasher 1.5 wsfu and then the domestic kitchen sink at 1.5 wsfu. The difference between Chapter 6 and Appendix A for the wsfu load for a domestic kitchen sink and dishwasher was an oversight when it was changed in Chapter 6 in 2012. Appendix A should have been changed with Chapter 6, meaning that the domestic dishwasher should be combined with the domestic kitchen sink for a total of 1.5 wsfu as well as the option of the “stand alone” domestic dishwasher.

Thura Zin:
In Table 610.3 Water Supply Fixture Units (WSFU) and Minimum Fixture Branch Pipe Size, Sink for Kitchen, domestic with or without dishwasher has 1.5 WSFU for Private or Public. Appendix A Table A 103 should be the same as Chapter 6 table 610.3 for "kitchen, domestic." If some City allows to use Appendix A for sizing, we are over sizing the hot water line for apartment complex.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 270
UPC 2024  Section: A 104.1

SUBMITTER: Domenico Barbato
City of Los Angeles

RECOMMENDATION:
Revise text

A 104.0 Permissible Friction Loss.
A 104.1 Residual Pressure. Decide what is the desirable minimum residual pressure that shall be maintained at the highest fixture in the supply system. Where the highest group of fixtures contains flushometer valves, the available residual pressure for the group shall be not less than 15 pounds-force per square inch (psi) (103 kPa). For flush tank supplies, the available residual pressure shall be not less than 8 psi (55 kPa).

SUBSTANTIATION:
The current verbiage is in conflict with Section 608.1 of the UPC which requires a minimum residual pressure of 15 psi regardless of the type of flushing device. This amendment reconciles the two sections.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 271
UPC 2024  Section: B 101.2

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION: Revise text

B 101.0 General.

B 101.2 General Requirements. Combination waste and vent systems, (which at best are merely an expedient designed to be used in locations where it would be structurally impractical to provide continuous venting of fixtures) as outlined in Section 910.0 of this code, cover the horizontal wet venting of a series of traps using a common waste and vent pipe. Pipe sizes not less than two pipe sizes larger than those required for a conventional system are designed to maintain a wetted perimeter or flow line low enough in the waste pipe to allow adequate air movement in the upper portion, thus balancing the system. Sinks, lavatories, and other fixtures that rough in above the floor, shall not be permitted on a combination waste and vent system, which, at best, is merely an expedient designed to be used in locations where it would be structurally impractical to provide venting in a conventional manner.

Combination waste and vent systems are intended primarily for extensive floor or shower drain installations where separate venting is not practical, for floor sinks in markets, demonstration or work tables in school buildings, or for similar applications where the fixtures are not adjacent to walls or partitions. Due to its oversized characteristics, such a waste system is not self-scouring and, consequently, care shall be exercised as to the type of fixtures connected to it and the location of cleanouts. Given its grease-producing potential, restaurant kitchen equipment shall not be connected to a combination waste and vent system.

SUBSTANTIATION:
This is an editorial change that clarifies the intent of Appendix B. Relocating the exiting language to the beginning will clarify the general requirements.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

WHITE: The substantiation is correct, it is an editorial change relocating an editorial statement. Editorial statements have no place in the code to start with.
Proposals

Item #: 272
UPC 2024 Section: C 201.1, E 201.1, F 201.1, L 101.2, L 201.1, N 102.1

SUBMITTER: Phillip H Ribbs
PHR Consultants

RECOMMENDATION:
Revise text
(below shown for reference only)

201.0 General.
201.1 Applicability. For the purpose of this code, the following terms have the meanings 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.

APPENDICES
The appendices are intended to supplement the provisions of the installation requirements of this code. The definitions in Chapter 2 are also applicable to the appendices.

C 201.0 Definitions.
C 201.1 General. For the purposes of this appendix, these following definitions shall apply to this appendix:

E 201.0 Definitions.
E 201.1 General. For the purposes of this chapter appendix, the following definitions shall apply:

F 201.0 Definitions.
F 201.1 General. For the purposes of this chapter appendix, the following definitions shall apply:

L 101.2 Definition of Terms. For the purposes of this code, the definitions in Section L 201.0 shall apply to this appendix.
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 appendix to avoid misunderstanding.
The definitions of terms are arranged alphabetically according to the first word of the term.

L 201.0 Definitions.
L 201.1 General. For the purpose of this appendix, the following definitions shall apply:

N 102.0 Definitions.
N 102.1 General. For the purpose of this appendix, the following definitions shall apply:

SUBSTANTIATION:
The above change intends to correlate the opening statement for definitions used throughout the code. Currently the appendices’ opening statement for definitions are different. The change updates all appropriate sections to the same statement to clarify that the definitions in the appendices are specific to the appendices. The main appendix statement already clarifies that Chapter 2 definitions apply to all sections of the code. Furthermore, Appendix L is being modified to match the other appendices as the statement is a repeat of what is in Chapter 2.
COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 273

UPC 2024  Section: E 403.7, Table 1701.2, Table L 503.3.2

SUBMITTER: Karan Kapila
    Self

RECOMMENDATION:
Revise text

**E 403.7 Plastic Piping.** Plastic piping shall only be used underground and shall meet the requirements of ASTM D2513 or ASTM D2517, as well as the design pressure and design limitations of 49 CFR (Section 192.123), and shall otherwise conform to the installation requirements thereof. ([NFPA 501A:4.3.6.3](#))

Table L 503.3.2
(portions of table not shown remains unchanged)

Notes:
(1-6) remains unchanged
7 In the U.S., the efficiency requirements for water heaters or gas pool heaters in this category or subcategory are specified by the U.S. Department of Energy. Those requirements and applicable test procedures are found in the Code of Federal Regulations 10 CFR Part 430.

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title 49, Code of Federal Regulations, Part 49 CFR 192</td>
<td>Transportation of Natural and Other Gas by Pipeline: Minimum Federal Standards</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
The proposed change cleans up the UPC by using the same formatting when calling out CFR standards. There are 7 other instances that use this format for CFR standards. This cleanup will assist the end user locate these standards. This is also how the standards are called out in other documents.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
E 403.13 Oil Supply Connections. Oil supply connections at manufactured home sites, where provided from a centralized oil distribution system, shall be located and arranged to permit attachment to a manufactured home utilizing the stand. [NFPA 501A:4.3.11.1] The installation of such facilities shall comply with the following requirements:

1. The main distribution pipeline shall be permitted to be connected to a tank or tanks having an aggregate capacity not exceeding 20,000 gallons (75,708 L) at a point below the liquid level.
2. Where this piping is so connected, a readily accessible internal or external shutoff valve shall be installed in the piping as close as practicable to the tank.
3. If external and aboveground, the shutoff valve and its tank connections shall be made of steel.
4. Connections between the tank(s) and the main pipeline shall be made with double swing joints or flexible connectors, or shall otherwise be arranged to permit the tank(s) to settle without damaging the system.
5. If located aboveground, the connections specified in Section E 403.13(4) shall be located within the diked area.
6. A readily accessible and identified manual shutoff valve shall be installed either inside or outside of the structure in each branch supply pipeline that enters a building, mobile home, travel trailer, or other structure. If outside, the valve shall be protected from weather and damage. If inside, the valve shall be located directly adjacent to the point at which the supply line enters the structure.
7. A device shall be provided in the supply line at or ahead of the point where it enters the interior of the structure that will automatically shut off the oil supply, if the supply line between this device and the appliance is broken. This device shall be located on the appliance side of the manual shutoff valve required in Section E 403.13(6) and shall be solidly supported and protected from damage.
8. Means shall be provided to limit the oil pressure at the appliance inlet to a maximum gauge pressure of 3 pounds-force per square inch gauge (psig) (21 kPa). If a pressure-reducing valve is used, it shall be a type approved for the service.
9. A device shall be provided that will automatically shut off the oil supply to the appliance if the oil pressure at the appliance inlet exceeds a gauge pressure of 8 psig (55 kPa). This device shall not be required under either of the following conditions:
   a. Where the distribution system is supplied from a gravity tank and the maximum hydrostatic head of oil in the tank is such that the oil pressure at the appliance inlet will not exceed a gauge pressure of 8 psig (55 kPa).
   b. Where a means is provided to automatically shut off the oil supply if the pressure-regulating device provided in accordance with Section E 403.13(8) fails to regulate the pressure as required.
10. Only appliances equipped with primary safety controls specifically listed for the appliance shall be connected to a centralized oil distribution system. [NFPA 31:9.2.10 – 9.2.15]

SUBSTANTIATION:
The above sections have been revised to correlate with NFPA 31-2020 (latest version) in accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines).

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
F 1101.0 System Assembly Requirements.

F 1101.2 Welding Requirements. Prior to and during the welding of sections of tubing, a continuous, regulated dry nitrogen or argon purge at 3 psi (21 kPa) shall be maintained to eliminate contamination with products of the oxidation or welding flux. The purge shall commence not less than 2 minutes prior to welding operations and continue until the welded joint is at ambient temperature. Welding procedures shall comply with the following requirements:

1. Qualification of the WPS to be used, and of the performance of welders and operators, is required and shall comply with the requirements of ASME B31.1.
2. No welding shall be done if there is impingement of rain, snow, sleet, or high wind on the weld area.
3. Tack welds permitted to remain in the finished weld shall be made by a qualified welder. Tack welds made by an unqualified welder shall be removed. Tack welds that remain shall be made with an electrode and WPS which that is the same as or equivalent to the electrode and WPS to be used for the first pass. The stopping and starting ends shall be prepared by grinding or other means so that they are capable of being satisfactorily incorporated into the final weld. Tack welds that have cracked shall be removed.
4. **CAUTION:** Arc strikes outside the area of the intended weld shall be avoided on a base metal. Arc strikes made outside of the weld joint area shall be removed and the surface visually examined. The surface shall also be examined by the liquid penetrant or magnetic particle method when the material is P-No. 4, P-No. 5A, P-No. 5B, or P-No. 15E. [ASME B31.1:127.4.1]

SUBSTANTIATION:
The above sections have been revised to correlate with ASME B31.1-2020 (latest version) in accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines).

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
APPENDIX G
SIZING OF VENTING SYSTEMS
(The content of this Appendix is based on Annex F of NFPA 54)

G 101.2 Examples Using Single Appliance Venting Tables. See Figure G 101.2(1) through Figure G 101.2(14). [NFPA 54: F.1]
Table 510.1.2(2) is used when sizing a single-wall metal vent connector attached to a Type B double-wall gas vent.

**Note:** The appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(2)**

**TYPE B DOUBLE-WALL VENT SYSTEM SERVING A SINGLE APPLIANCE WITH A SINGLE-WALL METAL VENT CONNECTOR**

Asbestos cement Type B or single-wall metal vent serving a single draft hood-equipped appliance. (See Table 510.1.2(5))

**FIGURE G 101.2(5)**

**ASBESTOS CEMENT TYPE B OR SINGLE-WALL METAL VENT SYSTEM SERVING A SINGLE DRAFT HOOD-EQUIPPED APPLIANCE**

Table 510.2(1) is used when sizing Type B double-wall vent connectors attached to a Type B double-wall common vent.

**Note:** Each appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(6)**

**VENT SYSTEM SERVING TWO OR MORE APPLIANCES WITH TYPE B DOUBLE-WALL VENT AND TYPE B DOUBLE-WALL VENT CONNECTORS**

Table 510.2(3) is used when sizing Type B double-wall vent connectors attached to a tile-lined masonry chimney.

**Notes:**
1. A is the equivalent cross-sectional area of the tile liner.
2. Each appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(8)**

**MASONRY CHIMNEY SERVING TWO OR MORE APPLIANCES WITH TYPE B DOUBLE-WALL VENT CONNECTORS**

**Notes:**
1. A is the equivalent cross-sectional area of the tile liner.
2. The appliance can be either Category I draft hood-equipped or fan-assisted type.
Figure G 101.2(9) Masonry Chimney Serving Two or More Appliances with Single-Wall Metal Vent Connectors

Figure G 101.2(11) Use of Manifolded Common Vent Connector

Figure G 101.2(10) Asbestos Cement Type B or Single-Wall Metal Vent System Serving Two or More Draft Hood-Equipped Appliances

Figure G 101.2(12) Use of Offset Common Vent
NFPA 54: FIGURE F.1(m)

Use individual vent for top-floor appliance if connector requirements for rise or total height cannot be met.

Available total height for third-floor appliance and combined input of three appliances (if top-floor appliance is not connected, measure total height to vent top).

Each interconnection tee is same size as segment of common vent directly above.
G 101.3 Example 1: Single Draft Hood-Equipped Appliance. An installer has a 120,000 Btu/h (35 kW) input appliance with a 5 inch (127 mm) diameter draft hood outlet that needs to be vented into a 10 foot (3048 mm) high Type B vent system. What size vent shall be used assuming: (1) a 5 foot (1524 mm) lateral single-wall metal vent connector is used with two 90 degree (1.57 rad) elbows or (2) a 5 foot (1524 mm) lateral single-wall metal vent connector is used with three 90 degree (1.57 rad) elbows in the vent system? (See Figure G 101.3)

Solution:
Table 510.1.2(2) should be used to solve this problem because single-wall metal vent connectors are being used with a Type B vent, as follows:
(1) Read down the first column in Table 510.1.2(2) until the row associated with a 10 foot (3048 mm) height and 5 foot (1524 mm) lateral is found. Read across this row until a vent capacity greater than 120,000 Btu/h (35 kW) is located in the shaded columns labeled NAT Max for draft hood-equipped appliances. In this case, a 5 inch (127 mm) diameter vent has a capacity of 122,000 Btu/h (35.7 kW) and can be used for this application.
(2) If three 90 degree (1.57 rad) elbows are used in the vent system, the maximum vent capacity listed in the tables must be reduced by 10 percent. This implies that the 5 inch (127 mm) diameter vent has an adjusted capacity of only 110,000 Btu/h (32 kW). In this case, the vent system must be increased to 6 inches (152 mm) in diameter. See the following calculations:

\[
122,000 \text{ Btu/h (35.7 kW)} \times 0.90 = 110,000 \text{ Btu/h (32 kW)} \text{ for 5 inch (127 mm) vent}
\]

From Table 510.1.2(2), select 6 inch (152 mm) vent.

186,000 Btu/h (54.5 kW) \times 0.90 = 167,000 Btu/h (49 kW)

This figure is greater than the required 120,000 Btu/h (35 kW). Therefore, use a 6 inch (152 mm) vent and connector where three elbows are used. [NFPA 54:F.1.1]

G 101.4 Example 2: Single Fan-Assisted Appliance. An installer has an 80,000 Btu/h (23.4 kW) input fan-assisted appliance that must be installed using 10 feet (3048 mm) of lateral connector attached to a 30 foot high (9144 mm) Type B vent. Two 90-degree (1.57 rad) elbows are needed for the installation. Can a single-wall metal vent connector be used for this application? (See Figure G 101.4)

Solution:
Table 510.1.2(2) refers to the use of single-wall metal vent connectors with Type B vent. In the first column find the row
associated with a 30 foot (9144 mm) height and a 10 foot (3048 mm) lateral. Read across this row, looking at the FAN Min and FAN Max columns, to find that a 3 inch (76 mm) diameter single-wall metal vent connector is not recommended. Moving to the next larger size single-wall connector [4 inch (102 mm)] we find that a 4 inch (102 mm) diameter single-wall metal connector has a recommended minimum vent capacity of 91 000 Btu/h (26.7 kW) and a recommended maximum vent capacity of 144 000 Btu/h (42.2 kW). The 80 000 Btu/h (23.4 kW) fan-assisted appliance is outside this range, so the conclusion is that a single-wall metal vent connector cannot be used to vent this appliance using 10 feet (3048 mm) of lateral for the connector.

However, if the 80 000 Btu/h (23.4 kW) input appliance could be moved to within 5 feet (1524 mm) of the vertical vent, a 4 inch (102 mm) single-wall metal connector could be used to vent the appliance. Table 510.1.2(2) shows the acceptable range of vent capacities for a 4 inch (102 mm) vent with 5 feet (1524 mm) of lateral to be between 72 000 Btu/h (21.1 kW) and 157 000 Btu/h (46 kW).

If the appliance cannot be moved closer to the vertical vent, a Type B vent could be used as the connector material. In this case, Table 510.1.2(1) shows that, for a 30 foot (9144 mm) high vent with 10 feet (3048 mm) of lateral, the acceptable range of vent capacities for a 4 inch (102 mm) diameter vent attached to a fan-assisted appliance is between 37 000 Btu/h (10.8 kW) and 150 000 Btu/h (44 kW). [NFPA 54: F.1.3]

**G 101.5 Example 3: Interpolating Between Table Values.** An installer has an 80 000 Btu/h (23.4 kW) input appliance with a 4 inch (102 mm) diameter draft hood outlet that needs to be vented into a 12 foot (3658 mm) high Type B vent. The vent connector has a 5 foot (1524 mm) lateral length and is also Type B. Can this appliance be vented using a 4 inch (102 mm) diameter vent?

Solution:

Table 510.1.2(1) is used in the case of an all Type B Vent system. However, Table 510.1.2(1) does not have an entry for a height of 12 feet (3658 mm), and interpolation must be used. Read down the 4 inch (102 mm) diameter NAT Max column to the row associated with 10 foot (3048 mm) height and 5 foot (1524 mm) lateral to find the capacity value of 77 000 Btu/h (22.6 kW). Read further down to the 15 foot (4572 mm) height, 5 foot (1524 mm) lateral row to find the capacity value of 87 000 Btu/h (25.5 kW). The difference between the 15 foot (4572 mm) height capacity value and the 10 foot (3048 mm) height capacity value is 10 000 Btu/h (3 kW). The capacity for a vent system with a 12 foot (3658 mm) height is equal to the capacity for a 10 foot (3048 mm) height plus two-fifths of the difference between the 10 foot (3048 mm) and 15 foot (4572 mm) height values, or 77 000 Btu/h (22.6 kW) + \( \frac{2}{5} \times 10 000 \text{ Btu/h} \) (3 kW) = 81 000 Btu/h (23.7 kW). Therefore, a 4 inch (102 mm) diameter vent can be used in the installation. [NFPA 54: F.1.3]

**G 101.6 Example 4: Common Venting Two Draft Hood-Equipped Appliances.** A 35 000 Btu/h (10.3 kW) water heater is to be common vented with a 150 000 Btu/h (44 kW) furnace, using a common vent with a total height of 30 feet (9144 mm). The connector rise is 2 feet (610 mm) for the water heater with a horizontal length of 4 feet (1219 mm). The connector rise for the furnace is 3 feet (914 mm) with a horizontal length of 8 feet (2438 mm). Assume single-wall metal connectors will be used with Type B vent. What size connectors and combined vent should be used in this installation? (See Figure G 101.6)

Solution:

Table 510.2(2) should be used to size single-wall metal vent connectors attached to Type B vertical vents. In the vent connector capacity portion of Table 510.2(2), find the row associated with a 30 foot (9144 mm) vent height. For a 2 foot (610 mm) rise on the vent connector for the water heater, read the shaded columns for draft hood-equipped appliances.
to find that a 3 inch (76 mm) diameter vent connector has a capacity of 37 000 Btu/h (10.8 kW). Therefore, a 3 inch (76 mm) single-wall metal vent connector can be used with the water heater. For a draft hood-equipped furnace with a 3 foot (914 mm) rise, read across the appropriate row to find that a 5 inch (127 mm) diameter vent connector has a maximum capacity of 120 000 Btu/h (35 kW) (which is too small for the furnace) and a 6 inch (152 mm) diameter vent connector has a maximum vent capacity of 172 000 Btu/h (50 kW). Therefore, a 6 inch (152 mm) diameter vent connector should be used with the 150 000 Btu/h (44 kW) furnace. Because both vent connector, horizontal lengths are less than the maximum lengths listed in Section 510.2.1; the table values can be used without adjustments.

In the common vent capacity portion of Table 510.2(2), find the row associated with a 30 foot (9144 mm) vent height and read over to the NAT + NAT portion of the 6 inch (152 mm) diameter column to find a maximum combined capacity of 257 000 Btu/h (75 kW). Since the two appliances total only 185 000 Btu/h (54 kW), a 6 inch (152 mm) common vent can be used. [NFPA 54:F.2.1]

[Image: NFPA 54: FIGURE F.2.1]

G 101.7 Example 5(a): Common Venting a Draft Hood-Equipped Water Heater with a Fan-Assisted Furnace into a Type B Vent. In this case, a 35 000 Btu/h (10.3 kW) input draft hood-equipped water heater with a 4 inch (102 mm) diameter draft hood outlet, 2 feet (610 mm) of connector rise, and 4 feet (1219 mm) of horizontal length is to be common vented with a 100 000 Btu/h (29 kW) fan-assisted furnace with a 4 inch (102 mm) diameter flue collar, 3 feet (914 mm) of connector rise, and 6 feet (1829 mm) of horizontal length. The common vent consists of a 30 foot (9144 mm) height of Type B vent. What are the recommended vent diameters for each connector and the common vent? The installer would like to use a single-wall metal vent connector. (See Figure G 101.7)

Solution:

Water Heater Vent Connector Diameter. Since the water heater vent connector, horizontal length of 4 feet (1219 mm) is less than the maximum value listed in Table 510.2(2), the venting table values can be used without adjustments. Using the Vent Connector Capacity portion of Table 510.2(2), read down the Total Vent Height (H) column to 30 feet (9144 mm) and read across the 2 feet (610 mm) Connector Rise (R) row to the first Btu/h rating in the NAT Max column that is equal to or greater than the water heater input rating. The table shows that a 3 inch (76 mm) vent connector has a maximum input rating of 37 000 Btu/h (10.8 kW). Although this rating is greater than the water heater input rating, a 3 inch (76 mm) vent connector is prohibited by Section 510.2.18. A 4 inch (102 mm) vent connector has a maximum input rating of 67 000 Btu/h (19.6 kW) and is equal to the draft hood outlet diameter. A 4 inch (102 mm) vent connector is selected. Since the water heater is equipped with a draft hood, there are no minimum input rating restrictions.
Furnace Vent Connector Diameter. Using the Vent Connector Capacity portion of Table 510.2(2), read down the Total Vent Height \((H)\) column to 30 feet \((9144\, \text{mm})\) and across the 3 feet \((914\, \text{mm})\) Connector Rise \((R)\) row. Because the furnace has a fan-assisted combustion system, find the first FAN Max column with a Btu/h rating greater than the furnace input rating. The 4 inch \((102\, \text{mm})\) vent connector has a maximum input rating of 119 000 Btu/h \((34.9\, \text{kW})\) and a minimum input rating of 85 000 Btu/h \((24.9\, \text{kW})\).

The 100 000 Btu/h \((29\, \text{kW})\) furnace in this example falls within this range, so a 4 inch \((102\, \text{mm})\) connector is adequate. Because the furnace vent connector horizontal length of 6 feet \((1829\, \text{mm})\) is less than the maximum value listed in Section 510.2.1; the venting table values can be used without adjustment. If the furnace had an input rating of 80 000 Btu/h \((23.4\, \text{kW})\), a Type B vent connector would be needed in order to meet the minimum capacity limit.

Common Vent Diameter. The total input to the common vent is 135 000 Btu/h \((40\, \text{kW})\). Using the Common Vent Capacity portion of Table 510.2(2), read down the Total Vent Height \((H)\) column to 30 feet \((9144\, \text{mm})\), and across this row to find the smallest vent diameter in the FAN + NAT column that has a Btu/h rating equal to or greater than 135 000 Btu/h \((40\, \text{kW})\). The 4 inch \((102\, \text{mm})\) common vent has a capacity of 132 000 Btu/h \((39\, \text{kW})\) and the 5 inch \((127\, \text{mm})\) common vent has a capacity of 202 000 Btu/h \((59\, \text{kW})\). Therefore, the 5 inch \((127\, \text{mm})\) common vent should be used in this example.

Summary: In this example, the installer can use a 4 inch \((102\, \text{mm})\) diameter, single-wall metal vent connector for the water heater and a 4 inch \((102\, \text{mm})\) diameter, single-wall metal vent connector for the furnace. The common vent should be a 5 inch \((127\, \text{mm})\) diameter Type B vent.

G 101.8 Example 5(b): Common Venting into an Interior Masonry Chimney. In this case, the water heater and fan-assisted furnace of Example 5(a) are to be common-vented into a clay-tile-lined masonry chimney with a 30 foot \((9144\, \text{mm})\) height. The chimney is not exposed to the outdoors below the roof line. The internal dimensions of the clay tile liner are nominally 8 inches \((203\, \text{mm})\) by 12 inches \((305\, \text{mm})\). Assuming the same vent connector heights, laterals, and materials found in Example 5(a), what are the recommended vent connector diameters, and is this an acceptable installation?

Solution:
Table 510.2(4) is used to size common venting installations involving single-wall connectors into masonry chimneys. Water Heater Vent Connector Diameter. Using Table 510.2(4), Vent Connector Capacity, read down the Total Vent Height \((H)\) column to 30 feet \((9144\, \text{mm})\), and read across the 2 feet \((610\, \text{mm})\) Connector Rise \((R)\) row to the first Btu/h rating in the NAT Max column that is equal to or greater than the water heater input rating. The table shows that a 3 inch \((76\, \text{mm})\) vent connector has a maximum input of only 31 000 Btu/h \((9\, \text{kW})\), while a 4 inch \((102\, \text{mm})\) vent connector has a maximum input of 57 000 Btu/h \((16.7\, \text{kW})\). A 4 inch \((102\, \text{mm})\) vent connector must therefore be used.

Furnace Vent Connector Diameter. Using the Vent Connector Capacity portion of Table 510.2(4), read down the Total Vent Height \((H)\) column to 30 feet \((9144\, \text{mm})\), and across the 3 feet \((914\, \text{mm})\) Connector Rise \((R)\) row. Because the furnace has a fan-assisted combustion system, find the first FAN Max column with a Btu/h rating greater than the furnace input rating. The 4 inch \((102\, \text{mm})\) vent connector has a maximum input rating of 127 000 Btu/h \((37\, \text{kW})\) and a minimum input rating of 95 000 Btu/h \((27.8\, \text{kW})\). The 100 000 Btu/h \((29\, \text{kW})\) furnace in this example falls within this range, so a 4 inch \((102\, \text{mm})\) connector is adequate.

Masonry Chimney. From Table G 101.8, the equivalent area for a nominal liner size of 8 inches \((203\, \text{mm})\) by 12 inches \((305\, \text{mm})\) is 63.6 square inches \((0.041\, \text{m}^2)\). Using Table 510.2(4), Common Vent Capacity, read down the FAN + NAT column under the Minimum Internal Area of Chimney value of 63 to the row for 30 foot \((9144\, \text{mm})\) height to find a capacity value of 739 000 Btu/h \((217\, \text{kW})\). The combined input rating of the furnace and water heater, 135 000 Btu/h \((40\, \text{kW})\)
Chimney Liner Requirement. As in Example 5(b), use the 63 square inches (0.04 m²) diameter outlets. From Table G 101.8, the equivalent area for an inside diameter of 4 inches (102 mm) is 12.2 square inches (0.008 m²). Seven times 12.2 equals 85.4, which is greater than 63.6, so this configuration is acceptable.

G 101.9 Example 5(c): Common Venting into an Exterior Masonry Chimney. In this case, the water heater and fan-assisted furnace of Examples 5(a) and 5(b) are to be common-vented into an exterior masonry chimney. The chimney height, clay-tile-liner dimensions, and vent connector heights and laterals are the same as in Example 5(b). This system is being installed in Charlotte, North Carolina. Does this exterior masonry chimney need to be relined? If so, what corrugated metallic liner size is recommended? What vent connector diameters are recommended? (See Table G 101.8 and Figure 510.1.10)

Solution:
According to Section 510.2.20, Type B vent connectors are required to be used with exterior masonry chimneys. Use Table 510.2(8) and Table 510.2(9) to size FAN+NAT common venting installations involving Type B double-wall connectors into exterior masonry chimneys.
The local 99 percent winter design temperature needed to use Table 510.2(8) and Table 510.2(9) can be found in ASHRAE Handbook – Fundamentals. For Charlotte, North Carolina, this design temperature is 19°F (-7.2°C).

TABLE G 101.8
MASONRY CHIMNEY LINER DIMENSIONS WITH CIRCULAR EQUIVALENTS*

(portion of table not shown remains unchanged)

Chimney Liner Requirement. As in Example 5(b), use the 63 square inches (0.04 m²) Internal Area columns for this size clay tile liner. Read down the 63 square inches (0.04 m²) column of Table 510.2(8) to the 30 foot (9144 mm) height row to find that the combined appliance maximum input is 747 000 Btu/h (218.9 kW). The combined input rating of the appliances in this installation, 135 000 Btu/h (40 kW), is less than the maximum value, so this criterion is satisfied. Table 510.2(9), at a 19°F (-7.2°C) design temperature, and at the same vent height and internal area used earlier, shows that the minimum allowable input rating of a space-heating appliance is 470 000 Btu/h (137.7 kW). The furnace input rating of 100 000 Btu/h (29 kW) is less than this minimum value. So this criterion is not satisfied, and an alternative venting design needs to be used, such as a Type B vent shown in Example 5(a) or a listed chimney liner system shown in the remainder of the example.

According to Section 510.2.19, Table 510.2(1) or Table 510.2(2) is used for sizing corrugated metallic liners in masonry chimneys, with the maximum common vent capacities reduced by 20 percent. This example will be continued assuming Type B vent connectors.

Water Heater Vent Connector Diameter. Using Table 510.2(1) Vent Connector Capacity, read down the total Vent Height (H) column to 30 feet (9144 mm), and read across the 2 feet (610 mm) Connector Rise (R) row to the first Btu/hour rating in the NAT Max column that is equal to or greater than the water heater input rating. The table shows that a 3 inch (76 mm) vent connector has a maximum capacity of 39 000 Btu/h (11.4 kW). Although this rating is greater than the water heater input rating, a 3 inch (76 mm) vent connector is prohibited by Section 510.2.20. A 4 inch (102 mm) vent connector has a maximum input rating of 70 000 Btu/h (20.5 kW) and is equal to the draft hood outlet diameter. A 4 inch (102 mm) vent connector is selected.

Furnace Vent Connector Diameter. Using Table 510.2(1), Vent Connector Capacity, read down the total Vent Height (H) column to 30 feet (9144 mm), and read across the 3 feet (914 mm) Connector Rise (R) row to the first Btu/h rating in the FAN MAX column that is equal to or greater than the furnace input rating. The 100 000 Btu/h (29 kW) furnace in this example falls within this range, so a 4 inch (102 mm) connector is adequate.

Chimney Liner Diameter. The total input to the common vent is 135 000 Btu/h (40 kW). Using the Common Vent Capacity portion of Table 510.2(1), read down the total Vent Height (H) column to 30 feet (9144 mm) and across this row to find the smallest vent diameter in the FAN + NAT column that has a Btu/h rating greater than 135 000 Btu/h (40 kW). The 4 inch (102 mm) common vent has a capacity of 138 000 Btu/h (40.4 kW). Reducing the maximum capacity by 20 percent results in a maximum capacity for a 4 inch (102 mm) corrugated liner of 110 000 Btu/h (32 kW), less than the total input of 135 000 Btu/h (40 kW). So a larger liner is needed. The 5 inch (127 mm) common vent capacity listed in Table 510.2(1) is 210 000 Btu/h (62 kW), and after reducing by 20 percent is 168 000 Btu/h (49.2 kW). Therefore, a 5 inch (127 mm) corrugated metal liner should be used in this example.

Single Wall Connectors. Once it has been established that relining the chimney is necessary, Type B double-wall vent connectors are not specifically required. This example could be redone using Table 510.2(2) for single-wall vent connectors. For this case, the vent connector and liner diameters would be the same as found for Type B double-wall connectors.

[NFPA 54: F.2.4]
SUBSTANTIATION:
The above sections have been revised to correlate with NFPA 54-2021 (latest version) in accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines).

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 277
UPC 2024 Section: H 301.1(5)

SUBMITTER: David Lentz
Infiltrator Water Technologies

RECOMMENDATION:
Revise text

H 301.0 Area of Disposal Fields and Seepage Pits.
H 301.1 General. The minimum effective absorption area in disposal fields in square feet (m²), and in seepage pits in square feet (m²) of sidewall, shall be predicated on the required septic tank capacity of gallons (liters), estimated waste/sewage flow rate, or whichever is greater, and shall be in accordance with Table H 201.1(2) as determined by the type of soil found in the excavation, and shall be as follows:
(1) - (4) (remaining text unchanged)
(5) Leaching chambers that comply with IAPMO PS 63 and bundled expanded polystyrene synthetic aggregate units that comply with IAPMO IGC 276 shall be sized using a 0.70 multiplier applied to the required area in calculated using Table H 201.1(2) with a 0.70 multiplier.

(below shown for reference only)

<table>
<thead>
<tr>
<th>TYPE OF SOIL</th>
<th>REQUIRED SQUARE FEET OF LEACHING AREA PER 100 GALLONS</th>
<th>MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FEET OF LEACHING AREA FOR A 24 HOUR PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse sand or gravel</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Fine sand</td>
<td>25</td>
<td>4.0</td>
</tr>
<tr>
<td>Sandy loam or sandy clay</td>
<td>40</td>
<td>2.5</td>
</tr>
<tr>
<td>Clay with considerable sand or gravel</td>
<td>90</td>
<td>1.1</td>
</tr>
<tr>
<td>Clay with small amount of sand or gravel</td>
<td>120</td>
<td>0.8</td>
</tr>
</tbody>
</table>

For SI units: 1 square foot = 0.0929 m², 1 gallon = 3.785 L, 1 gallon per square foot = 40.7 L/m²

SUBSTANTIATION:
The proposal clarifies how the disposal area trench or bed size is calculated, but makes no change to the disposal area sizing. The problem is that California county environmental health department staff have expressed misunderstanding about how the 0.70 multiplier is applied to the required square feet area value in Table H 201.1(2). Specifically, questions arise regularly about whether the disposal area sizing should be made 70% of the size or 130% of the size of the gravel disposal area. By rearranging the sentence, the intent is to improve the reader’s ability to interpret the code provisions and calculate the size of the disposal area correctly.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 278

UPC 2024  Section: H 301.1(6)

SUBMITTER: David Lentz
Infiltrator Water Technologies

RECOMMENDATION:
Revise text

H 301.0 Area of Disposal Fields and Seepage Pits.

H 301.1 General. The minimum effective absorption area in disposal fields in square feet (m²), and in seepage pits in square feet (m²) of sidewall, shall be predicated on the required septic tank capacity of gallons (liters), estimated waste/sewage flow rate, or whichever is greater, and shall be in accordance with Table H 201.1(2) as determined by the type of soil found in the excavation, and shall be as follows:

(1) (remaining text unchanged)

(2) Where leaching beds are permitted instead of trenches, the area of each such bed shall be not less than 50 percent greater than the tabular requirements for trenches. Perimeter sidewall area more than the required 12 inches (305 mm) and not exceeding 36 inches (914 mm) below the leach line shall be permitted to be added to the trench bottom area where computing absorption areas.

(3) – (5) (remaining text unchanged)

(6) Systems that combine treatment and disposal of sewage within a single footprint and comply with NSF 40 shall be sized using a 0.70 multiplier applied to the required area in Table H 201.1(2) for both leach lines and leach beds. No system component for a combined treatment and disposal leach line or leach bed shall be located within 2 feet (610 mm) of the water table nor to a depth where sewage is capable of contaminating the underground water stratum that is usable for domestic purposes. Combined treatment and disposal system operation and maintenance shall be in accordance with the manufacturer's instructions.

Exception: Combined treatment and disposal systems tested and certified in a bed configuration in accordance with NSF 40 are exempted from the requirements of Section H 301.1(2).

(below shown for reference only)

**TABLE H 201.1(2)**

**DESIGN CRITERIA OF FIVE TYPICAL SOILS**

<table>
<thead>
<tr>
<th>TYPE OF SOIL</th>
<th>REQUIRED SQUARE FEET OF LEACHING AREA PER 100 GALLONS</th>
<th>MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FEET OF LEACHING AREA FOR A 24 HOUR PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse sand or gravel</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Fine sand</td>
<td>25</td>
<td>4.0</td>
</tr>
<tr>
<td>Sandy loam or</td>
<td>40</td>
<td>2.5</td>
</tr>
<tr>
<td>Sandclay</td>
<td>Clay with considerable sand or gravel</td>
<td>90</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------</td>
<td>----</td>
</tr>
<tr>
<td></td>
<td>Clay with small amount of sand or gravel</td>
<td>120</td>
</tr>
</tbody>
</table>

For SI units: 1 square foot = 0.0929 m², 1 gallon = 3.785 L, 1 gallon per square foot = 40.7 L/m²

**SUBSTANTIATION:**

Since 2014, IAPMO has partnered with the United States Environmental Protection Agency (USEPA) as one of 14 collaborators operating under a Memorandum of Understanding (MOU) and aspiring to improve the overall performance and management of decentralized wastewater treatment systems (2020 IAPMO MOU announcement - see Attachment 1 of Supporting Document). Appendix H – Private Sewage Disposal Systems describes decentralized wastewater treatment systems and applies directly to the USEPA MOU. The proposed addition to Subsection H 301.1 recognizes the use of systems proven through an industry-recognized ANSI standard to be capable of treating and disposing of sewage in a single footprint. This class of wastewater treatment technology, referred to as combined treatment and dispersal (CTD), has been in use across the North America for over 25 years, with installations surging in the past 10 years as wastewater industry stakeholders seek reliable, sustainable, non-electric, low-impact means of treating and dispersing wastewater. CTD has transitioned to a major element of the wastewater treatment system framework in several states and Canadian provinces, including Connecticut, Indiana, Maine, Massachusetts, New Hampshire, New York, Ohio, Ontario, Quebec, and Rhode Island.

Multiple manufacturers have certified CTD systems under NSF 40-2018 - Residential Wastewater Treatment Systems. NSF 40 establishes minimum materials, design and construction, and performance requirements for residential wastewater treatment systems. Technologies in the marketplace include a proprietary device installed within a specified coarse-grained sand, most often sand conforming with ASTM C33 particle size gradation requirements. Septic tank effluent enters the proprietary CTD device, where distribution and filtering occur, followed by additional treatment in the surrounding specified sand, resulting in a treated effluent conforming with the NSF 40 biochemical oxygen demand concentration of 25 milligrams per liter (mg/l) and total suspended solids concentration of 30 mg/l conformance criteria. Extensive third-party testing of CTD systems to NSF 40 has shown that these non-mechanical, sand based systems meet the water quality criteria in the standard immediately upon start up. In contrast, electro-mechanical systems characteristically need the allotted 21-day grace period to achieve compliance, as allowed in NSF 40, while a microflora population capable of meeting treatment requirements develops. This capability of providing immediate performance shows that, beyond continuous-use applications, CTD systems are ideal for intermittent and inconsistent flow usage conditions, such as that which occurs with seasonal dwellings.

CTD processes occur without the need for electricity, using natural biological and chemical processes to provide wastewater meeting secondary treatment standards. Rather than discharging primary-treated wastewater to native soil like a pipe and filter material disposal field or seepage pits described in Section H 301, CTD systems disperse secondary-treated effluent to the native soil, providing a tangible environmental benefit that is required for certain building sites by Authorities Having Jurisdiction across the nation. For this reason, the minimum 5-foot separation beneath the disposal field or seepage pit described in Section H 301.1(3) is established as 2 feet, aligning with the separation distance established in Section 9.4.8 of the California State Water Resources Control Board's 2012 Onsite Wastewater Treatment Systems Policy, which states: “Separation of the bottom of dispersal system to groundwater less than two (2) feet, except for seepage pits, which shall not be less than 10 feet.” (See Attachment 2 of Supporting Document).

Similar to gravelless chamber and bundled expanded polystyrene unit disposal field sizing in Section H 301.1(5), gravelless CTD disposal field sizing corresponds to a 0.70 multiplier on the area required in Table H 201.1(2). The absence of gravel fines, combined with secondary treated effluent, warrants sizing of CTD systems as gravelless systems. Gravelless technology sizing at a 0.70 multiplier has been in the UPC for over twenty years, is well-established through third-party studies, and is accepted broadly by Authority Having Jurisdiction around the U.S. and Canada. Over 50% of residential decentralized wastewater treatment systems installed in North America last year incorporated gravelless technologies for effluent disposal. Mined, processed, and washed gravel used as a pipe and filter material disposal system has become the minority of installed disposal systems.

Supporting document(s) has been provided to the Technical Committee for review.
COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
There was not technical justification provided as to why Section H 301.1(2) is being exempted. The term "water stratum" is not clear and needs clarification.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 279

UPC 2024  Section: H 501.14, Table 1701.1, Table 1701.2

SUBMITTER: David Lentz
Infiltrator Water Technologies

RECOMMENDATION:
Revise text

H 501.0 Septic Tank Construction.

H 501.14 Prefabricated Septic Tanks. Prefabricated septic tanks shall comply with the following requirements:
(1) Manufactured or prefabricated concrete, fiberglass-reinforced polyester, thermoplastic, and steel septic tanks shall comply with approved applicable standards IAPMO/ANSI Z1000 or CSA B66 and be approved by the Authority Having Jurisdiction. Prefabricated bituminous coated septic tanks shall comply with UL 70.
(2) Independent laboratory tests and engineering calculations certifying the tank capacity and structural stability shall be provided as required by the Authority Having Jurisdiction.

SUBSTANTIATION:
The proposed changes add the appropriate standard for manufactured or prefabricated concrete, fiber-reinforced polyester, thermoplastic, and steel septic tanks. The current language does not provide a specific reference standard. However, ANSI and Standards Council of Canada standards are available to define requirements for manufactured or prefabricated septic tanks to ensure the tanks are safe for use in their application. This section of the code already specifies UL 70 for bituminous coated septic tanks, so the inclusion of IAPMO/ANSI Z1000-2019 for concrete, fiber-reinforced polyester, thermoplastic, and steel septic tanks would be a parallel addition to the existing code structure.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

H 501.0 Septic Tank Construction.

H 501.14 Prefabricated Septic Tanks. Prefabricated septic tanks shall comply with the following requirements:
(1) Manufactured or prefabricated concrete, fiberglass-reinforced polyester, thermoplastic, and steel septic tanks shall comply with IAPMO/ANSI Z1000 or CSA B66 and be approved by the Authority Having Jurisdiction. Prefabricated bituminous coated septic tanks shall comply with UL 70.
(2) Independent laboratory tests and engineering calculations certifying the tank capacity and structural stability shall be provided as required by the Authority Having Jurisdiction.

COMMITTEE STATEMENT:
The modification removes the list of septic tank materials as they are not needed for the enforcement of such tanks.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 280
UPC 2024  Section: H 501.14, Table 1701.1

SUBMITTER: David Lentz
Infiltrator Water Technologies

RECOMMENDATION:
Revise text

H 501.0 Septic Tank Construction.
H 501.14 Prefabricated Septic Tanks. Prefabricated septic tanks shall comply with the following requirements:
(1) Manufactured or prefabricated septic tanks shall comply with approved applicable standards and be approved by the Authority Having Jurisdiction.
(2) Prefabricated bituminous coated septic tanks shall comply with UL 70.
(3) Prefabricated thermoplastic tanks having a total liquid volume less than 750 gallons (2389 L) shall comply with IAPMO IGC 262.
(4) Independent laboratory tests and engineering calculations certifying the tank capacity and structural stability shall be provided as required by the Authority Having Jurisdiction.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 262-2020</td>
<td>Corrugated Thermoplastic Tanks</td>
<td>DWV Components</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
The proposed change adds the appropriate standard for manufactured or prefabricated corrugated thermoplastic tanks having a total liquid volume less than 750 gallons in pumping and holding applications. The current language does not provide a specific reference standard. However, a standard is available to define requirements for manufactured or prefabricated septic tanks used for pumping and holding applications to ensure the tanks are safe for use in its application. This section of the code already specifies UL 70 for bituminous coated septic tanks, so the inclusion of IAPMO IGC 262-2020 for corrugated thermoplastic tanks would be a parallel addition to the existing code structure. In adding IAPMO IGC 262-2020, the proposal includes separating the UL 70 bituminous coated tank requirements into a new subsection, so that differing technical specifications are presented clearly and independently.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
This proposed change is overly restrictive regarding a maximum volume of 750 gallons and conflicts with the IAPMO IGC 262 standard. The standard does not provide a maximum volume, only a minimum volume of 300 gallons.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
Proposals

Item #: 281
UPC 2024 Section: H 601.1.1

SUBMITTER: David Lentz
Infiltrator Water Technologies

RECOMMENDATION:
Add new text

H 601.0 Disposal Fields.
H 601.1 Distribution Lines. (remaining text unchanged)

H 601.1.1 Bundled Expanded Polystyrene Synthetic Aggregate Units. Bundled expanded polystyrene synthetic aggregate units with an integrated distribution line consisting of perforated, corrugated high-density polyethylene pipe that complies with IAPMO IGC 276 shall be permitted.

SUBSTANTIATION:
The proposed change recognizes the method of constructing bundled expanded polystyrene synthetic aggregate (EPS) units complying with IAPMO IGC 276, which includes an integrated perforated, corrugated high-density polyethylene pipe conforming with ASTM F667. Section H 201.1 requires that wastewater entering a disposal field must first flow through a conforming septic tank, where primary treatment occurs, separating liquid and solids and producing a clarified effluent (see page 1 of Supporting Document - USEPA fact sheet). Clarifying effluent in the septic tank prior to discharge to the disposal field eliminates the potential for solids to become trapped in the disposal field pipe corrugations and obstruct flow within the EPS unit. Section 310.5 describes specific instances when piping may exceed the normal frictional resistance to flow. The proposed subsection represents an additional allowable instance when normal frictional resistance to flow may occur. By conveying only liquid in the EPS unit pipe via primary treatment in the septic tank, an integrated perforated, corrugated high-density polyethylene pipe conforming with ASTM F667 can successfully distribute wastewater within the disposal field.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 282
UPC 2024  Section: H 601.2

SUBMITTER: David Lentz
Infiltrator Water Technologies

RECOMMENDATION:
Revise text

H 601.0 Disposal Fields.

H 601.2 Filter Material. Before placing filter material or drain lines in a prepared excavation, smeared or compacted surfaces shall be removed from trenches by raking to a depth of 1 inch (25.4 mm) and the loose material removed. Clean stone, gravel, slag, or similar filter material acceptable to the Authority Having Jurisdiction, varying in size from ¾ of an inch to 2 ½ inches (19.1 mm to 64 mm), shall be placed in the trench to the depth and grade required by this section. Drain pipe shall be placed on filter material in an approved manner. The drain lines shall then be covered with filter material to the minimum depth required by this section, and this material covered with untreated building paper, straw, or similar porous material to prevent the closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspection and acceptance.

Exception: Listed or approved plastic leaching chambers, and bundled expanded polystyrene synthetic aggregate units, and systems that treat and dispose of sewage within a single footprint shall be permitted to be used in lieu of pipe and filter material. Chamber, and bundled expanded polystyrene synthetic aggregate unit, and systems that treat and dispose of sewage within a single footprint installations shall follow the rules for disposal fields, where applicable, and shall be in accordance with the manufacturer's instructions.

SUBSTANTIATION:
This proposal is associated with a separate proposal to add combined treatment and dispersal (CTD) private sewage systems to Section H 301.1. The separate Section H 301.1 proposal expands the gravelless effluent disposal technology described in the code, adding to the current description of plastic leaching chambers and bundled expanded polystyrene synthetic aggregate units described in Section H 301.1(5). The change to the Section H 601.2 exception is proposed in order to maintain consistency with the manner in which similar effluent disposal technologies are addressed in the code, where these technologies collectively represent recognized substitute media for a pipe and filter material trench or bed (see Section H 301.0 for pipe and filter material description).

Since 2014, IAPMO has partnered with the United States Environmental Protection Agency (USEPA) as one of 14 collaborators operating under a Memorandum of Understanding (MOU) and aspiring to improve the overall performance and management of decentralized wastewater treatment systems (see Supporting Document - IAPMO WE•Stand Newswire 2020 IAPMO MOU announcement). Appendix H – Private Sewage Disposal Systems describes decentralized wastewater treatment systems and applies directly to the USEPA MOU. The proposed addition to Subsection H 601.2 recognizes the use of systems proven through an industry-recognized ANSI standard to be capable of treating and disposing of sewage in a single footprint. This class of wastewater treatment technology, referred to as CTD, has been in use across the North America for over 25 years, with installations surging in the past 10 years as wastewater industry stakeholders seek reliable, sustainable, non-electric, low-impact means of treating and dispersing wastewater. CTD has transitioned to a major element of the wastewater treatment system framework in several states and Canadian provinces, including Connecticut, Indiana, Maine, Massachusetts, New Hampshire, New York, Ohio, Ontario, Quebec, and Rhode Island.
Multiple manufacturers have certified CTD systems under NSF 40-2018 - Residential Wastewater Treatment Systems. NSF 40-2018 establishes minimum materials, design and construction, and performance requirements for residential wastewater treatment systems. Technologies in the marketplace include a proprietary device installed within a specified coarse-grained sand, most often sand conforming with ASTM C33 particle size gradation requirements. Septic tank effluent enters the proprietary CTD device, where distribution and filtering occur, followed by additional treatment in the surrounding specified sand, resulting in a treated effluent conforming with the NSF 40-2018 biochemical oxygen demand concentration of 25 milligrams per liter (mg/l) and total suspended solids concentration of 30 mg/l conformance criteria. Extensive third-party testing of CTD systems to NSF 40 has shown that these non-mechanical, sand based systems meet the water quality criteria in the standard immediately upon start up. In contrast, electro-mechanical systems characteristically need the allotted 21-day grace period to achieve compliance, as allowed in NSF 40-2018, while a microflora population capable of meeting treatment requirements develops. This capability of providing immediate performance shows that, beyond continuous-use applications, CTD systems are ideal for intermittent and inconsistent flow usage conditions, such as that which occurs with seasonal dwellings.

CTD processes occur without the need for electricity, using natural biological and chemical processes to provide wastewater meeting secondary treatment standards. Rather than discharging primary-treated wastewater to native soil like a pipe and filter material disposal field or seepage pits described in Section H 301, CTD systems disperse secondary-treated effluent to the native soil, providing a tangible environmental benefit that is required for certain building sites by Authorities Having Jurisdiction across the nation.

Supporting document(s) has been provided to the Technical Committee for review.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The language is vague and not enforceable. The statement "treat and dispose of sewage within a single footprint" gives no direction to the end user. This will be consistent with the actions taken on Item # 278.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
APPENDIX J
COMBINATION OF INDOOR AND OUTDOOR COMBUSTION AND VENTILATION OPENING DESIGN
(The content of this Appendix is based on Annex I of NFPA 54)

J 101.0 General.

J 101.1 Applicability. This appendix provides general guidelines for the sizing of combination indoor and outdoor combustion and ventilation air openings.

J 101.2 Example of Combination Indoor and Outdoor Combustion Air Opening. Determine the required combination of indoor and outdoor combustion air opening sizes for the following appliance installation example.

Example Installation: A fan-assisted furnace and a draft-hood-equipped water heater with the following inputs are located in a 15 foot by 30 foot (4572 mm by 9144 mm) basement with an 8 foot (2438 mm) ceiling. No additional indoor spaces can be used to help meet the appliance combustion air needs.

Fan-Assisted Furnace Input: 100 000 British thermal units per hour (Btu/h) (29 kW)
Draft Hood-Equipped Water Heater Input: 40 000 Btu/h (11.7 kW)

Solution:
(1) Determine the total available room volume. Appliance room volume:
15 feet by 30 feet (4572 mm by 9144 mm) with an 8 foot (2438 mm) ceiling = 3600 cubic feet (101.94 m³)

(2) Determine the total required volume. The standard method to determine combustion air is used to calculate the required volume. The combined input for the appliances located in the basement is calculated as follows:

100 000 Btu/h (29 kW) + 40 000 Btu/h (11.7 kW) = 140 000 Btu/h (41 kW)

The standard method requires that the required volume be determined based on 50 cubic feet per 1000 Btu/h (4.83 m³/kW). Using Table J 101.2, the required volume for a 140 000 Btu/h (41 kW) water heater is 7000 cubic feet (198.22 m³).

Conclusion: The indoor volume is insufficient to supply combustion air since the total of 3600 cubic feet (101.94 m³) does not meet the required volume of 7000 cubic feet (198.22 m³). Therefore, additional combustion air shall be provided from the outdoors.

(3) Determine ratio of the available volume to the required volume:

\[
\frac{3600 \text{ cubic feet}}{7000 \text{ cubic feet}} = 0.51
\]
(4) Determine the reduction factor to be used to reduce the full outdoor air opening size to the minimum required based on the ratio of indoor spaces:

\[ 1.00 - 0.51 \text{ (from Step 3)} = 0.49 \]

(5) Determine the single outdoor combustion air opening size as though all combustion air is to come from outdoors. In this example, the combustion air opening directly communicates with the outdoors:

\[ \frac{140 \,000 \text{ Btu/h}}{3000 \text{ British thermal units per square inch (Btu/in}^2)} = 47 \text{ square inches (0.03 m}^2) \]

(6) Determine the minimum outdoor combustion air opening area:

Outdoor opening area = 0.49 (from Step 4) x 47 square inches (0.03 m\(^2\)) = 23 square inches (0.01 m\(^2\))

Section 506.5.3(3) requires the minimum dimension of the air opening should not be less than 3 inches (76 mm). [NFPA 54:I.1]

SUBSTANTIATION:
The above sections have been revised to correlate with NFPA 54-2021 (latest version) in accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines).

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 283, Section J 101.2 (Example of Combination Indoor and Outdoor Combustion Air Opening) and UMC Item # 322, Section G 103.0 (Example of Combination Indoor and Outdoor Combustion Air Opening Design) resulted in conflicting language between the codes. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

J 101.2 Example of Combination Indoor and Outdoor Combustion Air Opening Design. (remaining text unchanged)

Solution:
(1) Determine the total available room volume. Appliance room volume:

15 feet by 30 feet (4572 mm by 9144 mm) with an 8 foot (2438 mm) ceiling = 3600 cubic feet (101.94 m\(^3\))

(2) Determine the total required volume. The standard method to determine combustion air is used to calculate the required volume. The combined input for the appliances located in the basement is calculated as follows:

100 000 Btu/h (29 kW) + 40 000 Btu/h (11.7 kW) = 140 000 Btu/h (41 kW)

The standard method requires that the required volume be determined based on 50 cubic feet per 1000 Btu/h (4.83 m\(^3\)/kW). Using Table J 101.2, the required volume for a 140 000 Btu/h (41 kW) water heater combined input is 7000 cubic feet (198.22 m\(^3\)).

(remaining text unchanged)

[NFPA 54:I.1]

TCC ACTION: ACCEPT AS SUBMITTED
TCC STATEMENT:
The language in UPC Item # 283, Section J 101.2 (Example of Combination Indoor and Outdoor Combustion Air Opening) is being revised to correlate with the action taken by the UMC TC for Item # 322, Section G 103.0 (Example of Combination Indoor and Outdoor Combustion Air Opening Design) with regards to replacing the term “water heater” with “combined input” and adding the term “Design” to the title to correlate with the latest edition of the NFPA 54 extract.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Section J 101.2 regarding the update from the term “water heater” to “combined input” and adding the term “Design” to the title.
Proposals

Item #: 284
UPC 2024  Section: K 101.2

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

K 101.0 General.

K 101.2 System Design. Potable rainwater catchment systems in accordance with this appendix shall be designed by a registered design professional or person deemed competent by the Authority Having Jurisdiction to perform potable rainwater catchment system design work. Where required, rainwater catchment systems shall be seismically restrained against earthquakes in accordance with the building code.

SUBSTANTIATION:
Rainwater catchment systems are currently silent with regards to seismic provisions. It is imperative to protect the potable water that has been captured and the system. The addition of seismic restraints (where required) will guide the end user and designer to implement these safety features.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

COMMITTEE STATEMENT:
The language is being accepted, however, the Technical Committee recommends that sizing of rainwater catchment systems be addressed by public comment.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 285
UPC 2024  Section: K 103.2.1

SUBMITTER: Karan Kapila  
Self

RECOMMENDATION:
Add new text

K 103.0 Potable Rainfall Catchment System Materials.

K 103.2 Rainwater Catchment System Drainage Materials. Materials used in rainwater catchment drainage systems, including gutters, downspouts, conductors, and leaders shall be in accordance with the requirements of this code for storm drainage.

K 103.2.1 Material for Potable Water Applications. Rainwater catchment system materials and components intended for potable water applications shall comply with NSF/ANSI 61 and shall be not more than a weighted average of 0.25 percent with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures in accordance with NSF/ANSI 372. For solder and flux, the lead content shall be not more than 0.2 percent where used in piping systems that convey or dispense water for human consumption.

Exceptions:
(1) Gutters, downspouts, conductors, and leaders shall not be required to comply with the requirements of Section K 103.2.1.
(2) Pipes, pipe fittings, plumbing fittings, fixtures, or backflow preventers used for nonpotable services or any other uses where the water is not used for human consumption.
(3) Flush valves, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are 2 inches (50 mm) in diameter or larger.

SUBSTANTIATION:
The proposed provisions are being included as minimum health and safety provisions concerning potable water. This makes it clear and upfront regarding what components of the rainwater catchment systems are required to meet the minimum potable water standards and lead contents allowed in the plumbing code.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the exception will allow potable water components to be exempt from complying with NSF 372.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 286
UPC 2024  Section: K 105.3.1

SUBMITTER: Karan Kapila
Self

RECOMMENDATION:
Revise text

K 105.0 Rainwater Storage Tanks.

K 105.3 Location. (remaining text unchanged)
K 105.3.1 Above Grade. Above grade, storage tanks shall be of an opaque material, approved for aboveground use in direct sunlight, or shall be shielded from direct sunlight. Tanks shall be installed in an accessible location to allow for inspection and cleaning. The tank shall be installed on a foundation or platform that is constructed to accommodate the weight and loads when filled to maximum capacity in accordance with the building code.

SUBSTANTIATION:
The proposed text adds clarity that foundations and supports for rainwater storage tanks should be designed to the maximum weights and loads of a tank that is filled to capacity. This may be intuitive; however, it may not be addressed elsewhere and this will ensure these loads and weights are taken into account.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

COMMITTEE STATEMENT:
The term "maximum" was added editorially for clarification.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
APPENDIX L
SUSTAINABLE PRACTICES

L 404.0 Non-Sewered Sanitation Systems.
L 404.1 General. Non-sewered sanitation systems shall comply with ISO 30500.
L 404.2 Installation. The installation of non-sewered sanitation systems shall be in accordance with the manufacturer's installation instructions and Section 404.2.1 through Section 404.2.5.
L 404.2.1 Operating Conditions. A non-sewered sanitation system in either a conditioned or unconditioned space shall be installed where the ambient temperature, ambient humidity, and altitude (atmospheric pressure) are in accordance with the manufacturer's installation instructions or product listing.
L 404.2.2 Clearances for Servicing and Maintenance. A non-sewered sanitation system shall be located to permit access and sufficient clearance for service and maintenance. Unless otherwise specified by the manufacturer's installation instructions, not less than 30 inches in depth, width, and height of working space shall be provided at any access panel.
L 404.2.3 Backflow Prevention. A domestic water supply connection to a non-sewered sanitation system shall be protected in accordance with the plumbing code.
L 404.2.4 Effluent Storage. Any container or vessel for the storage of effluent discharged from a non-sewered sanitation system and not integral to such system shall be installed in accordance with the plumbing code.
L 404.2.5 Systems Employing Combustion. A non-sewered sanitation system employing combustion shall comply with the mechanical code.

Exception: A non-sewered sanitation system listed for unvented use.

L 404.3 Operation and Maintenance Manual. Non-sewered sanitation systems shall have an operation and maintenance manual provided by the manufacturer.
L 404.4 System Output. The use or disposal of all substances exiting the non-sewered sanitation system shall be determined by the Authority Having Jurisdiction.

(renumber remaining sections)

L 201.0 Definitions
Non-Sewered Sanitation System. A prefabricated integrated sewage treatment unit that is not connected to a public sewer or private sewage disposal system.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
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SUBSTANTIATION:
This proposal covers the essential considerations that a building official must assess when a nonsewered sanitation system (as defined) is installed in a building. To facilitate commercialization of hi-tech toilets and their acceptance by national regulatory bodies, an ISO standard was adopted in 2018 to establish the key performance attributes of non-sewered sanitation systems (NSSSs). Standard 30500, "Non-sewered sanitation systems - Prefabricated integrated treatment units - General safety and performance requirements for design and testing," sets performance requirements for solid and liquid outputs, odor, noise, air emissions, materials, safety, marking, and ergonomics, together with relevant test procedures for measuring the attainment of these requirements. Designed for operation without a sewer connection and, in many cases, without a dedicated water supply, NSSSs are anticipated to meet critical public health needs in developing countries with limited water and wastewater infrastructure. However, this new standard carries important implications for water and wastewater management and utility service in North America as well. From national parks to suburban shopping malls to net zero homes, high-tech toilets meeting the new ISO standard could find uses that upend our approach to sanitation and our expectations about future water demands and the placement and capacity of water-related infrastructure. In 2011, the Bill & Melinda Gates Foundation launched the "Reinvent the Toilet Challenge" to bring new technology to bear to achieve "sustainable sanitation solutions." The target is a device that provides complete and effective treatment of human sanitary waste, unconnected to any sewer or drainage network and with minimal inputs of water and energy. Eight teams have received foundation support to develop prototypes for lab testing, field trials, and eventual commercialization. Among these early devices, three broad pathways for treatment technology have been applied - electro-chemical, biological, and combustion - and in some cases, combinations of these in the same device. The provisions in this proposal address the considerations that must be taken into account by building officials regarding the placement and installation of NSSSs in buildings. The proposal would permit (but not require) the installation of a NSSS listed to the ISO standard, providing an exception to the general requirement that sanitation devices be connected to the building drainage system. Criteria for the functioning of the unit for its intended purpose are established by the ISO standard, and do not need to be repeated in code language in the UPC. Certain key protections, such as backflow prevention, proper ventilation of combustion-based units, and proper siting of any storage tanks external to the unit are each specified in the proposal. The clearance requirements in Section L 404.2.2 correspond with the basic requirements found in the Uniform Mechanical Code, Section 304.1. Considerations of the use and disposal of outputs of the system are specifically referred to an AHJ, which would most likely be a health department. With reinvented toilets now on the cusp of commercialization, the widespread use of toilets without water and sewer connections carries profound implications for US utilities and builders. While much is still unknown about their cost, maintenance, reliability, and even the business model for their installation and service, forward-looking communities will want to be prepared to ensure the safe installation and use of this promising new technology, which will soon be available. This proposal lays the necessary groundwork for code officials to inspect and approve their installation.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as the changes pertaining to non-sewered sanitation systems in this proposal are already being addressed in Item # 306.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 288

UPC 2024  Section: L 201.0, L 402.3.2 - L 503.3.6, Table 1701.2

SUBMITTER: Jim Kendzel
American Supply Association
Rep. Chairman of the Alternate Water Sources Task Group

RECOMMENDATION:
Revise text

L 201.0 Definitions

**Dedicated Meter.** A water measuring device used at a subsection or end use of a water supply system for any of the following purposes: billing, water management, collecting and analyzing water usage data, detection of leaks, equipment failure, water waste, and irregular or abnormal use for a specific application. Also called a submeter.

**Dry Weather Runoff.** Water that flows along a surface, in a channel or sub-surface including groundwater seepage, and is not associated with a rain event.

**ET\(_c\).** Evapotranspiration rate of the plants derived by multiplying \(ET_o\) by the appropriate plant factor or coefficient.

**ET\(_o\).** Reference evapotranspiration for a cool-season grass as calculated by the standardized Penman-Monteith equation based on weather-station data.

**Flow-Through Design.** A fitting or a fitting configuration with two primary inlet connections and one or more outlet connections with the purpose to supply water to a fixture fitting.

**Low Flow Emitter.** Low-flow irrigation emission device designed to dissipate water pressure and discharge a small uniform flow or trickle of water at a constant flow rate. To be classified as a low flow emitter, drip emitters shall discharge water at less than 4 gallons (15 L) per hour per emitter; microspray, micro-jet, and misters shall discharge water at a maximum of 30 gallons (114 L) per hour per nozzle.

**L 402.3.2 Nonwater Urinals with Drain Cleansing Action.** Nonwater urinals with drain cleansing action shall comply with ASME A112.19.19 and shall be cleaned, maintained, and installed in accordance with the manufacturer’s installation instructions.

**L 402.6.2 Bath and Shower Diverters.** The rate of leakage out of the tub spout of bath and shower diverters, while operating in the shower mode, shall not exceed 0.1 gpm (0.4 L/m) in accordance with ASME A112.18.1/CSA B125.1 perform with zero leakage.

**L 402.6.3 Shower Valves.** Shower valves shall comply with the temperature control performance requirements of ASSE 4016 or ASME A112.18.1/CSA B125.1 where ASSE 1016/ASME A112.1016/CSA B125.16 when tested at 2.0 gpm (7.6 L/m) for the rated flow rate of the installed showerhead.

**L 402.6.3.1 Marking.** Control valves for showers and tub/shower combinations shall be tagged, labeled, or marked with the manufacturer’s minimum rated flow and such marking shall be visible after installation.

**L 402.8 Commercial Pre-Rinse Spray Valves.** The flow rate for a pre-rinse spray valve installed in a commercial kitchen to remove food waste from cookware and dishes before cleaning shall not be more than 1.28 gpm (4.8 L/m) at 60 psi (414 kPa). Where pre-rinse spray valves with maximum flow rates of 1.0 gpm (3.8 L/m) or less are installed, the static pressure shall be not less than 30 psi (207 kPa). Commercial kitchen pre-rinse spray valves shall be equipped with an integral automatic shutoff. Pre-rinse spray valves shall be listed to the EPA WaterSense Commercial Pre-rinse Spray Valve Specification.
L 402.10 Drinking Fountains and Bottle Filling Stations. Bottle filling stations shall be included on or used as a substitute to meet the requirements of drinking fountains in at least 50 percent of the requirements for drinking fountains. Bottle filling stations and drinking fountains shall be self-closing.

L 404.2 Ice Makers. Ice makers shall be air cooled and shall be in accordance with Energy Star for energy use for commercial ice machines. Ice makers producing cubed-type ice shall not exceed 20 gallons (75.7 L) of water per 100 pounds (45.4 kg) of ice produced. Ice makers producing nugget and flake ice shall not exceed 14 gallons of water per 100 pounds (45.4 kg) of ice produced.

L 404.5 Grease Interceptors. Grease interceptor maintenance procedures shall not include post-pumping/cleaning refill using potable water. Refill shall be by connected appliance accumulated discharge only.

L 404.5.1 Temperature. Grease Interceptors shall be designed and installed to maintain a mean temperature not exceeding 95°F (35°C). FOG (fats, oils, and greases) disposal systems in compliance with ASME A112.14.6 using biological cultures shall not exceed 104°F (40°C). Passive or active cooling and heat recovery to be employed where applicable.

L 404.6 Dipper Well Faucets. Where dipper wells have a permanent water supply, the faucet shall have metered or sensor activated flow. The volume of water dispensed into a dipper well in each activation cycle of a self-closing fixture fitting shall not exceed the water capacity of the dipper well, and the maximum flow shall not exceed 0.2 gpm (0.8 L/m) at a supply pressure of 60 psi (414 kPa). Where dipper wells are installed, the water supply to a dipper well shall have a shutoff valve and flow control. The flow of water into a dipper well shall be limited by not less than one of the following methods:
(1) Water flow shall not exceed the water capacity of the dipper well in one minute at a supply pressure of 60 psi (414 kPa), and the maximum flow shall not exceed 2.2 gpm (8.3 L/m) at a supply pressure of 60 psi (414 kPa). The water capacity of a dipper well shall be the maximum amount of water that the fixture can hold before water flows into the drain.
(2) The maximum volume of water dispensed into a dipper well in each activation cycle of a self-closing fixture fitting shall not exceed the water capacity of the dipper well, and the maximum flow shall not exceed 2.2 gpm (8.3 L/m) at a supply pressure of 60 psi (414 kPa).

L 404.7.1 Pulpers and Mechanical Strainers. The water use for pulpers or mechanical strainers shall not exceed 3.2 gpm (11.4 L/m). A flow restrictor shall be installed on the water supply to limit the water flow.

L 404.8 Tempering Water. The discharge waste from commercial dishwashers, ware washers, combination ovens, and food steamers that exceeds 140°F (60°C) shall not be tempered with potable water.

L 405.1 General. Where installed, leak detection and control devices shall comply with IAPMO IGC 115 or IAPMO IGC 349. Leak detection and control devices help protect property from water damage and also conserve water by shutting off the flow when leaks are detected shall not be installed where they isolate fire sprinkler systems.

L 407.1 Required. A water meter shall be required for each building site connected to a public water system, including municipally supplied reclaimed (recycled) water. In other than single-family houses, a dedicated meter in multifamily structures of three stories or fewer above grade, and modular houses, a separate meter or submeter shall be installed in accordance with Table L 407.1 the following locations:
(1) The water supply for irrigated landscape with an accumulative area exceeding 2500 square feet (232.3 m²).
(2) The water supply to a water using process where the consumption exceeds 1000 gallons per day (gal/d) (0.0438 L/s), except for manufacturing processes.
(3) The water supply to each building on a property with multiple buildings where the water consumption exceeds 500 gals/d (0.021 L/s).
(4) The water supply to an individual tenant space on a property where one or more of the following applies:
(a) Water consumption exceeds 500 gals/d (0.021 L/s) for that tenant.
(b) Tenant space is occupied by a commercial laundry, cleaning operation, restaurant, food service, medical office, dental office, laboratory, beauty salon, or barbershop.
(c) Total building area exceeds 50 000 square feet (4645 m²).
(5) The makeup water supplies to a swimming pool.

L 407.3 Remote Data Transfer Requirements. Consumption Data. A means of communicating water consumption data from submeters to the water consumer shall be provided. Where more than 10 non-utility-owned water meters are located at a building site, the meters shall include remote data transfer capability to collect and analyze the data at a single location.
<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Towers</td>
<td>The makeup water supply to cooling towers, evaporative condensers, and fluid coolers. Cooling towers sharing a common basin can be grouped together using one meter.</td>
</tr>
<tr>
<td>Evaporative Coolers</td>
<td>The makeup water supply to an evaporative cooler having an air flow exceeding 30 000 cubic feet per minute (ft³/min) (50 970.3 m³/hr).</td>
</tr>
<tr>
<td>Fluid Coolers and Chillers</td>
<td>The makeup water supply on water-cooled fluid coolers and chillers not utilizing closed-loop recirculation.</td>
</tr>
<tr>
<td>– Open Systems</td>
<td>Systems with 50 ton (175 843 W) or greater of cooling capacity and where a make-up water supply is connected.</td>
</tr>
<tr>
<td>Hydronic Cooling Systems</td>
<td>The makeup water supply to one or more boilers collectively exceeding 1 000 000 British thermal units per hour (Btu/h) (293 071 W).</td>
</tr>
<tr>
<td>– Closed Loop</td>
<td></td>
</tr>
<tr>
<td>Hydronic Heating Systems</td>
<td></td>
</tr>
<tr>
<td>Industrial Processes</td>
<td>The water supply to an industrial water-using process where the average consumption exceeds 1000 gallons per day (gal/d) (3 785 L/d). Like equipment sharing one common water supply can be grouped together using one meter.</td>
</tr>
<tr>
<td>Landscape Irrigation</td>
<td>Landscape irrigation water where either of the following conditions exist: (1) Total accumulated landscape area with in-ground irrigation system exceeds 2500 square feet (232 m²). or (2) Total accumulated landscape area using an automatic irrigation controller exceeds 1500 square feet (139 m²)</td>
</tr>
<tr>
<td>Onsite Water Collection</td>
<td>Potable or reclaimed water supplies for supplementing onsite alternative water collection systems.</td>
</tr>
<tr>
<td>Systems</td>
<td></td>
</tr>
<tr>
<td>Ornamental Water Features</td>
<td>Potable or reclaimed water supplies for ornamental water features where the water feature uses an automatic refill valve.</td>
</tr>
<tr>
<td>Pools and Spas</td>
<td>A makeup water supply to a swimming pool or spa.</td>
</tr>
<tr>
<td>Roof Spray Systems</td>
<td>Roof spray systems for irrigating vegetated roofs or thermal conditioning covering an area greater than 300 square feet (28 m²).</td>
</tr>
<tr>
<td>Tenant Buildings -</td>
<td>Water supplies used in common areas of a site. The dedicated meter for common area water use shall not include water supplied inside tenant space. Water supplies for sanitary fixtures and other water use in common areas can be grouped together for metering requirements, except where dedicated water meter installations are otherwise required.</td>
</tr>
<tr>
<td>Common Areas</td>
<td></td>
</tr>
<tr>
<td>Tenant Spaces - Residential</td>
<td>All water supplies to each residential tenant space for indoor water use.</td>
</tr>
<tr>
<td>Tenant Spaces - Non-</td>
<td>All water supplies to individual non-residential tenant spaces for indoor water use where any of the following conditions exist: (1) The nominal size of a water supply pipe(s) to the individual tenant space is greater than ½ inch, or (2) Water consumption within in the tenant space is estimated or expected to average greater than 1000 gallons/day (3 785 L/d).</td>
</tr>
<tr>
<td>residential, car washes</td>
<td>Where water is supplied to tenant space that is not required to have dedicated meter, the water supply pipe(s) shall be accessible to install a meter.</td>
</tr>
<tr>
<td></td>
<td>Exception: Where a water purveyor has individual meters for each tenant space and the other meter requirements included in Table 407.1 do not apply, no additional dedicated meter is required.</td>
</tr>
</tbody>
</table>
L 410.3 Point-of-Use Reverse Osmosis Water Treatment Systems. Reverse osmosis water treatment systems installed in residential occupancies shall be equipped with automatic shutoff valves to prevent discharge when there is no call for producing treated water. Reverse osmosis water treatment systems shall comply with NSF 58.

L 410.4 Drinking Water Treatment Systems. Drinking water treatment systems shall be listed to WQA/ASPE S-803.

L 411. General. Where landscape irrigation systems are installed, they shall be in accordance with Section L 411.2 through Section L 411.14. Requirements limiting the amount or type of plant material used in landscapes shall be established by the Authority Having Jurisdiction.

Exception: Plants grown for food production.

L 411.1 Irrigation Design and Installation. The Authority Having Jurisdiction shall have the authority to require landscape irrigation contractors, installers, or designers to demonstrate competency. The system shall be designed and record drawings showing changes during installation shall be made available for the owner and for any required inspections. Where required by the Authority Having Jurisdiction, the contractor, installer, or designer shall be licensed, certified, or both to perform such work.

L 411.2 Plant and Irrigation System Limitations. Nuisance, invasive and noxious plants as defined by the Authority Having Jurisdiction shall not be used in the landscape. Plants not requiring supplement irrigation and not principally used as an athletic field or public recreation shall be used in no less than 60 percent of the landscape that is not principally used as an athletic field or public recreation. Inground irrigation system shall not be installed in more than 40 percent of the landscaped area.

Exceptions:
(1) Where average annual rainfall is less than 12 inches (305 mm) and in landscape areas where the plant materials have an annual ETc of not exceeding 15 inches (381 mm), an in-ground irrigation system shall be allowed.
(2) Where neither potable or reclaimed (recycled) water is used in the irrigation system, an in-ground irrigation system shall be allowed in 100 percent of the landscaped area and vegetative roofs.

L 411.3 Vegetative Roofs and Walls. Irrigation systems using potable water for vegetative roofs and walls are prohibited.

L 411.4 Maximum Velocity. Velocity of water flow shall not exceed 5 feet per second (1.5 m/s) for thermoplastic irrigation pipes. Velocity of water flow shall not exceed 7.5 feet per second (2.3 m/s) for metal irrigation pipes.

(rerunumber remaining sections)

L 411.2 Backflow Protection. Potable water and reclaimed water supplies to landscape irrigation systems shall be protected from backflow in accordance with this code and the Authority Having Jurisdiction.

L 411.3 Use of Alternate Water Sources for Landscape Irrigation. Where available by pre-existing treatment, storage, or distribution network, and where approved by the Authority Having Jurisdiction, alternative water source(s) shall be utilized for landscape irrigation. Where adequate capacity and volumes of pre-existing alternative water sources are available, the irrigation system shall be designed to use a minimum of 75 percent of alternative water for the annual irrigation demand before supplemental potable water is used.

Exception: Plants grown for food production for direct human consumption.

L 411.3.1 Master Valve. Where continuously pressurized alternate water sources supply an existing irrigation system, a master valve shall be installed at the point where the alternate water sources supply piping connects to the existing irrigation system downstream of the backflow preventer where required.

L 411.3.2 Identification. Where alternate water sources supply an existing irrigation system, the existing sprinkler heads, valve boxes, the continuously pressurized line supplying the irrigation master valve, or any other components required by the Authority Having Jurisdiction, shall be colored purple. The piping supplying the irrigation master valve shall be identified in accordance with Chapter 15 of this code.

L 411.3.2.1 Additional Zones. Newly installed zones shall have purple pipe.

L 411.4 Irrigation Control Systems. Where installed as part of a landscape irrigation system, irrigation control systems shall:
(1) Automatically adjust the irrigation schedule to respond to plant water needs determined by weather or soil moisture conditions.
(2) Utilize onsite sensors or remote weather data to inhibit or to suspend irrigation when adequate soil moisture is present or during a rainfall or freezing conditions.
(3) Utilize either one or more on-site sensors or a weatherbased irrigation controller listed to the US EPA WaterSense Weather Based Irrigation Controllers Specification to suspend irrigation where adequate soil moisture is present for plant growth.
(4) Have the capability to program multiple and different run times for each irrigation zone to enable cycling of water applications and durations to mitigate water flowing off of the intended irrigation zone.
(5) Be capable of indicating to the user when it is not receiving a signal or local sensor input.
(6) Be capable of allowing for a manual operation troubleshooting test cycle and shall automatically return to sensor input mode within some period of time as designated by the manufacturer, even when the switch is still positioned for...
The site-specific settings of the irrigation control system shall be posted at the control system location. The posted data, where applicable to the settings of the controller, shall include:

(a) Precipitation rate for each zone.
(b) Plant evapotranspiration coefficients for each zone.
(c) Soil absorption rate for each zone.
(d) Rain sensor settings.
(e) Soil moisture setting.
(f) Peak demand schedule including run times for each zone and the number of cycles to mitigate runoff and monthly adjustments or percentage change from peak demand schedule.

**L 411.5 Irrigation Flow Sensing System.** On commercial landscape irrigation systems, an irrigation flow sensing system shall be installed that shall interface with the control system to suspend irrigation for abnormal flow conditions. If equipped with totalizer capabilities, the irrigation flow sensing system shall also function as a meter for irrigation water.

**L 411.5 Low Flow Irrigation.** Irrigation zones using low flow irrigation emitters with emitter flow rates not to exceed 6.3 gallons (24 L) per hour shall comply with ASABE/ICC 802 Landscape Irrigation Sprinkler and Emitter Standard and shall be equipped with filters sized according to the manufacturer’s recommendation for the specific low flow emitter, and with a pressure regulator installed upstream of the irrigation emission devices as necessary to reduce the operating water pressure in accordance with the manufacturers’ equipment requirements.

**L 411.6 Mulched Planting Areas.** Only low flow emitters with flow rates not to exceed 6.3 gallons (24 L) per hour are allowed to be installed in mulched planting areas with vegetation taller than 12 inches (305 mm).

**L 411.7 System Performance Requirements.** The landscape irrigation system shall be designed and installed to:

1. Prevent irrigation water from runoff out of the irrigation zone.
2. Prevent water in the supply line drainage from draining out between irrigation events.
3. Not allow irrigation water to be applied onto or enter non-targeted areas including adjacent property and vegetation areas, adjacent hydrozones not requiring the irrigation water to meet its irrigation demand, non-vegetative areas, impermeable surfaces, roadways, and structures.

**Exception:** Landscape features outside of the public right of way such as paved walkways, jogging paths, and golf cart paths, are exempted from this requirement where run off drains into the same hydrozone without puddling.

**L 411.8 Narrow or Irregularly Shaped Landscape Areas.** Narrow or irregularly shaped landscape areas, less than 4 feet (1219 mm) in any direction across opposing boundaries, shall not be irrigated by an irrigation emission device except low flow emitters with flow rates not to exceed 6.3 gallons (24 L) per hour.

**L 411.9 Sloped Areas.** Where soil surface rises more than 1 foot (305 mm) per 4 feet (1219 mm) of length, the irrigation zone system average precipitation rate shall not exceed 0.75 inches (19.1 mm) per hour as verified through either of the following methods:

1. Manufacturer documentation that the precipitation rate for the installed sprinkler head does not exceed 0.75 inches (19.1 mm) per hour where the sprinkler heads are installed not closer than the specified radius and where the water pressure of the irrigation system is not more than the manufacturer’s recommendations.
2. Catch can test in accordance with the requirements of the Authority Having Jurisdiction and where emitted water volume is measured with a minimum of six catchment containers at random places within the irrigation zone for a minimum of 15 minutes to determine the average precipitation rate, expressed as inches per hour (mm/h).

**L 411.9 Irrigation System Inspection and Performance Check.** The irrigation system shall be inspected to verify compliance with the irrigation design in accordance with the following:

1. Inspection and performance check shall be by an independent third party having credentials in accordance with the US EPA WaterSense program or the Authority Having Jurisdiction.
2. Sprinklers shall be installed as specified with proper spacing and required nozzle.
3. Sprinklers shall be activated and visually inspected for covering areas without causing overspray or runoff.
4. Valves shall be installed as specified.
5. Drip irrigation systems shall be inspected to verify the proper valve, pressure regulation, filtering device, location of flush valves, and that the installed emitters comply with the irrigation plan.
6. Control system shall be installed as specified and listed as a US EPA WaterSense labeled controller, and all sensors shall be installed and verified for proper installation and operation.
7. The peak demand irrigation schedule shall be posted near the controller, or the scheduling parameters for the controller shall be listed for each station including cycle and soak times.
8. Record drawings of the irrigation system shall be completed and provided for the irrigation inspection.
9. An inspection report shall be provided to the property owner or management company identifying problems and what corrective actions are required.
L 411.10.1 Sprinkler Heads in Common Irrigation Zones. Sprinkler heads installed in irrigation zones served by a common valve shall be limited to applying water to plants with similar irrigation needs, and shall have matched precipitation rates (identical inches of water application per hour as rated or tested; plus or minus 6.7 percent as labeled or declared in manufacturer's published performance data).

L 411.10.4 Sprinkler Head Maximum Precipitation Rate. Where the slope of the landscape exceeds 25 percent, the precipitation rate of sprinkler heads shall not exceed 1.75 inches per hour when tested to ASABE/ICC 802.

L 411.11 Irrigation Zone Performance Criteria. Irrigation zones shall be designed and installed to ensure the average precipitation rate of the sprinkler heads over the irrigated area does not exceed 1 inch per hour (25.4 mm/h) as verified through either of the following methods:

1. Manufacturer’s documentation that the precipitation rate for the installed sprinkler head does not exceed 1 inch per hour (25.4 mm/h) where the sprinkler heads are installed not closer than the specified radius and where the water pressure of the irrigation system is not more than the manufacturer’s recommendations.
2. Catch can test in accordance with the requirements of the Authority Having Jurisdiction and where emitted water volume is measured with a minimum of six catchment containers at random places within the irrigation zone for a minimum of 15 minutes to determine the average precipitation rate, expressed as inches per hour (mm/h).

L 411.11 Outside Hose Bibbs. Outside hose bibbs shall be allowed on irrigation pipe downstream of the backflow preventer. Hose bibbs supplying water from the irrigation system shall be indicated by posted signs marked with the words: “CAUTION: NONPOTABLE WATER. DO NOT DRINK” and the symbol in Figure 1505.9 of this code.

(renumber remaining sections)

L 411.14 Qualifications. The Authority Having Jurisdiction shall have the authority to require landscape irrigation contractors, installers, or designers to demonstrate competency. Where required by the Authority Having Jurisdiction, the contractor, installer, or designer shall be certified to perform such work.

L 501.2.2 Building Cavities. Building cavities used for hot water supply and return piping shall be large enough to accommodate the combined diameter of the pipe plus the insulation, plus any other objects in the cavity that the piping must cross.

L 502.7 Maximum Volume and Length of Hot Water. The maximum volume of water contained in a hot water branch distribution pipe shall be in accordance with Section L 502.7.1 or Section L 502.7.2. The water volume shall be calculated using Table L 502.7. The maximum length per volume of piping shall comply with Section L 502.7.2.

L 502.7.1 Maximum Volume of Hot Water in a Branch Without Recirculation or Heat Trace. The maximum volume of water contained in hot water distribution pipe between the water heater and any fixture fitting shall not exceed 32 ounces (oz) (946 mL). Where a fixture fitting shutoff valve (supply stop) is installed ahead of the fixture fitting, the maximum volume of water is permitted to be calculated between the water heater and the fitting shutoff valve (supply stop): The water volume per foot of piping shall be calculated using Table L 502.7.1. The maximum volume of water in a fixture branch between any source of hot water (water heaters, recirculation loops and electrically heat traced pipe shall be considered sources of hot water) and the fixture fitting shall be:

1. 24 oz, where a single branch serves a single fixture.
2. 40 oz, where a series branch incorporating one or more flow-through design configurations that serves two or more fixtures.
3. 60 oz, where a ring branch incorporating two or more flow-through design configurations that serves two or more fixtures.

Exceptions:
1. The maximum volume of a single branch or series branch between any source of hot water and a kitchen sink and dishwasher located on an island or a peninsula where the floor is a concrete slab shall not contain more than 40 oz.
2. The maximum volume of a single branch to a standalone tub shall not contain more than 80 oz.

L 502.7.2 Maximum Length Per Volume of Water in a Branch Volume of Hot Water with Recirculation or Heat Trace. The maximum volume of water contained in the branches between the recirculation loop or electrically heat traced pipe, and the fixture fitting shall not exceed 16 oz (473 mL). Where a fixture fitting shutoff valve (supply stop) is installed ahead of the fixture fitting, the maximum volume of water is permitted to be calculated between the recirculation loop or electrically, heat traced pipe and the fixture fitting shutoff valve (supply stop).

Exception: Whirlpool bathtubs or bathtubs that are not equipped with a shower are exempted from the requirements of Section 502.7. For fixture branches in accordance with Section 1003.7.1, the maximum length of piping shall be calculated using Table L 502.7.2(1) through Table L 502.7.2(4). Where a fixture fitting shutoff valve (supply stop) is installed ahead of the fixture fitting, the maximum length is measured between the source of hot water and the fixture fitting shutoff valve (supply stop).
### TABLE L 502.7.1
WATER VOLUME FOR DISTRIBUTION PIPING MATERIALS

<table>
<thead>
<tr>
<th>NOMINAL SIZE (inch)</th>
<th>COPPER TYPE M</th>
<th>COPPER TYPE L</th>
<th>COPPER PIPE TYPE K</th>
<th>CPVC PIPE TYPE L</th>
<th>CPVC PIPE TYPE K</th>
<th>PE-RT PIPE TYPE</th>
<th>PP PIPE TYPE</th>
<th>PP PIPE TYPE</th>
<th>CPVC PIPE TYPE K</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>1.06</td>
<td>0.97</td>
<td>0.84</td>
<td>NA 0.68</td>
<td>1.17</td>
<td>0.5963</td>
<td>0.85 NA</td>
<td>0.64</td>
<td>0.64</td>
</tr>
<tr>
<td>½</td>
<td>1.69</td>
<td>1.55</td>
<td>1.45</td>
<td>1.235 1.89</td>
<td>1.2244 1.464</td>
<td>1.18 1.18</td>
<td>1.3544 1.648</td>
<td>2.12NA 2.33</td>
<td></td>
</tr>
<tr>
<td>¾</td>
<td>3.43</td>
<td>3.22</td>
<td>2.90</td>
<td>2.5267 3.38</td>
<td>3.2839 2.724</td>
<td>2.35 2.1426</td>
<td>2.5462 3.37NA</td>
<td>3.68</td>
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</tr>
<tr>
<td>1</td>
<td>5.81</td>
<td>5.49</td>
<td>5.17</td>
<td>4.2443 5.53</td>
<td>5.3766 4.582</td>
<td>3.8894 4.2236</td>
<td>5.56NA 5.83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

### TABLE L 502.7.2(1)
LENGTH (FT) PER VOLUME OF PIPING

<table>
<thead>
<tr>
<th>NOMINAL SIZE (inch)</th>
<th>24 OZ</th>
<th>40 OZ</th>
<th>60 OZ</th>
<th>24 OZ</th>
<th>40 OZ</th>
<th>60 OZ</th>
<th>24 OZ</th>
<th>40 OZ</th>
<th>60 OZ</th>
<th>24 OZ</th>
<th>40 OZ</th>
<th>60 OZ</th>
<th>24 OZ</th>
<th>40 OZ</th>
<th>60 OZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>22.7</td>
<td>37.8</td>
<td>56.7</td>
<td>24.9</td>
<td>41.4</td>
<td>62.1</td>
<td>28.4</td>
<td>47.4</td>
<td>71.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>14.2</td>
<td>23.7</td>
<td>35.5</td>
<td>15.5</td>
<td>25.8</td>
<td>38.7</td>
<td>16.5</td>
<td>27.6</td>
<td>41.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4</td>
<td>7.0</td>
<td>11.6</td>
<td>17.5</td>
<td>7.5</td>
<td>12.4</td>
<td>18.6</td>
<td>8.3</td>
<td>13.8</td>
<td>20.7</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1</td>
<td>4.1</td>
<td>6.9</td>
<td>10.3</td>
<td>4.4</td>
<td>7.3</td>
<td>10.9</td>
<td>4.6</td>
<td>7.7</td>
<td>11.6</td>
<td></td>
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<td></td>
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<tr>
<td>11/4</td>
<td>2.8</td>
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<td>6.9</td>
<td>2.9</td>
<td>4.8</td>
<td>7.2</td>
<td>3.0</td>
<td>4.9</td>
<td>7.4</td>
<td></td>
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</tr>
<tr>
<td>11/2</td>
<td>2.0</td>
<td>3.3</td>
<td>4.9</td>
<td>2.0</td>
<td>3.4</td>
<td>5.1</td>
<td>2.1</td>
<td>3.5</td>
<td>5.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1.1</td>
<td>1.9</td>
<td>2.8</td>
<td>1.2</td>
<td>1.9</td>
<td>2.9</td>
<td>1.2</td>
<td>2.0</td>
<td>3.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

### TABLE L 502.7.2 (2)
LENGTH (FT) PER VOLUME OF PIPING

<table>
<thead>
<tr>
<th>NOMINAL SIZE (inch)</th>
<th>CPVC CTS SDR 11</th>
<th>CPVC SCH 40 PIPE</th>
<th>CPVC SCH 80 PIPE</th>
<th>CPVC SDR 11 PIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>35.5</td>
<td>59.1</td>
<td>88.6</td>
<td>20.5</td>
</tr>
<tr>
<td>1/2</td>
<td>19.5</td>
<td>32.6</td>
<td>48.8</td>
<td>12.7</td>
</tr>
<tr>
<td>3/4</td>
<td>9.5</td>
<td>15.9</td>
<td>23.8</td>
<td>7.1</td>
</tr>
<tr>
<td>1</td>
<td>5.7</td>
<td>9.4</td>
<td>14.2</td>
<td>4.3</td>
</tr>
<tr>
<td>11/4</td>
<td>3.8</td>
<td>6.3</td>
<td>9.4</td>
<td>2.5</td>
</tr>
<tr>
<td>11/2</td>
<td>2.7</td>
<td>4.5</td>
<td>6.7</td>
<td>1.8</td>
</tr>
<tr>
<td>2</td>
<td>1.6</td>
<td>2.6</td>
<td>3.9</td>
<td>1.1</td>
</tr>
</tbody>
</table>

For SI units: 1 foot = 304.8 mm, 1 ounce = 29.573 mL
**TABLE L 502.7.2 (3)**
LENGTH (FT) PER VOLUME OF PIPING

<table>
<thead>
<tr>
<th>NOMINAL SIZE, inches (DN)*</th>
<th>PEX &amp; PE-RT CTS SDR 9</th>
<th>PEX-AL-PEX (DN)</th>
<th>PE-AL-PE (DN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 OZ</td>
<td>40 OZ</td>
<td>60 OZ</td>
</tr>
<tr>
<td>3/8(12)</td>
<td>37.5</td>
<td>62.5</td>
<td>93.8</td>
</tr>
<tr>
<td>1/2(16)</td>
<td>20.4</td>
<td>33.9</td>
<td>50.9</td>
</tr>
<tr>
<td>3/4(25)</td>
<td>10.2</td>
<td>17.0</td>
<td>25.5</td>
</tr>
<tr>
<td>1(32)</td>
<td>6.2</td>
<td>10.3</td>
<td>15.5</td>
</tr>
<tr>
<td>11/4(40)</td>
<td>4.1</td>
<td>6.9</td>
<td>10.3</td>
</tr>
<tr>
<td>11/2(50)</td>
<td>3.0</td>
<td>4.9</td>
<td>7.4</td>
</tr>
<tr>
<td>2(63)</td>
<td>1.7</td>
<td>2.9</td>
<td>4.3</td>
</tr>
</tbody>
</table>

For SI units: 1 foot = 304.8 mm, 1 ounce = 29.573 mL
* DN is outside diameter

**TABLE L 502.7.2 (4)**
LENGTH (FT) PER VOLUME OF PIPING

<table>
<thead>
<tr>
<th>NOMINAL SIZE, Inches (DN)</th>
<th>PP SDR 6 (DN)</th>
<th>PP SDR 7.3 (DN)</th>
<th>PP SDR 11 (DN)1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 OZ</td>
<td>40 OZ</td>
<td>60 OZ</td>
</tr>
<tr>
<td>3/8(16)</td>
<td>28.2</td>
<td>46.9</td>
<td>70.4</td>
</tr>
<tr>
<td>1/2(20)</td>
<td>17.7</td>
<td>29.6</td>
<td>44.3</td>
</tr>
<tr>
<td>3/4(25)</td>
<td>11.2</td>
<td>18.7</td>
<td>28.0</td>
</tr>
<tr>
<td>1(32)</td>
<td>6.9</td>
<td>11.6</td>
<td>17.3</td>
</tr>
<tr>
<td>11/4(40)</td>
<td>4.4</td>
<td>7.3</td>
<td>11.0</td>
</tr>
<tr>
<td>11/2(50)</td>
<td>2.8</td>
<td>4.6</td>
<td>6.9</td>
</tr>
<tr>
<td>2(63)</td>
<td>1.8</td>
<td>2.9</td>
<td>4.4</td>
</tr>
</tbody>
</table>

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

Notes:
1. PP SDR 11 products are not typically used or rated at 180°F
2. DN is outside diameter

**L 503.3.3 Insulation.** Insulation of hot water and return piping shall meet the provisions in Section L 501.2. The following piping shall be insulated in accordance with Table L 503.3.3:

1. Recirculating system piping, including the supply and return piping of a circulating tank-type water heater.
2. The first 8 feet (2438 mm) of outlet piping for a constant temperature nonrecirculating storage system.
3. The first 8 feet (2438 mm) of branch piping connecting to recirculated, heat-traced, or impedance-heated piping.
4. The inlet piping between the storage tank and a heat trap in a nonrecirculating storage system.
5. Piping that is externally heated (such as heat trace or impedance heating). [ASHRAE 90.1:7.4.3]

**TABLE L 503.3.3**
MINIMUM PIPING INSULATION THICKNESS FOR HEATING AND HOT-WATER SYSTEMS (STEAM, STEAM CONDENSATE, HOT-WATER HEATING, AND DOMESTIC WATER SYSTEMS) [ASHRAE 90.1: TABLE 6.8.3-1]

<table>
<thead>
<tr>
<th>FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)</th>
<th>INSULATION CONDUCTIVITY</th>
<th>MEAN-RATING TEMPERATURE (°F)</th>
<th>NOMINAL PIPE SIZE OR TUBE SIZE (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONDUCTIVITY Btu•inches/(h•ft²•°F)</td>
<td></td>
<td></td>
<td>&lt;4</td>
</tr>
<tr>
<td>&gt;350</td>
<td>0.32 to 0.34</td>
<td>260</td>
<td>4.5</td>
</tr>
<tr>
<td>261 to 350</td>
<td>0.29 to 0.32</td>
<td>290</td>
<td>3.0</td>
</tr>
<tr>
<td>201 to 260</td>
<td>0.27 to 0.30</td>
<td>450</td>
<td>2.5</td>
</tr>
<tr>
<td>141 to 200</td>
<td>0.25 to 0.29</td>
<td>125</td>
<td>1.5</td>
</tr>
<tr>
<td>105 to 140</td>
<td>0.22 to 0.28</td>
<td>100</td>
<td>1.0</td>
</tr>
</tbody>
</table>

INSULATION THICKNESS (inches)

- 5.0
- 4.5
- 4.0
- 3.5
- 3.0
- 2.5
- 2.0
- 1.5
- 1.0
For SI units: °C = (°F - 32) / 1.8, 1 British thermal unit per hour square foot degree Fahrenheit = [0.1 W/(m•K)], 1 inch = 25 mm

Notes:
1 For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:
   \[ T = r \left( \frac{1 + t}{r/k} \right) K - 1 \]
   Where:
   \[ T = \text{minimum insulation thickness (inches)} \]
   \[ r = \text{actual outside radius of pipe (inches)} \]
   \[ t = \text{insulation thickness listed in this table for applicable fluid temperature and pipe size} \]
   \[ K = \text{conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature} \]
   \[ k = \text{the upper value of the conductivity range listed in this table for the applicable fluid temperature} \]
2 These thicknesses are based on energy efficiency considerations only. Additional insulation is sometimes required relative to safety issues or surface temperature.
3 For piping 11/2 inches (40 mm) or less, and located in partitions within conditioned spaces, reduction of insulation thickness by 1 inch (25.4 mm) shall be permitted before thickness adjustment required in Footnote 1, but not a thickness less than 1 inch (25.4 mm).
4 For direct-buried heating and hot water system piping, reduction of insulation thickness by 11/2 inch (38 mm) shall be permitted before thickness adjustment required in Footnote 1, but not a thickness less than 1 inch (25.4 mm).
5 Table L 503.3.3 is based on steel pipe. Non-metallic pipes, Schedule 80 thickness or less shall use the table values. For other non-metallic pipes having a thermal resistance more than that of steel pipe, reduced insulation thicknesses shall be permitted where documentation is provided showing that the pipe with the proposed insulation has no more heat transfer per foot (mm) than a steel pipe of the same size with the insulation thickness shown in Table L 503.3.3.

L 503.3.6 Swimming Pools, Spas, and Hot Tubs. Pool, spa, and hot tub heating systems shall comply with Section L 503.3.6(1) through Section L 503.3.6(5).

(1) Pool, spa, and hot tub heaters shall be equipped with a readily accessible ON/OFF on and off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas shall not have continuously burning pilot lights. [ASHRAE 90.1:7.4.5.1]
(2) Heated pools and inground permanently installed spas, and portable spas, shall be provided with a non-liquid vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12.

Exception: Pools that are deriving over Where more than 60 70 percent of the energy for heating, computed over an operating season, is from site-recovered energy such as from a heat pump or solar energy. [ASHRAE 90.1:7.4.4.2]
(3) Portable spa covers shall meet the requirements of ASPE-14.
(4) (remaining text unchanged)
(5) Pool pumps and replacement pool pump motors shall meet requirements of ASPE-15.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASABE/ICC 802-2014</td>
<td>Landscape Irrigation Sprinkler and Emitter Standard</td>
<td>Irrigation</td>
</tr>
<tr>
<td>Energy Star-2007</td>
<td>Program Requirements for Commercial Ice Machines</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>EPA WaterSense-2017</td>
<td>Specifications for Weather-Based Irrigation Controllers</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>WQA/ASPE/ANSI S-803-2017</td>
<td>Sustainable Drinking Water Treatment Systems</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(substantiation: The proposed changes to Appendix L are updates correlate with the latest edition of the WeStand.

Committee action: REJECT

Committee statement: There was insufficient technical justification to warrant such change. Section L 402.6.2 is overly stringent by requiring zero leakage. Section L 402.6.3.1 is overly restrictive regarding the marking on the control valves, to be visible after installation. The markings should be left to the applicable standards. In Table L 407.1, the area of 100 square feet for swimming pools is overly restrictive and should be larger.)
TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 22  NEGATIVE: 3  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: The proposed change would harmonize the code with WE-Stand.

GORSUCH: Agree with Charles White.

WHITE: This is updating Appendix L in alignment with the latest WE-Stand work, as appendices are generally not adopted as mandatory code, jurisdictions could decide to use all or part of the appendix as guidance.
Proposals

Item #: 289

UPC 2024  Section: L 201.0, L 503.2 - L 503.4.5, Table 1701.2

SUBMITTER: IAPMO Staff - Update Extracts  ASHRAE 90.1 Extract Update

RECOMMENDATION:
Revise text

L 201.0 Definitions.
On-Site Renewable Energy. Energy from renewable energy resources harvested at the building site. [ASHRAE 90.1:3.2]

Renewable Energy Resources. Energy from solar, wind, biomass or hydro, or extracted from hot fluid or steam heated within the earth. [ASHRAE 90.1:3.2]

L 503.2 Compliance Paths. Service water heating systems and equipment shall comply with Section L 503.2.1 and Section L 503.2.2.

L 503.2.1 Requirements for All Compliance Path(s). Compliance shall be achieved in accordance with the requirements of Service water heating systems and equipment shall comply with Section L 503.1, Section L 503.3, Section L 503.4, and Section L 503.5. [ASHRAE 90.1:7.2.1]

L 503.2.2 Additional Requirements for Service Water Heating. Service water heating systems and equipment shall comply with Section L 503.4.1 through Section L 503.4.3. [ASHRAE 90.1:7.2.2]

L 503.2.1 Energy Cost Budget Method. Projects using the energy cost budget method of ASHRAE 90.1 for demonstrating compliance with the standard shall be in accordance with the requirements of Section L 503.3 in conjunction with the energy cost budget method of ASHRAE 90.1.

L 503.3.1 Load Calculations. Service water-heating system design loads for the purpose of sizing systems and equipment shall be determined in accordance with manufacturer’s published sizing guidelines or generally accepted engineering standards and handbooks acceptable to the adopting authority (e.g., ASHRAE Handbook – HVAC Applications). [ASHRAE 90.1:7.4.1]

L 503.3.6 Pools. Pool heating systems shall comply with Section L 503.3.6(1) through Section L 503.3.6(3). (1) Pool heaters shall be equipped with a readily accessible ON/OFF switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas shall not have continuously burning pilot lights. [ASHRAE 90.1:7.4.5.1] (2) Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12. Exception: Pools that are deriving over 60 percent of the energy for heating from site-recovered energy or solar energy on-site renewable energy. [ASHRAE 90.1:7.4.5.2] (3) Time switches shall be installed on swimming pool heaters and pumps. Exceptions: (1) Where public health standards require 24-hour pump operation. (2) Where pumps are required to operate solar and waste heat recovery pool heating systems. [ASHRAE 90.1:7.4.5.3]

L 503.4.2 Service Water Heating Equipment. Service water-heating equipment used to provide the additional function of space heating as part of a combination (integrated) system shall satisfy all stated requirements for the service water-
L 503.4.3 Buildings with High-Capacity Service Water-Heating Systems. New buildings with gas service heating systems with a total installed gas water-heating input capacity of 1 000 000 Btu/h (293 kW) or more, shall have gas service water-heating equipment with a thermal efficiency \( E_t \) of not less than 90 percent. Multiple units of gas water-heating equipment shall be permitted to comply with this requirement where the water-heating input provided by the equipment, with thermal efficiency \( E_t \) of more or less than above and below 90 percent, provides an input capacity-weighted average thermal efficiency of not less than 90 percent.

Exceptions:
(1) Where 25 percent of the annual service water-heating requirement is provided by site-solar on-site renewable energy or site-recovered energy.
(2) Water heaters installed in individual dwelling units.
(3) Individual gas water heaters with input capacity, not more than 100 000 Btu/h (29.3 kW). [ASHRAE 90.1:7.5.3]

L 503.4.4 Heat Recovery for Service Water Heating. Condenser heat recovery systems shall be installed for heating or preheating of service hot water provided all of the following are true:
(1) The facility operates 24 hours a day.
(2) The total installed heat rejection capacity of the water-cooled systems exceeds 6 000 000 Btu/h (1758 kW) of heat rejection.
(3) The design service water-heating load exceeds 1 000 000 Btu/h (293 kW). [ASHRAE 90.1:6.5.6.2.1]

L 503.4.5 Capacity. The required heat recovery system shall have the capacity to provide the smaller of:
(1) Sixty percent of the peak heat-rejection load at design conditions.
(2) Preheat of the peak service hot-water draw to 85°F (29°C).

Exceptions:
(1) Facilities that employ condenser heat recovery for space heating with a heat recovery design exceeding 30 percent of the peak water-cooled condenser load at design conditions.
(2) Facilities that provide 60 percent of their service water heating from site-solar or site-recovered energy or other sources on-site renewable energy. [ASHRAE 90.1:6.5.6.2.2]

### TABLE L 503.3.2
**PERFORMANCE REQUIREMENTS FOR WATER-HEATING EQUIPMENT MINIMUM EFFICIENCY REQUIREMENTS**  
[ASHRAE 90.1: TABLE 7.8]

<table>
<thead>
<tr>
<th>EQUIPMENT TYPE</th>
<th>SIZE CATEGORY (INPUT)</th>
<th>SUBCATEGORY OR RATING CONDITION</th>
<th>PERFORMANCE REQUIRED</th>
<th>TEST PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric table-top water heaters</td>
<td>( \leq 12 \text{ kW} )</td>
<td>Resistance ( \leq 4000 \text{ (Btu/h)/gal} ), ( \geq 20 \text{ gal} ) and ( \leq 120 \text{ gal} )</td>
<td>See footnote 7. For applications outside U.S., see footnote (h). For U.S. applications, see footnote (7).</td>
<td>—</td>
</tr>
<tr>
<td>Electric water heaters</td>
<td>( \leq 12 \text{ kW} )</td>
<td>Resistance ( \geq 20 \text{ gal} )</td>
<td>See footnote 7.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>( &gt; 12 \text{ kW} )</td>
<td>Resistance ( \geq 20 \text{ gal} )</td>
<td>( 0.3 + 27V_m % / h )</td>
<td>Section G.2 of CSA Z21.10.3</td>
</tr>
<tr>
<td></td>
<td>( \leq 24 \text{ Amps and} \leq 250 \text{ Volts} )</td>
<td>Heat Pump</td>
<td>See footnote 7.</td>
<td>—</td>
</tr>
<tr>
<td>Electric storage water heaters</td>
<td>( \leq 12 \text{ kW} )</td>
<td>( \leq 4000 \text{ (Btu/h)/gal} ), ( \geq 20 \text{ gal} ) and ( \leq 55 \text{ gal} )</td>
<td>For applications outside U.S., see footnote (8). For U.S. applications, see footnote (7).</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td></td>
<td>( \leq 58.6 \text{ kW} )</td>
<td>( \leq 4000 \text{ (Btu/h)/gal} ), ( &gt; 55 \text{ gal} ) and ( \leq 120 \text{ gal} )</td>
<td>For applications outside U.S., see footnote (8). For U.S. applications, see footnote (7).</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td>Electric instantaneous water heaters</td>
<td>( \leq 12 \text{ kW} )</td>
<td>( \leq 4000 \text{ (Btu/h)/gal} ), ( &lt; 2 \text{ gal} )</td>
<td>For applications outside U.S., see footnote (8). For US applications, see footnote (7).</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td></td>
<td>( &gt; 12 \text{ kW and} \leq 58.6 \text{ kW} )</td>
<td>( \leq 4000 \text{ (Btu/h)/gal} ), ( &lt; 2 \text{ gal} ) and ( \leq 180^\circ \text{F} )</td>
<td>Very Small DP: UEF = 0.80 Low DP: UEF = 0.80</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
</tbody>
</table>

[507]
<table>
<thead>
<tr>
<th>Gas storage water heaters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=58.6 kW³</td>
<td>Medium DP: UEF = 0.80</td>
</tr>
<tr>
<td></td>
<td>High DP: UEF = 0.80</td>
</tr>
<tr>
<td></td>
<td>No requirement</td>
</tr>
<tr>
<td>&gt;=4000 (Btu/h)/gal &lt;10 gal</td>
<td>No requirement</td>
</tr>
<tr>
<td>&gt;=4000 (Btu/h)/gal &gt;=10 gal</td>
<td>No requirement</td>
</tr>
<tr>
<td>&lt;=75 000 Btu/h</td>
<td>See footnote 7</td>
</tr>
<tr>
<td></td>
<td>For applications outside</td>
</tr>
<tr>
<td></td>
<td>U.S., see footnote (8),</td>
</tr>
<tr>
<td></td>
<td>For U.S. applications,</td>
</tr>
<tr>
<td></td>
<td>see footnote (7).</td>
</tr>
<tr>
<td>&gt;75 000 Btu/h and &lt;=105 000 Btu/h</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td>&lt;=120 gal and &lt;180°F</td>
<td>Very Small DP: UEF = 0.2674 – (0.0009 × Vᵢ)</td>
</tr>
<tr>
<td></td>
<td>Low DP: UEF = 0.5362 – (0.0012 × Vᵢ)</td>
</tr>
<tr>
<td></td>
<td>Medium DP: UEF = 0.6002 – (0.0011 × Vᵢ)</td>
</tr>
<tr>
<td></td>
<td>High DP: UEF = 0.6597 – (0.0009 × Vᵢ)</td>
</tr>
<tr>
<td>&gt;75 000-105 000 Btu/h</td>
<td>80% Et SL &lt;= (Q/800 +110v V)</td>
</tr>
<tr>
<td></td>
<td>Sections G.1 and G.2 of CSA Z21.10.3</td>
</tr>
<tr>
<td></td>
<td>10 CFR 431.106</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gas instantaneous water heaters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=20 gal and &lt;=55 gal</td>
<td>See footnote 7</td>
</tr>
<tr>
<td>&gt;=4000 (Btu/h)/gal</td>
<td>For applications outside</td>
</tr>
<tr>
<td>and &lt;=2 gal</td>
<td>U.S., see footnote (8),</td>
</tr>
<tr>
<td>and &lt;=55 gal and &lt;=100 gal</td>
<td>For U.S. applications,</td>
</tr>
<tr>
<td>and &lt;=100 gal</td>
<td>see footnote (7).</td>
</tr>
<tr>
<td>&gt;200 000 Btu/h and &lt;=55 gal</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td>and &lt;=2 gal</td>
<td>80% Et (Q/799 ±16.6vV) SL, Btu/h</td>
</tr>
<tr>
<td>and &gt;=20 gal</td>
<td>Sections G.1 and G.2 of CSA Z21.10.3</td>
</tr>
<tr>
<td>and &gt;=10 gal</td>
<td>10 CFR 431.106</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oil storage water heaters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=105 000 Btu/h</td>
<td>Medium DP: UEF = 0.08</td>
</tr>
<tr>
<td></td>
<td>Low DP: UEF = 0.2674 – (0.0009 × Vᵢ)</td>
</tr>
<tr>
<td></td>
<td>Medium DP: UEF = 0.5362 – (0.0012 × Vᵢ)</td>
</tr>
<tr>
<td></td>
<td>High DP: UEF = 0.6002 – (0.0011 × Vᵢ)</td>
</tr>
<tr>
<td></td>
<td>High DP: UEF = 0.6597 – (0.0009 × Vᵢ)</td>
</tr>
<tr>
<td>&gt;105 000-140 000 Btu/h</td>
<td>80% Et SL &lt;= (Q/800 +110v V)</td>
</tr>
<tr>
<td>and &lt;=140 000 Btu/h</td>
<td>Sections G.1 and G.2 of CSA Z21.10.3</td>
</tr>
<tr>
<td>and &lt;=180°F</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td>&gt;140 000 Btu/h</td>
<td>80% Et SL &lt;= (Q/800 +110v V)</td>
</tr>
<tr>
<td>&gt;140 000-210 000 Btu/h</td>
<td>Sections G.1 and G.2 of CSA Z21.10.3</td>
</tr>
<tr>
<td></td>
<td>10 CFR 431.106</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oil instantaneous water heaters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=210 000 Btu/h</td>
<td>Medium DP: UEF = 0.08</td>
</tr>
<tr>
<td>&gt;=4000 (Btu/h)/gal and &lt;=2 gal</td>
<td>80% Et EF &gt;= 0.59 – 0.0005 × V</td>
</tr>
<tr>
<td></td>
<td>See footnote 7</td>
</tr>
<tr>
<td></td>
<td>For applications outside</td>
</tr>
<tr>
<td></td>
<td>U.S., see footnote (8),</td>
</tr>
<tr>
<td></td>
<td>For U.S. applications,</td>
</tr>
<tr>
<td></td>
<td>see footnote (7).</td>
</tr>
<tr>
<td></td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td></td>
<td>as it appeared as of 1/1/2014</td>
</tr>
<tr>
<td>Capacity</td>
<td>Minimum Efficiency</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>&gt;210,000 Btu/h</td>
<td>&gt;=4000 (Btu/h)/gal and &lt;=10 gal</td>
</tr>
<tr>
<td>&gt;210,000 Btu/h</td>
<td>&gt;=4000 (Btu/h)/gal and &gt;=10 gal</td>
</tr>
<tr>
<td>&gt;=300,000 Btu/h and &lt;125,000 Btu/h</td>
<td>&gt;=4000 (Btu/h)/gal and &lt;=10 gal</td>
</tr>
<tr>
<td>&gt;=300,000 Btu/h and &gt;=125,000 Btu/h</td>
<td>&gt;=4000 (Btu/h)/gal and &gt;=10 gal</td>
</tr>
<tr>
<td>All</td>
<td>—</td>
</tr>
</tbody>
</table>

### Notes:

1. Thermal efficiency (Et) is a minimum requirement, while standby loss (SL) is a maximum Btu/h (kW) based on a 70°F (21°C) temperature difference between stored water and ambient requirements. In the SL equation, V is the rated volume in gallons and Q is the nameplate input rate in Btu/h (kW). \( V_m \) is the measured volume in the tank in gallons. Standby loss for electric water heaters is in terms of %/h and denoted by the term “S,” and standby loss for gas and oil water heaters is in terms of Btu/h and denoted by the term “SL.” Draw pattern (DP) refers to the water draw profile in the Uniform Energy Factor (UEF) test. UEF and Energy Factor (EF) are minimum requirements. In the UEF standard equations, \( V_r \) refers to the rated volume in gallons.

2. ASHRAE 90.1 contains a complete specification, including the year version, of the referenced test procedure.


4. Electric instantaneous water heaters with input rates below capacity > 40,946 Btu/h (12 kW) and <= 200,000 Btu/h (58.6 kW) shall be in accordance with the requirements where for the 200,000 Btu/h (58.6 kW) if the water heater either:
   - (a) has a storage volume >2 gallons (7.6 L);
   - (b) is designed to provide outlet hot water at temperatures greater than 180°F (82°C); or
   - (c) uses three-phase power.

5. Electric water heaters with input rates less than 40,946 Btu/h (12 kW) shall be in accordance with these requirements where the water heater is designed to heat water to temperatures of 180°F (82°C) or higher.

4. Gas storage water heaters with input capacity >75,000 Btu/h (22 kW) and <=105,000 Btu/h (30.8 kW) must comply with the requirements for the >105,000 Btu/h (30.8 kW) if the water heater either:
   - (a) has a storage volume >120 gallons (454 L);
   - (b) is designed to provide outlet hot water at temperatures greater than 180°F (82°C); or
   - (c) uses three-phase power.

5. Oil storage water heaters with input capacity >105,000 Btu/h (30.8 kW) and <=140,000 Btu/h (41.0 kW) must comply with the requirements for the >140,000 Btu/h (41.0 kW) if the water heater either:
   - (a) has a storage volume >120 gallons (454 L);
   - (b) is designed to provide outlet hot water at temperatures greater than 180°F (82°C); or
   - (c) uses three-phase power.

6. Refer to Section L 503.4.3 for additional requirements for gas storage and instantaneous water heaters and
gas hot-water supply boilers.

7. In the U.S., the efficiency requirements for water heaters or gas pool heaters in this category or subcategory are specified by the U.S. Department of Energy. Those requirements and applicable test procedures are found in the Code of Federal Regulations 10 CFR Part 430.

8. Water heaters or gas pool heaters in this category or subcategory are regulated as consumer products by the USDOE as defined in 10 CFR 430.

8. Where this standard is being applied to a building outside the U.S. and Canada and water heaters in this subcategory are being installed in that building, those water heaters shall meet the local efficiency requirements. If there are no local efficiency standards for residential water heaters, consideration should be given to using the USDOE efficiency requirements shown in Appendix F, Table F-2 of ASHRAE 90.1.

### TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 CFR 430</td>
<td>Energy Conservation Program for Consumer Products</td>
<td>Energy Conservation</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

**SUBSTANTIATION:**
The above sections have been revised to correlate with ASHRAE 90.1-2019 [ASHRAE 90.1-2019 - Addenda ck, cp] (latest version) in accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines).

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 290

UPC 2024  Section: L 201.0

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Revise text

L 201.0 Definitions.

Water Factor (WF). A measurement and rating of appliance water efficiency, most often used for residential and light commercial clothes washers, as follows:

Water Factor (WF), Clothes Washer. The quantity of water in gallons used to complete a full wash and rinse cycle per measured cubic foot capacity of the clothes washer container.

Integrated Water Factor (IWF). The quotient of the total weighted per-cycle water consumption for all wash cycles in gallons divided by the cubic foot (or liter) capacity of the clothes washer.

SUBSTANTIATION:
Replace definitions of Water Factor (WF) and Water Factor, Clothes Washer. These terms have been superseded and are out of date. Suggest including definition for Integrated Water Factor, as defined by ENERGY STAR.


COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

L 201.0 Definitions.

Integrated Water Factor (IWF). The quotient of the total weighted per-cycle water consumption for all wash cycles in gallons divided by the cubic foot (or liter) capacity of the clothes washer.

COMMITTEE STATEMENT:
The modification removes the new proposed definition as the term "Integrated Water Factor (IWF)" is not used in Appendix L.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 291

UPC 2024  Section: Table L 402.1

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>TABLE L 402.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAXIMUM FIXTURE AND FIXTURE FITTINGS FLOW RATES</td>
</tr>
<tr>
<td>FIXTURE TYPE</td>
</tr>
<tr>
<td>Showerheads</td>
</tr>
<tr>
<td>Kitchen faucets residential⁴</td>
</tr>
<tr>
<td>Lavatory faucets residential</td>
</tr>
<tr>
<td>Lavatory faucets other than residential</td>
</tr>
<tr>
<td>Metering faucets</td>
</tr>
<tr>
<td>Metering faucets for wash fountains</td>
</tr>
<tr>
<td>Wash fountains</td>
</tr>
<tr>
<td>Water Closets</td>
</tr>
<tr>
<td>Urinals</td>
</tr>
<tr>
<td>Commercial Pre-Rinse Spray Valves</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 inch = 25.4 mm, 1 gallon = 3.785 L

Notes:
¹ For multiple showerheads serving one shower compartment see Section L 402.6.1.
² Shall be listed to EPA WaterSense Tank-Type Toilet Specification.
³ Shall be listed to EPA WaterSense Flushing Urinal Specification. Non-water urinals shall comply with specifications listed in Section L 402.3.1.
⁴ See Section L 402.4.

SUBSTANTIATION:
Commercial pre-rinse spray valves are no longer regulated at clear flow rate maximum, and instead are regulated based on spray force. See later comment on Section L 402.8.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25    NOT RETURNED: 1    Daniels
Proposals

Item #: 292
UPC 2024  Section: Table L 402.1, Table 1701.2

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Revise text

TABLE L 402.1
MAXIMUM FIXTURE AND FIXTURE FITTINGS FLOW RATES

<table>
<thead>
<tr>
<th>FIXTURE TYPE</th>
<th>FLOW RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Showerheads</td>
<td>2.0 gpm at 80 psi¹</td>
</tr>
<tr>
<td>Kitchen faucets residential⁴</td>
<td>1.8 gpm at 60 psi</td>
</tr>
<tr>
<td>Lavatory faucets residential</td>
<td>1.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Lavatory faucets other than residential</td>
<td>0.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Metering faucets</td>
<td>0.25 gallons/cycle</td>
</tr>
<tr>
<td>Metering faucets for wash fountains</td>
<td>One 0.25 gallons/cycle fixture fitting for each 20 inches rim space</td>
</tr>
<tr>
<td>Wash fountains</td>
<td>One 2.2 gpm at 60 psi fixture fitting for each 20 inches rim space</td>
</tr>
<tr>
<td>Water Closets</td>
<td>1.28 gallons/flush²</td>
</tr>
<tr>
<td>Urinals</td>
<td>0.5 gallons/flush³</td>
</tr>
<tr>
<td>Commercial Pre-Rinse Spray Valves</td>
<td>1.3 gpm at 60</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 inch = 25.4 mm, 1 gallon = 3.785 L

Notes:
1. Shall be listed to EPA WaterSense Specification for Showerheads. For multiple showerheads serving one shower compartment see Section L 402.6.1.
2. Shall be listed to EPA WaterSense Tank-Type Toilet Specification.
3. Shall be listed to EPA WaterSense Flushing Urinal Specification. Non-water urinals shall comply with specifications listed in Section L 402.3.1.
4. See Section L 402.4.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA WaterSense-2018</td>
<td>Specification for Showerheads</td>
<td>Fixtures</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
Revised note is consistent with other references to WaterSense specifications within Table L402.1 notes.
COMMITTEE ACTION: ACCEPT AS SUBMITTED
TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 293
UPC 2024 Section: Table L 402.1, Table 1701.2

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Revise text

### TABLE L 402.1
MAXIMUM FIXTURE AND FIXTURE FITTINGS FLOW RATES

<table>
<thead>
<tr>
<th>FIXTURE TYPE</th>
<th>FLOW RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Showerheads</td>
<td>2.0 gpm at 80 psi[1]</td>
</tr>
<tr>
<td>Kitchen faucets residential[4]</td>
<td>1.8 gpm at 60 psi</td>
</tr>
<tr>
<td>Lavatory faucets residential</td>
<td>1.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Lavatory faucets other than residential</td>
<td>0.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Metering faucets</td>
<td>0.25 gallons/cycle</td>
</tr>
<tr>
<td>Metering faucets for wash fountains</td>
<td>One 0.25 gallons/cycle fixture</td>
</tr>
<tr>
<td></td>
<td>fitting for each 20 inches rim space</td>
</tr>
<tr>
<td>Wash fountains</td>
<td>One 2.2 gpm at 60 psi fixture</td>
</tr>
<tr>
<td></td>
<td>fitting for each 20 inches rim space</td>
</tr>
<tr>
<td>Water Closets</td>
<td>1.28 gallons/flush [2]</td>
</tr>
<tr>
<td>Urinals</td>
<td>0.5 gallons/flush[3]</td>
</tr>
<tr>
<td>Commercial Pre-Rinse Spray Valves</td>
<td>1.3 gpm at 60</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 inch = 25.4 mm, 1 gallon = 3.785 L

Notes:
1 For multiple showerheads serving one shower compartment see Section L 402.6.1.
2 Shall be listed to EPA WaterSense Specification for Tank-Type Toilet or Specification for Flushometer-Valve Water Closets.
3 Shall be listed to EPA WaterSense Flushing Urinal Specification. Non-water urinals shall comply with specifications listed in Section L 402.3.1.
4 See Section L 402.4.

### TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA WaterSense-2015</td>
<td>Specification for Flushometer-Valve Water Closets</td>
<td>Fixtures</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
EPA WaterSense has developed separate specifications that differentiate between tank-type toilets (i.e., gravity, pressure assist, or electro-hydraulic tank-type water closets) and flushometer-valve water closets. Both specifications are currently referenced in Section L402.2, so notes should be consistent.
COMMITTEE ACTION: ACCEPT AS SUBMITTED
TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 294

UPC 2024  Section: Table L 402.1

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Revise text

### TABLE L 402.1
MAXIMUM FIXTURE AND FIXTURE FITTINGS FLOW RATES

<table>
<thead>
<tr>
<th>FIXTURE TYPE</th>
<th>FLOW RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Showerheads</td>
<td>2.0 gpm at 80 psi</td>
</tr>
<tr>
<td>Kitchen faucets residential</td>
<td>1.8 gpm at 60 psi</td>
</tr>
<tr>
<td>Lavatory faucets residential</td>
<td>1.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Lavatory faucets other than residential</td>
<td>0.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Metering faucets</td>
<td>0.25 gallons/cycle</td>
</tr>
<tr>
<td>Metering faucets for wash fountains</td>
<td>One 0.25 gallons/cycle fixture fitting for each 20 inches rim space</td>
</tr>
<tr>
<td>Wash fountains</td>
<td>One 2.2 gpm at 60 psi fixture fitting for each 20 inches rim space</td>
</tr>
<tr>
<td>Water Closets</td>
<td>1.28 gallons/flush</td>
</tr>
<tr>
<td>Urinals</td>
<td>0.5 gallons/flush</td>
</tr>
<tr>
<td>Commercial Pre-Rinse Spray Valves</td>
<td>1.3 gpm at 60</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 inch = 25.4 mm, 1 gallon = 3.785 L

Notes:
1  For multiple showerheads serving one shower compartment see Section L 402.6.1.
2  Shall be listed to EPA WaterSense Tank-Type Toilet Specification.
3  Shall be listed to EPA WaterSense Flushing Urinal Specification. Non-water urinals shall comply with specifications listed in Section L 402.3.1.
4  See Section L 402.4.
5  Shall be listed to EPA WaterSense High-Efficiency Lavatory Faucet Specification.

SUBSTANTIATION:
Consistent with other references to WaterSense specifications within Table 402.1 notes. WaterSense Specification is already referenced in Section L 402.5.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 295

UPC 2024  Section: L 402.8, Table L 402.8

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Revise text

L 402.0 Water-Conserving Plumbing Fixtures and Fittings.

L 402.8 Commercial Pre-Rinse Spray Valves. The flow rate for a pre-rinse spray valve installed in a commercial kitchen to remove food waste from cookware and dishes before cleaning shall not be more than 1.28 gpm (4.8 L/m) at 60 psi (414 kPa), as specified in Table L 402.8. Where pre-rinse spray valves with maximum flow rates of 1.0 gpm (3.8 L/m) or less are installed, the static pressure shall be not less than 30 psi (207 kPa). Commercial kitchen pre-rinse spray valves shall be equipped with integral automatic shutoff. Pre-rinse spray valves shall be listed to the EPA WaterSense Commercial Pre-rinse Spray Valve Specification.

<table>
<thead>
<tr>
<th>PRODUCT CLASS BY SPRAY FORCE</th>
<th>MAXIMUM FLOW RATE (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Class 1 (&lt;= 5.0 ounces-force)</td>
<td>1.00</td>
</tr>
<tr>
<td>Product Class 2 (&gt; 5.0 ounces-force and &lt;= 8.0 ounces-force)</td>
<td>1.20</td>
</tr>
<tr>
<td>Product Class 3 (&gt; 8.0 ounces-force)</td>
<td>1.28</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 3.785 L/min, 1 ounce-force = 0.0625 pound-force

SUBSTANTIATION:
Effective as of January 2019, the Department of Energy has new maximum flow rate requirements for pre-rinse spray valves depending on the spray force. Suggest revising flow rate requirements within UPC to be consistent.

In response, WaterSense sunset its specification and no longer labels this product category. See https://www.epa.gov/watersense/pre-rinse-spray-valves for more information.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 296
UPC 2024  Section: L 402.8

SUBMITTER:  Tim Collings
self

RECOMMENDATION:
Add new text

L 402.0 Water-Conserving Plumbing Fixtures and Fittings.

L 402.8 Bath and Shower Flow-Reduction Devices. Bath and shower flow-reduction devices shall comply with IAPMO IGC 244.

(renumber remaining sections)

SUBSTANTIATION:
Tub and shower flow-reduction devices are intended for reducing the waste of water and energy by the use of a valve or system of valves that reduces the flow of water to a trickle once a set temperature is reached. This standard covers temperature-actuated flow-reduction devices and systems intended to be installed in tub spouts or immediately upstream of shower heads and specifies requirements for materials, physical characteristics, performance testing, and markings.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 297
UPC 2024  Section: L 404.8

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Revise text

L 404.0 Occupancy Specific Water Efficiency Requirements.

L 404.8 Medical and Laboratory Facilities. Medical and laboratory facilities shall comply with the water efficiency requirements in Section L 404.9 through Section L 404.12.

SUBSTANTIATION:
In later comment, suggest adding new section (L 404.12) to address vacuum systems within medical and laboratory facilities. If accepted, section reference should be updated in Section L 404.8.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The change is not needed as the section does not exist.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 298
UPC 2024  Section: L 404.12

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Add new text

L 404.0 Occupancy Specific Water Efficiency Requirements.

**L 404.12 Vacuum Systems.** Dry vacuum systems that do not use water to form a seal for a vacuum pump or use flowing water to create a vacuum shall be used.

SUBSTANTIATION:
Wet vacuum pumps can be large water users within medical and laboratory settings. Suggest specifying that dry vacuum systems should be used in these facility types, as this is the "sustainable" option (purpose of Appendix L). Dry vacuums are also becoming more and more prevalent.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
This proposal is being rejected as the language is confusing and unclear as to what these vacuum systems are.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
L 409.0 Water-Powered Sump Pumps.

L 409.1 General. Sump pumps powered by potable or reclaimed (recycled) water pressure shall be used as an emergency backup pump and shall comply with IAPMO PS 119. The water-powered pump shall be equipped with a battery powered alarm having a minimum rating of 85 dBA at 10 feet (3048 mm). Water-powered pumps shall have a water efficiency factor of pumping at least 1.4 gallons (5.3 L) of water to a height of 10 feet (3048 mm) for every gallon of water used to operate the pump, measured at a water pressure of 60 psi (414 kPa). Pumps shall be labeled as to the gallons of water pumped per gallon of potable water consumed.

Water-powered stormwater sump pumps shall be equipped with a reduced pressure principle backflow prevention assembly.

SUBSTANTIATION:
Water powered emergency backup sump pumps are commonly used in the industry. This standard covers water-powered sump pumps intended to provide emergency or backup groundwater or storm water removal from buildings in the event of power failure and specifies requirements for materials, physical characteristics, performance testing, and markings. Once water rises past the normal high-water level in your pit, the water powered pump’s float lifts, causing it to take over the pumping duties and prevent water from overflowing out of your sump pit. The addition of the standard is required to ensure that these emergency pumps meet the minimum safety and performance requirements.
Proposals

Item #: 300
UPC 2024  Section: L 410.3, Table 1701.2

SUBMITTER: Jason M Shank
ASSE International

RECOMMENDATION:
Revise text

L 410.0 Water Softeners and Treatment Devices.

L 410.3 Point-of-Use Reverse Osmosis Water Treatment Systems. Reverse osmosis water treatment systems installed in residential occupancies shall be equipped with automatic shutoff valves to prevent discharge when there is no call for producing treated water. Reverse osmosis water treatment systems shall be listed in accordance with NSF 58 and ASSE 1086.

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSE 1086-2020</td>
<td>Reverse Osmosis Water Efficiency – Drinking Water</td>
<td>Appliances</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
This standard covers water efficiency, automatic shut-off valves, and flow restrictor requirements for Residential RO systems and performance testing to address the membrane life concerns of high efficiency RO membranes. This standard includes test requirements for complete systems or components (RO membrane, automatic shut off valve, flow restrictor).

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 301

UPC 2024  Section: L 411.4, Table 1701.2

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Revise text

L 411.0 Landscape Irrigation Systems.

L 411.4 Irrigation Control Systems. Where installed as part of a landscape irrigation system, irrigation control systems shall:
(1) Automatically adjust the irrigation schedule to respond to plant water needs determined by weather or soil moisture conditions. Shall be listed to the EPA WaterSense Specification for Weather-Based Irrigation Controllers or the EPA WaterSense Specification for Soil Moisture-Based Irrigation Controllers.
(2) - (5) (remain unchanged)

<table>
<thead>
<tr>
<th>TABLE 1701.2</th>
<th>STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCUMENT NUMBER</td>
<td>DOCUMENT TITLE</td>
</tr>
<tr>
<td>EPA WaterSense-2011</td>
<td>Specification for Weather-Based Irrigation Controllers</td>
</tr>
<tr>
<td>EPA WaterSense-2021</td>
<td>Specification for Soil Moisture-Based Irrigation Controllers</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
EPA WaterSense has developed a specification for weather-based irrigation controllers and a specification for soil moisture-based irrigation controllers. More information can be found here: https://www.epa.gov/watersense/irrigation-controllers. These specifications ensure performance (and efficiency) of irrigation controllers that use weather and soil data, are were developed in collaboration with industry and other stakeholders.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 302

UPC 2024  Section: L 411.10.2, Table 1701.2

SUBMITTER: Robert Pickering
   Eastern Research Group, Inc.
   Rep. EPA WaterSense

RECOMMENDATION:
Revise text

L 411.0 Landscape Irrigation Systems.

L 411.10 Sprinkler Head Installations. (remaining text unchanged)

L 411.10.2 Sprinkler Head Pressure Regulation. Sprinkler heads shall utilize pressure regulation devices (as part of an irrigation system or integral to the sprinkler body/head) to maintain manufacturer's recommended operating pressure for each sprinkler and nozzle type. *Spray sprinkler bodies with integral pressure regulation shall be listed to the EPA WaterSense Specification for Spray Sprinkler Bodies.*

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA WaterSense-2017</td>
<td>Specification for Spray Sprinkler Bodies</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
EPA WaterSense has developed a specification for spray sprinkler bodies, that ensures they have integral pressure regulation. More information can be found here: https://www.epa.gov/watersense/spray-sprinkler-bodies

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
L 501.0 Water Heating Design, Equipment, and Installation.

L 501.4 Recirculation Pump Controls. Pump controls shall include on-demand activation or time clocks combined with temperature sensing. Time clock controls for pumps shall not let the pump operate more than 15 minutes every hour. Temperature sensors shall stop circulation where the temperature set point is reached and shall be located on the circulation loop at or near the last fixture. The pump, pump controls, and temperature sensors shall be accessible. Pump operation shall be limited to the building’s hours of operation.

L 501.4.1 Hot Water On-Demand Pumping Systems. Hot water on-demand pumping systems manually actuated or automatically activated hot water pumping systems shall comply with IAPMO PS 115.

SUBSTANTIATION:
These pumping systems use a hot water return line to prime the hot water piping system upon activation. These pumping systems do not mix the hot or warm water with the cold water supply. These systems do not run continuously, they supply the hot water when activated.
COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 304
UPC 2024  Section: L 503.3.4

SUBMITTER: David D Dexter, P.E.
3D Engineering Consultants, LLC

RECOMMENDATION:
Revise text

L 503.0 Service Hot Water – Other Than Low-Rise Residential Buildings.

L 503.3 Mandatory Provisions. (remaining text unchanged)

L 503.3.4 Hot Water System Design. Hot water systems shall comply with Section L 503.3.4(1) and Section L 503.3.4(2).

(1) Recirculation systems shall comply with the provisions of Section L 501.3. Circulating hot water systems shall be arranged so that the circulating pump(s) are capable of being turned off (automatically or manually) where the hot water system is not in operation.

Exception: For hospitals, custodial care facilities, nursing homes, hotels, or motels, devices that automatically turn off the circulation pump(s) shall not be utilized.

(2) Where used to maintain storage tank water temperature, circulating pump(s) shall be equipped with controls limiting operation to a period from the start of the heating cycle to a maximum of 5 minutes after the end of the heating cycle.

(3) The maximum volume of water contained in hot water distribution lines between the water heater and the fixture stop or connection to showers, kitchen faucets, and lavatories shall be determined in accordance with Section L 502.7.

SUBSTANTIATION:
• Given the concern for Legionella risk mitigation in facilities where there are higher potentials to immuno-compromised person or persons with pre-existing condition, the current health care design advice is to maintain circulation along with a temperature above the growth range for pathogen growth.
• ASHRAE 188 recommends continuous circulation of the water system as part of a good water management program.
• OSHA Technical Manual, Section III, Chapter 7, V. Controls, 3, c states: Domestic hot-water recirculation pumps should run continuously. They should be excluded from energy conservation measures.
• JCAHO (Joint Commission on Accreditation of Healthcare Organizations) mandate that covered organizations follow the OSHA requirements
• VA (Veterans Administration) provides similar mandates to minimize Legionella risks.
• CMS (Centers for Medicare & Medicaid Services) provides similar mandates to minimize Legionella risks. Therefore, it is in the best interest of public health, safety and welfare to provide this revision to the minimum requirements of the code as a way to comply with the requirements of other authorities and in the interest of mitigating the risk of Legionella as well as other potential pathogens within the water system

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as immuno-compromised persons or persons with pre-existing condition do not always occupy hotel and motel occupancies. The proposed language is not enforceable as there is no means of monitoring this after initial inspection. These requirements should be left to the local jurisdictions. Additionally, this change will eliminate the use of circulating pumps with timers that are currently in use.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 22  NEGATIVE: 3  NOT RETURNED: 1  Daniels
EXPLANATION OF NEGATIVE:

BALLANCO: This change should have been accepted based on the substantiation.

GORSUCH: This proposal has good intentions and the substantiation justifies the change. I agree the language needs to be further refined. From a water quality control point of view, commercial buildings’ hot water circulation shall maintain constant circulation (per OSHA requirement) unless the hot water system is completely shut down and drained. Water quality control should have priority over energy conservation.

MATA: The proponent has provided adequate justification as to why this proposal is needed. However, any needed revisions will be made at public comment.
APPENDIX N
IMPACT OF WATER TEMPERATURE ON THE POTENTIAL FOR SCALDING AND LEGIONELLA GROWTH

N 101.0 General.
N 101.1 Applicability. This appendix provides guidelines on the impact of water temperature in minimizing both scalding and Legionella growth potential associated with occupiable commercial, institutional, multi-unit residential, and industrial building plumbing systems.

This Appendix shall not include single-family residential buildings. This appendix shall not be considered a risk management guidance document for scalding or Legionella.

Note: Published documents which address Legionella risk management include ASHRAE 188, ASHRAE Guideline 12, or as required by the Authority Having Jurisdiction.

There are additional factors associated with the potential for scalding and Legionella growth other than temperature.

For scalding potential, other factors include, but are not limited to, user age, health, body part, length of contact time, and water source.

For Legionella growth potential other factors include, but are not limited to, water source and plumbing system: size, design, circulation rate, water age, disinfectant residual, piping material and component complexity.

N 102.0 Definitions.
N 102.1 General. For the purpose of this appendix the following definitions shall apply:
Biofilm. Microorganisms and the slime they secrete that grow on any continually moist surface.
Cold Water. Water at a temperature less than 77°F (25°C).
Control. The management to maintain compliance with established criteria.
Disinfection. Chemical or physical control measures or procedures used to kill or inactivate pathogens.
Disinfecting Hot Water. Water at a temperature not less than 160°F (71°C).
Hazard. See Risk.
Halogenation. A chemical reaction that involves the addition of one or more halogens, including, but not limited to, chlorine, bromine, or iodine, commonly used to disinfect water systems.
Hot Water. Water at a temperature not less than 130°F (54°C) and less than 140°F (60°C).
Legionella Growth Potential. The likelihood that Legionella bacteria will reproduce.
Monitor. Observing and checking the progress or quality of (something) or measuring the physical and chemical characteristics of control measures.
Scald Potential. The likelihood of burning the skin.
Scalding. The potential to cause harm resulting from exposure.
Tempered Hot Water. Water at a temperature not less than 120°F (49°C) and less than 130°F (54°C).
Tepid Cold Water. Water at a temperature not less than 77°F (25°C) and less than 85°F (29°C).
Tepid Water. Water at a temperature not less than 85°F (29°C) and less than 110°F (43°C).
**Test.** The measurement of the physical, chemical, or microbial characteristics or quality of water.

**N 102.7** **Very Hot Water.** Water at a temperature not less than 140°F (60°C) and less than 160°F (71°C).

**N 102.4** **Warm Water.** Water at a temperature not less than 110°F (43°C) and less than 120°F (49°C).

**Water Management Plan.** A comprehensive risk management plan for controlling Legionella growth in building water systems.

**N 103.0 Building Water System Design Documentation.**

**N 103.1 Required Design Documentation.** Construction documents shall be required for new construction, renovation, refurbishment, replacement, or repurposing of an occupiable building water system, including a water management plan, and shall be submitted to the Authority Having Jurisdiction.

**N 103.2 Onsite Documentation.** Documentation shall be maintained onsite and shall be readily accessible to the Authority Having Jurisdiction.

**N 104.0 Potential Exposure.**

**N 104.1 Legionella Growth Potential.** The Authority Having Jurisdiction shall have the authority to require documentation to address Legionella growth potential, where water temperatures in a water distribution system are within ranges shown in Table N 104.1 Figure N 104.1 that pose a Legionella growth potential.

**FIGURE N 104.1**

**WATER TEMPERATURE RANGES AND LEGIONELLA GROWTH POTENTIAL**

For SI units: °C = (°F-32)/1.8

* Temperature ranges reported are experimentally determined in a laboratory setting in the absence of a realistic microbial community. Legionella can survive for longer periods of time at temperatures higher and lower than the growth temperature ranges indicated due to changes in their metabolic state and/or protection from thermal disinfection within biofilm or amoeba host organisms.

**N 104.2 Scald Potential.** Where the water distribution system’s water temperature(s) range poses a scald potential in accordance with Table N 104.1 N 104.2, protection shall be provided in accordance with Chapter 4.
<table>
<thead>
<tr>
<th>WATER DESCRIPTION</th>
<th>TEMPERATURE (°F)</th>
<th>SCALD POTENTIAL1</th>
<th>LEGIONELLA GROWTH POTENTIAL2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold</td>
<td>&lt;77</td>
<td>None</td>
<td>Minimal</td>
</tr>
<tr>
<td>Tepid Cold</td>
<td>&gt;/=77 and &lt;85</td>
<td>None</td>
<td>Low</td>
</tr>
<tr>
<td>Tepid</td>
<td>&gt;/=85 and &lt;110</td>
<td>None Hyperthermia possible after long exposure in a bathtub or whirlpool tub.</td>
<td>High</td>
</tr>
<tr>
<td>Warm</td>
<td>&gt;/=110 and &lt;120</td>
<td>Minimal At 111°F, greater than 220 minutes for second-degree burn.</td>
<td>Moderate</td>
</tr>
<tr>
<td>Tempered Hot</td>
<td>&gt;/=120 and &lt;130</td>
<td>Low At 120°F, greater than 5 minutes for second-degree burn, and 10 minutes to third-degree burn; At 124°F, two minutes for second-degree burn, and 4 minutes, 10 seconds for third-degree burn.</td>
<td>Low</td>
</tr>
<tr>
<td>Hot</td>
<td>&gt;/=130 and &lt;140</td>
<td>Moderate to High At 130°F, 18 seconds for second-degree burn, and 30 seconds for third-degree burn.</td>
<td>None</td>
</tr>
<tr>
<td>Very Hot</td>
<td>&gt;/=140 and &lt;160</td>
<td>High At 140°F, three seconds for second-degree burn, and 5 seconds for third-degree burn; At 150°F, instant for second-degree burn, and less than two seconds for third-degree burn; At 158°F, instant for second-degree burn, and less than a second for third-degree burn.</td>
<td>None</td>
</tr>
<tr>
<td>Disinfecting Hot</td>
<td>&gt;/=160</td>
<td>Immediate</td>
<td>None</td>
</tr>
</tbody>
</table>

Notes:
1: The infant, elderly, and infirm have a higher potential for scalding at temperatures lower than listed.
2: Temperature ranges reported are experimentally determined in a laboratory setting in the absence of a realistic microbial community. Legionella can survive for longer periods of time at temperatures higher and lower than the growth temperature ranges indicated due to changes in their metabolic state and/or protection from thermal disinfection within biofilm or amoeba host organisms.

N 105.0 Disinfection.
N 105.1 Disinfection Documentation. Where required by the Authority Having Jurisdiction, documentation for disinfection of all building water systems shall be provided by the registered design professional in the construction documents.

Methods for new construction and any repaired system disinfection shall include, but not be limited to, the chlorination methods and procedures for flushing and disinfection in accordance with Section 609.10.

Other or alternative water treatment methods for disinfection shall include, but not be limited to, one of the following methods:

(+) N 105.1.1 Copper-Silver Ionization. Copper-silver ionization methods and procedures, shall include including the following documentation.

(a1) Copper and silver ionization concentrations shall be included in the documentation.
Methods and documentation for monitoring ion levels.

Electrode cleaning cycles and methods shall be reported.

(2) Ultraviolet Light. Ultraviolet light methods shall include the following documentation:
- Locations of ultraviolet light units.
- Cleaning cycles and methods of the quartz sleeves and housing shall be documented.

N 105.2 Chemical Disinfection. Chemical biocide treatment shall be permitted to be used in accordance with the following:
1. Oxidizing biocides in accordance with manufacturer’s guidelines.
2. Non-oxidizing biocides in accordance with manufacturer’s guidelines.
3. Alternating the use of different types of biocides, dose, and frequency is recommended.
4. These treatment methods can be used for continuous, online disinfection or shock treatment online or offline.
5. Biocides intended for potable water applications shall be listed in accordance with NSF 60 and approved by the Authority Having Jurisdiction.

N 105.3 Non-Chemical Treatment. Non-chemical treatment devices shall be permitted to be used in accordance with manufacturer’s guidelines.

N 105.3.1 Thermal Shock. Thermal treatment using heat shock at 158°F (70°C) for 30 minutes shall be permitted in accordance with applicable guidelines and the Authority Having Jurisdiction.

N 105.4 Frequency of Cleaning and Disinfection. Where a water management plan is implemented, the frequency of cleaning and disinfection logs shall be readily accessible to the water management team and the Authority Having Jurisdiction.

N 105.5 Control Measures. Control measures for Legionella prevention shall be evaluated for potential consequences that affect overall health risks.

N 201.0 Supply System Legionella Test Levels.
N 201.1 General. The minimum remediation action for water supply systems shall be in accordance with Table N 201.1.

### TABLE N 201.1
LEGIONELLA REMEDIATION ACTIONS DOMESTIC WATER SYSTEMS

<table>
<thead>
<tr>
<th>Percentage of Positive Legionella Test Sites</th>
<th>Remediation Action&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30</td>
<td>Maintain environmental assessment and Legionella monitoring in accordance with the water management plan.</td>
</tr>
</tbody>
</table>
| > / = 30                                    | - Immediately institute short-term control measures<sup>2</sup> in accordance with the direction of a qualified professional,<sup>3</sup> and notify the Authority Having Jurisdiction, if required.  
  - The water system shall be re-sampled no sooner than 7 days and no later than 4 weeks after disinfection to determine the efficacy of the treatment.  
  - For persistent results, as determined by the Authority Having Jurisdiction, showing > 30 percent positive sites, long-term control measures<sup>5</sup> shall be implemented in accordance with the direction of a qualified professional<sup>3</sup> and the Authority Having Jurisdiction.  
  - Retreat and retest. If retest is > 30 percent positive, repeat short-term control measures.<sup>2</sup>  
  - With receipt of results < 30 percent positive,<sup>4</sup> resume monitoring in accordance with the water management plan.  
  - For persistent results, as determined by the Authority Having Jurisdiction, showing > 30 percent positive sites, long-term control measures<sup>5</sup> shall be implemented in accordance with the direction of a qualified professional<sup>3</sup> and the Authority Having Jurisdiction. |

**Notes:**
1. In the event that one or more cases of legionellosis are, or may be, associated with the facility, the sampling interpretation shall be in accordance with the direction of a qualified professional and the Authority Having Jurisdiction.
2. Short-term control measures are temporary interventions that may include, but are not limited to, heating and flushing the water system, hyperchlorination, or the temporary installation of treatment such as copper silver ionization (CSI).
3. Control measures shall be conducted in accordance with the direction of a qualified professional. A qualified professional is an Authority Having Jurisdiction licensed professional engineer; certified industrial hygienist; certified
Positive samples should be minimized.
5 Long-term control measures may include supplemental disinfection treatments.

**N 202.0 Emergency Response Plan.**

**N 202.1 General.** An emergency response plan shall be provided when required by with the Authority Having Jurisdiction and shall include, but not be limited to, the following:

1. Procedures to be followed if there are cases of Legionellosis associated with the plumbing system.
2. Procedures to be followed if the plumbing system reaches greater than or equal to 30 percent of test sites positive for Legionella.
3. Testing for Legionella shall be performed. Procedures shall include the type of tests to be performed, sampling, and the interpretation of test results.
4. Procedures for emergency disinfection.
5. Procedures for other actions identified by the water management plan to prevent exposure to contaminated water.

**TABLE 1701.2**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF/ANSI/CAN 60-2020</td>
<td>Drinking Water Treatment Chemicals - Health Effects</td>
<td>Water Treatment</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

**SUBSTANTIATION:**

The UMC Legionella Task Group met several times throughout 2020 to develop a new Appendix (Impact of Water Temperature on the Potential for Legionella Growth) to establish minimum requirements for building mechanical systems to minimize Legionella growth potential within such systems. The UMC Legionella Task Group also reviewed the existing UPC Appendix N (Impact of Water Temperature on the Potential for Scalding and Legionella Growth) to correlate and further enhance the UPC Appendix N.

Included in the recommendations are a new Figure N 104.1 that is a specifically scaled for Legionella growth potential. Figure N 104.2 (formerly Figure N 104.1) remains mostly unchanged, except that the Legionella growth potential temperature ranges have been relocated into a separate figure, Figure N 104.1. This update simplifies the temperature ranges for Legionella growth potential and scald potential and adds clarity for the end user on the use of the figures and assists when acquiring the important information needed. The updates also include a distinction between chemical and non-chemical disinfection and treatment criteria, remediation guidelines for domestic water, and an emergency response plan.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 306

UPC 2024 Section: Appendix O, Table 1701.2

SUBMITTER: Edward R. Osann (Natural Resources Defense Council); C.J. Lagan (LIXIL Water Technology Americas); Albert Robert (Bob) Rubin (North Carolina State University)

RECOMMENDATION:
Add new text

APPENDIX O
NON-SEWERED SANITATION SYSTEMS

O 101.0 General.
O 101.1 Applicability. The provisions of this appendix shall apply to the installation of non-sewered sanitation systems.

O 201.0 Definitions.
O 201.1 General. For the purpose of this appendix, the following definitions shall apply:
Conditioned Space. An area, room, or space normally occupied and being heated or cooled for human habitation by any equipment.
Non-Sewered Sanitation System. A prefabricated integrated sewage treatment unit that is not connected to a public sewer or private sewage disposal system.

O 301.0 Installation.
O 301.1 General. The installation of non-sewered sanitation systems shall be in accordance with the manufacturer's installation instructions and with Section O 301.2 through Section O 301.7.
O 301.2 Operating Conditions. A non-sewered sanitation system in either a conditioned or unconditioned space shall be installed where the ambient temperature, ambient humidity, and altitude (atmospheric pressure) are in accordance with the manufacturer's installation instructions or product listing.
O 301.3 Clearances for Servicing and Maintenance. A non-sewered sanitation system shall be located to permit access and sufficient clearance for service and maintenance. Unless otherwise specified by the manufacturer's installation instructions, not less than 30 inches (762 mm) in depth, width, and height of working space shall be provided at any access panel.
O 301.4 Backflow Prevention. A domestic water supply connection to a non-sewered sanitation system shall be protected in accordance with this code.
O 301.5 Effluent Storage. Any container or vessel for the storage of effluent discharged from a non-sewered sanitation system and not integral to such system shall be installed in accordance with the plumbing code.
O 301.6 Systems Employing Combustion. A non-sewered sanitation system employing combustion shall comply with the mechanical code.
Exception: A non-sewered sanitation system listed for unvented use.
O 301.7 Connection to Plumbing System Not Required. Unless the Authority Having Jurisdiction determines otherwise, a non-sewered sanitation system is not required to be connected to the drainage system of the building or premises.

O 401.0 Manual Required.
O 401.1 Operation and Maintenance Manual. Non-sewered sanitation systems shall have an operation and maintenance manual provided by the manufacturer.

O 501.0 System Output. The use or disposal of all substances exiting the non-sewered sanitation system shall be determined by the Authority Having Jurisdiction.
TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI/CAN/IAPMO/ISO</td>
<td>Non-Sewered Sanitation Systems - Prefabricated Integrated Treatment Units - General Safety and Performance Requirements for Design and Testing</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(portions of tale not shown remains unchanged)

Note: ANSI/CAN/IAPMO/ISO 30500 meets the requirements for a mandatory reference standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
This proposal covers the essential considerations that a building official must assess when a non-sewered sanitation system (NSSS) as defined herein is installed in a building. Designed for operation without a sewer connection and, in many cases, without a dedicated water supply, NSSSs are anticipated to meet critical public health needs in areas with limited water and wastewater infrastructure, water supply constraints, and/or unfavorable soils for traditional on-site disposal methods. In the U.S., over 20% of the population relies on an onsite wastewater system. And even today, a portion of our population does not have access to fully functioning sanitation, largely due to lack of affordable infrastructure or to challenging site conditions.

To facilitate commercialization of hi-tech toilets and their acceptance by state and national regulatory bodies, an ISO standard was adopted in 2018 to establish the key performance attributes of NSSSs. Standard 30500, Non-sewered sanitation systems - Prefabricated integrated treatment units - General safety and performance requirements for design and testing, sets performance requirements for solid and liquid outputs, odor, noise, air emissions, materials, safety, marking, and ergonomics, together with relevant test procedures for measuring the attainment of these requirements. This ISO standard was adopted in identical form as a US and Canadian national standard in 2019, designated as ANSI/CAN/IAPMO/ISO 30500:2019.

In 2011, the Bill & Melinda Gates Foundation launched the "Reinvent the Toilet Challenge" to bring new technology to bear to achieve sustainable sanitation solutions. The target is a factory-built device that provides complete and effective treatment of human sanitary waste, unconnected to any sewer or drainage network and with minimal inputs of water and energy. Eight teams have received foundation support to develop prototypes for lab testing, field trials, and commercialization. Among these initial devices, three broad pathways for treatment technology have emerged - electro-chemical, biological, and combustion - and in some cases, combinations of these in the same device. Manufacturers have been involved in these efforts, and LIXIL (owner of American Standard) and other companies are working to develop compliant systems for both domestic and international installations. It is the general preference of manufacturers to design systems that are compliant with published codes and standards, rather than one-off compliance reviews by individual jurisdictions.

The provisions in this proposal address the considerations that must be taken into account by building officials regarding the placement and installation of NSSSs in buildings. The proposal would permit (but not require) the installation of a NSSS listed to the ISO standard, and provide an exception to the general requirement in the UPC that sanitation devices be connected to the building drainage system, unless a connection is required by the AHJ. Certain key protections, such as backflow prevention, proper ventilation of combustion-based units, and proper siting of storage tanks (if any) external to the unit are each specified in the proposal. The clearance requirements in Section “O” 301.3 correspond with the basic requirements found in the Uniform Mechanical Code, Section 304.1. Considerations of the use and disposal of outputs of the system are specifically referred to an AHJ, which would most likely be a health department.

Criteria for the functioning of the unit for its intended purpose are established by the ISO standard, and do not need to be repeated in plumbing code language. It should be noted that the ISO standard was developed by an international team of scientists, engineers, and regulators to assure the highest levels of treatment available would apply to all outputs (air, water and solids) from the device. The microbiological reduction requirements for solid and liquid waste are based on the quantitative microbial risk assessment (QMRA) method recognized by the World Health Organization for this purpose. The requirements of the standard mimic the highest quality standards imposed by regulatory agencies on waste-derived materials destined for reuse. The standard’s test procedures are rigorous (both lab and field tests are required), and the proposal allows only NSSSs listed to the standard to be approved for installation.
With reinvented toilets now on the cusp of commercialization, the arrival of toilets without water and sewer connections at job sites across the country can reasonably be expected by the time this code update is published and adopted by states and localities, e.g., 2025. Clear code language will accelerate the availability of safe sanitation for people who lack it today. While much is still unknown about the cost, maintenance, and reliability of NSSSs, or even the business model for their installation and servicing, forward-looking communities and jurisdictions with acute sanitation needs will want to be prepared for the safe installation and use of this promising new technology as it enters the market. This proposal lays the necessary groundwork for code officials to inspect and approve their installation, set out in an appendix available for voluntary adoption by state and local code bodies.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC

Amend proposal as follows:

APPENDIX O
NON-SEWERED SANITATION SYSTEMS

O 101.0 General.
O 101.1 Applicability. The provisions of this appendix shall apply to the installation of non-sewered sanitation systems.

O 201.0 Definitions.
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Non-Sewered Sanitation System. A prefabricated integrated sewage treatment unit that is not connected to a public sewer or private sewage disposal system.

O 301.0 Installation.
O 301.1 General. The installation of non-sewered sanitation systems shall be in accordance with the manufacturer's installation instructions and with Section O 301.2 through Section O 301.7.
O 301.2 Operating Conditions. A non-sewered sanitation system in either a conditioned or unconditioned space shall be installed where the ambient temperature, ambient humidity, and altitude (atmospheric pressure) are in accordance with the manufacturer's installation instructions or product listing.
O 301.3 Clearances for Servicing and Maintenance. A non-sewered sanitation system shall be located to permit access and sufficient clearance for service and maintenance. Unless otherwise specified by the manufacturer's installation instructions, not less than 30 inches (762 mm) in depth, width, and height of working space shall be provided at any access panel.
O 301.4 Backflow Prevention. A domestic water supply connection to a non-sewered sanitation system shall be protected in accordance with this code.
O 301.5 Effluent Storage. Any container or vessel for the storage of effluent discharged from a non-sewered sanitation system and not integral to such system shall be installed in accordance with the plumbing code.
O 301.6 Systems Employing Combustion. A non-sewered sanitation system employing combustion shall comply with the mechanical code.
Exception: A non-sewered sanitation system listed for unvented use.
O 301.7 Connection to Plumbing System Not Required. Unless the Authority Having Jurisdiction determines otherwise, a non-sewered sanitation system is not required to be connected to the drainage system of the building or premises.

O 401.0 Manual Required.
O 401.1 Operation and Maintenance Manual. Non-sewered sanitation systems shall have an operation and maintenance manual provided by the manufacturer.

O 501.0 System Output. The use or disposal of all substances exiting the non-sewered sanitation system shall be determined by the Authority Having Jurisdiction.
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<th>DOCUMENT NUMBER</th>
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**COMMITTEE STATEMENT:**
The modification removes the exception of Section O 301.6 regarding "non-sewered sanitation system listed for unvented use" as it is not appropriate for the code.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  **AFFIRMATIVE:** 25  **NOT RETURNED:** 1  Daniels
P 101.0 General.
P 101.1 Scope. The provisions of this appendix address minimum qualifications for installers, inspectors, or employers for systems covered within the scope of this code.

P 102.0 Qualifications.
P 102.1 General. Where permits are required, the Authority Having Jurisdiction shall have the authority to require contractors, installers, or service technicians to demonstrate competency. Where determined by the Authority Having Jurisdiction, the contractor or technicians shall be licensed or certified to perform such work. Professional qualifications shall be required for an individual to demonstrate the required level of competency.
P 102.2 Inspectors and Plans Examiners. Professional qualification for plumbing inspectors and-plumbing plans examiners shall be qualified in accordance with ASSE/IAPMO/ANSI Series 16000.
P 102.2.1 Qualification for Plumbing Inspector. Professional qualification for plumbing inspectors shall be in accordance with ASSE 16010.
P 102.2.2 Qualification for Plumbing Plan Examiner. Professional qualification for plumbing plans examiners shall be in accordance with ASSE 16040.
P 102.3 Service Plumber Technician. Professional qualification for plumbing service technicians shall be qualified to ASSE/IAPMO/ANSI Series 13000.
P 102.3.1 Qualification for Service Plumbers. Professional qualification for service plumbers shall be in accordance ASSE 13010.
P 102.4 Cross-Connection Control. Professional qualification for cross-connection control professionals shall be in accordance with ASSE/IAPMO/ANSI Series 5000.
P 102.4.1 Qualification for Backflow Testers. Professional qualification for backflow assembly testers shall be in accordance with ASSE 5110.
P 102.4.2 Qualification for Surveyors. Professional qualification for cross-connection assembly surveyors shall be qualified in accordance with ASSE 5120.
P 102.4.3 Qualification for Repairers. Professional qualification for backflow prevention assembly repairers shall be in accordance with ASSE 5130.
P 102.4.4 Qualification for Fire Protection Systems. Professional qualification for backflow assembly testers of fire protection systems shall be in accordance with ASSE 5140.
P 102.4.5 Qualification for Program Administrator. Professional qualification for backflow prevention administrator shall be in accordance with ASSE 5150.
P 102.5 Medical Gas Systems. Professional qualification for medical gas systems personnel shall be in accordance with ASSE/IAPMO/ANSI Series 6000.
P 102.5.1 Qualification for Medical Gas Installers. Professional qualification for medical gas system installers shall be in accordance with ASSE 6010.
P 102.5.2 Qualification for Bulk Medical Gas/Cryogenic Fluid Installers. Professional qualification for bulk
medical gas/cryogenic fluid installers shall be in accordance ASSE 6015.

P 102.5.3 Qualification for Medical Gas Systems Inspectors. Professional qualification for medical gas systems inspectors shall be in accordance with ASSE 6020.

P 102.5.4 Qualification for Medical Gas System Verifiers. Professional qualification for medical gas system verifiers shall be in accordance with ASSE 6030.

P 102.5.5 Qualification for Bulk Medical Gas/Cryogenic Fluid Central Supply System Verifiers. Professional qualification for bulk medical gas/cryogenic fluid central supply system verifiers shall be in accordance with ASSE 6035.

P 102.5.6 Qualification for Medical Gas Systems Maintenance. Professional qualification for medical gas systems maintenance personnel shall be in accordance with ASSE 6040.

P 102.6 Residential Potable Water Fire Sprinkler System Installers and Inspectors for One- and Two-Family Dwellings. Professional qualification for residential potable water fire protection system installers and inspectors for one- and two-family dwellings shall be in accordance with ASSE/IAPMO/ANSI Series 7000.

P 102.6.1 Qualification for Installers. Professional qualification for persons who provide layout, detail and calculations for residential potable water fire protection systems for one- and two-family dwellings and install such systems shall be in accordance with ASSE 7010.

P 102.6.2 Qualification for Inspectors. Professional qualification for inspectors of residential potable water fire protection systems for one- and two-family dwellings shall be in accordance with ASSE 7020.

P 102.7 Water Management and Infection Control Risk Assessment for Building Systems. Professional qualification for construction and maintenance personnel and employers to identify and manage potentially hazardous exposure to bloodborne, waterborne and airborne pathogens. Also includes qualifications for members of a water safety team involved in the development of a risk assessment analysis, and water management and sampling plan, for protection from Legionella and other waterborne pathogens and persons who conduct a facility risk assessment and implement a water safety and management program to reduce the risk of infections due to Legionella. Qualifications are in accordance with ASSE/IAPMO/ANSI Series 12000.

P 102.7.1 Environment of Care, Infection Control and Construction Risk Assessment Professional Qualification Standard. Professional qualification for general knowledge of the environment of care, infection control and construction risk assessment procedures to protect facility operations, occupants, workers or any individual who has the potential for harm caused by construction activities shall be in accordance with ASSE 12010.

P 102.7.2 Environment of Care, Infection Control and Construction Risk Assessment Professional Qualification Standard for Construction and Maintenance Employers. Professional qualification for general knowledge of the environment of care, infection control and construction risk assessment requirements and procedures to protect facility operations, occupants, workers, or any individual who has the potential for harm caused by construction activities shall be in accordance with ASSE 12020. It also provides general knowledge of employer responsibilities to the worker and to the facility.

P 102.7.3 Water Quality Program Professional Qualifications Standard for Employers and Designated Representatives. Professional qualification for employers and designated representatives implementing water quality programs shall be in accordance with ASSE 12060.

P 102.7.4 Qualification for Water Quality Program, Plumbers. Professional qualification for plumbers implementing a water quality program shall be in accordance with ASSE 12061.

P 102.7.5 Qualification for Water Quality Program and Pipefitters. Professional qualification for pipefitters implementing a water quality program shall be in accordance with ASSE 12062.

P 102.7.6 Qualification for Water Quality Program, Sprinkler Fitters. Professional qualification for sprinkler fitters implementing a water quality program shall be in accordance with ASSE 12063.

P 102.7.7 Legionella Water Safety and Management Specialist. Professional qualification for persons who conduct a facility risk assessment and implement a water safety and management program to reduce the risk of infections due to Legionella shall be in accordance with ASSE 12080.

P 102.8 Rainwater Catchment System Personnel. Professional qualification for designers and installers of rainwater catchment systems, and inspectors of rainwater/stormwater catchment systems shall be in accordance with ASSE/IAPMO/ANSI Series 21000.

P 102.8.1 Qualification for Installer. Professional qualification for rainwater catchment systems installers shall be in accordance with ASSE 21110.

P 102.8.2 Qualification for Designer. Professional qualification for rainwater catchment system designers shall be in accordance with ASSE 21120.

P 102.8.3 Qualification for Inspectors. Professional qualification for rainwater and stormwater catchment systems inspectors shall be in accordance with ASSE 21130.
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<td>Cross-Connection Control Surveyors</td>
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<td>Water Quality Program Professional Qualifications Standard for Employers and Designated Representatives</td>
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<td>Water Quality Program Professional Qualifications Standard for Plumbers</td>
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<td>Rainwater Catchment Systems Designers</td>
<td>ASSE 21130-2017</td>
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**SUBSTANTIATION:**
By including these Professional Qualification Standards in the Appendix of this code it creates a base line for what an AHJ may or should expect from installers and inspectors of these systems.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 17  NEGATIVE: 7  ABSTAIN: 1  NOT RETURNED: 1  Daniels

**EXPLANATION OF NEGATIVE:**

**BALLANCO:** This change should be rejected. This does not belong in the code. Furthermore, the charging statement does not address all of the listed qualification standards. Section P 102.1 states that it applies to contractors, installers, and service technicians. Then the first section applies to plans examiners and inspectors. Yet, they are not included in the charging section. The Code should never be a licensing document. If ASSE wants to put this out as a separate document, they can do so. But this does not belong in the UPC.

**BARBATO:** Professional qualifications are regulated by state laws and local ordinances and have no place in the code.

**FEEHAN:** This does not belong in the code. This is up to the Jurisdictions to determine qualifications.

**GORSUCH:** Professional qualifications should be decided by AHJs.

**KREITENBERG:** The Plumbing Code is not the appropriate body to address this type of "qualification" criteria.

**RODIO:** This code change is seriously flawed. It places requirements for installers to meet ASSE but provides no method of having the installers tested. The AHJ's will have to establish tracking, testing, and monitoring systems to
ensure that the various installers and inspectors conform with and maintain current certifications. It mandates superseding qualifications over state and county licensing requirements. It adds another layer of administration and complexity to the installers that does nothing to benefit the end-user. As an example: As a plumber in California with a C-36 general plumbing license, I and all of my employees would have to be tested and certified as meeting ASSE 13010, ASSE/IAPMO/ANSI Series 6000, ASSE 6010, ASSE 12061, ASSE 12062, ASSE/IAPMO/ANSI Series 21000, ASSE 21110 and ASSE 21120. These are eight additional tests and certifications to install work for all of my employees that are currently covered under my license. Backflow workers are just as bad. Are AHJ’s going to have all of their inspectors tested and certified to dozens of these standards? This code change is way beyond the scope of our code.

**WHITE:** This is not a code issue; it is a jurisdictional issue.

**EXPLANATION OF ABSTAIN:**

**CUDAHY:** Not sure; qualifications should be jurisdictional.
APPENDIX Q
THE SAFE OPERATION, CLOSURE AND REOPENING OF BUILDING WATER SYSTEMS

Part I – General.

Q 101.0 General.

Q 101.1 Applicability. This appendix shall apply to risk management practices for all potable and non-potable water supply systems during normal operation, when closing, interruption to normal operation (system shutdown), and re-opening of all building occupancy types except for single- and two-family residential buildings. Part I shall apply to potable water systems and non-potable water systems. Part II shall apply to potable water systems. Part III shall apply to non-potable water systems.

Q 101.2 Building Water Systems. This appendix shall be applicable to building water systems for plumbing systems including the following:
(1) Potable water systems
(2) Non-potable water systems shall include, but not limited to, the following:
(a) Alternate water systems for outdoor use and indoor water use (dual plumbing systems)
(b) Utility supplied reclaimed water
(c) Rainwater catchment
(d) Gray water
(e) Landscape irrigation
(f) Decorative features
(g) Outdoor use systems (showers, hose bibs, etc.)

Q 101.3 Building Types. This appendix shall be applicable to the following building types:
(1) Non-residential (low- and high-rise)
(a) Office buildings
(b) Mercantile (seasonal retail)
(c) Schools/dormitories
(d) Hotels/motel
(e) Assembly
(f) Healthcare
(2) Residential
(a) All except single and double family residences

Q 201.0 Definitions.

Q 201.1 General. For the purpose of this appendix, the following definitions shall apply.

Building Water. Water collected, conveyed, circulated, stored, drained, or discharged by building plumbing systems for use in and around buildings.

Building Water Systems. Potable and non-potable water systems in the building, or on site.
**Potable Water System.** A building water distribution system that provides hot or cold water intended for direct or indirect human contact or consumption.

**Risk.** The potential to cause harm resulting from exposure.

**Risk Management.** Systematic activities to reduce risk.

**SUBSTANTIATION:**
The new section is being added to the UPC Appendix Q to address the safe operation, closure and reopening of building water systems. The additions in this section provide a broad overview of what building types and systems have an elevated risk profile for Legionella amplification and transmission. The definitions were added as these terms are needed for application, clarification and enforceability of the provisions above.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
Proposals

Item #: 309

UPC 2024 Section: Q 201.0 - Q 201.1, Q 301.0 – Q 301.4.1.2

SUBMITTER: Gary Klein
Self
Chair, Potable Water Working Group

RECOMMENDATION:
Add new text

**Q 301.0 Water Management Program.**

**Q 301.1 Development.** Where a water management program is not in place, a water management program shall be developed for the building water systems covered in this appendix according to ASHRAE 188 that addresses:

1. All building water systems described in Section Q 101.2.
2. The physical, chemical, and biological risks to the building water systems.
3. The normal operation, shutdown, maintenance, and start-up of building water systems.

**Q 301.2 Application.** Where a water management program is in-place, it shall be reviewed prior to applying this manual to ensure it covers the above information. When a water management program is not in place, this information shall be compiled in order to apply this appendix. The following elements of a water management program shall be developed, in accordance with ASHRAE 188, prior to implementing this appendix:

1. A program team shall be identified.
2. The potable and non-potable building water systems shall be described, and process flow diagrams created.
3. An analysis of the building water systems, including all engineering controls, shall be conducted and documented.

**Note:** ASHRAE 188 defines a water management program as “the risk management plan for the prevention and control of legionellosis associated with building water systems, including documentation of the plan’s implementation and operation.” Building water systems, including water supply and sanitary drainage, can present many additional risks to water quality and human health that warrant careful management of physical, chemical, and biological characteristics through a water management program.

Managing water quality can also improve the performance of building water systems and extend the life of plumbing system. Managing water in building plumbing systems further requires understanding and monitoring the interaction between supply water and premise plumbing systems, compelling coordination with water providers to ensure building managers are aware of upstream risks that may impact building water quality (see also Section Q 301.3 on utility coordination).

**Q 301.3 Utility Coordinator.** Information shall be obtained about the specific disinfection and corrosion control chemicals being used in the supply water to the building from the water utility, including the following:

1. General water quality information
2. Type and level of disinfectant residual
3. Corrosion control chemicals added to the water
4. Distribution system maintenance near the building
5. Expected water quality changes

**Note:** It is important to notify the water utility of any sensitive water quality parameters for the building or facility, and to review/develop the notification protocol for significant water quality.

**Q 301.4 Microbiological Testing.** Microbial testing shall be done in accordance with Section Q 301.4.1 through Section Q 301.4.1.2.

**Q 301.4.1 Laboratory Testing.** Laboratory testing shall utilize culture testing methodology. Where a sample contains at least 1 CFU/mL or exceeds the limit of detection where the LOD of the method used is greater than 1 CFU/mL, the sample shall be deemed positive for Legionella.

**Note:** Other methodologies such as quantitate-polymerase chain reaction (qPCR) may be considered, usually in conjunction with the culture testing method.
Q 301.4.1.1 Culture Testing. Legionella culture testing shall be conducted by an accredited laboratory in accordance with the Authority Having Jurisdiction.

Q 301.4.1.2 qPCR Testing. When qPCR testing is used, Legionella pneumophila qPCR testing shall be conducted by an accredited laboratory in accordance with the Authority Having Jurisdiction.

Q 201.0 Definitions.

Q 201.1 General. For the purposes of this appendix, the following definitions shall apply.

Legionella. The name of the genus of bacteria that can cause a pneumonia called Legionnaires’ disease or a flu-like illness called Pontiac fever when inhaled, aspirated, or directly introduced into the lungs of susceptible individuals. Legionella are common aquatic bacteria found in natural and building water systems, as well as in some soils. Legionellosis. The term used to describe Legionnaires’ disease, Pontiac fever, and any illness caused by exposure to Legionella bacteria.

Program Team. The group or individual designated by the building owner or designee to be responsible for developing, implementing, and maintaining the program.

Risk. The potential to cause harm resulting from exposure.

Risk Management. Systematic activities to reduce risk.

System Reopening. The set of actions that should be taken to ready a building for normal operations after an extended period of no or limited operations.

Water Management Program (WMP). A risk management plan to help building managers identify risks to water quality and establish clear guidelines for managing these risks at various points in the building lifecycle, including start-up, normal operation, under occupancy, water system shutdown, and water system restart. Such programs often focus on Legionella risk prevention, as required in some states for certain building types to combat waterborne pathogens such as Legionellosis.

SUBSTANTIATION:
The new sections are being added to the UPC Appendix Q to address the safe operation, closure and reopening of building water systems. This section directs building owners with populations that are susceptible to Legionella outbreaks and provide the general framework to reduce the risk. The definitions were added as these terms are needed for application and enforceability of the provisions.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposals that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 310
UPC 2024  Section: Q 201.0, Q 401.0

SUBMITTER: Gary Klein
Self
Chair, Potable Water Working Group

RECOMMENDATION:
Add new text

**Part II – Potable Water Systems.**

Reference sections need to be updated.

**Q 401.0 Potable Water Systems.**

**Q 401.1 General.** The five distinct building water conditions of a potable water system shall be as shown in Figure Q 401.1 and in accordance with the following:

1. The building potable water system during construction activities shall be in accordance with Section Q 402.0.
2. The building potable water system during normal operations shall be in accordance with Section Q 403.0.
3. When there is an interruption to normal operations (system shut down process), the potable water system shall be in accordance with Section Q 404.0.
4. When a building is vacant or partially occupied (system is shutdown), the potable water system shall be in accordance with Section Q 405.0.
5. The potable water system during reopening shall be in accordance with Section Q 406.0.

![Figure Q 401.1 BUILDING WATER CONDITIONS](image)

**Q 401.2 Equipment Requirements.** Personnel that perform flushing shall utilize appropriate personal protective equipment (PPE) based on a task specific risk assessment and in accordance with OSHA requirements.

**Q 401.2.1 Other Equipment Requirements.** The following equipment shall be required for plumbing system evaluation:

1. Sampling bottles or supplies for laboratory samples.
2. Chlorine meter/test kit with an accuracy of +/- 3 percent.
3. Digital thermometer for measuring water temperature with an accuracy of +/- 2°F (+/-1°C).
4. Tools for removing aerators and supply stop covers (check with the appropriate manufacturers).

**Q 401.3 Water Stagnation.** Maintenance personnel shall take steps to prevent stagnant water in the potable water system in accordance with the water management program.

*Note:* These steps may include reducing the length of “dead legs” or lengths of pipe that are unused to prevent stagnation of water in piping systems.
Q 401.4 Water Purveyor Communication. The water utility provider shall be contacted prior to initiating the flushing process as required in Section Q 401.4.1 and the following:

(1) Identify where the water purveyor is monitoring water quality nearest to the building in the distribution system and determine water quality at that location at present time and for the preceding years.

(2) Verify that fresh utility water is available in the building's incoming water supply line.

(3) Verify with the water utility provider on the expected disinfectant residual level in fresh utility water at your building.

(4) The flushing process shall be in accordance with the Authority Having Jurisdiction. Where available, the Authority Having Jurisdiction's data sheets shall be utilized to document the flushing process. If Items (1) through (3) are not possible, the regulated contaminants and disinfectants in the water supply for preceding years in the annual Consumer Confidence Report (CCR) shall be used.

Note: The frequency of maintenance, inspection, flushing, and monitoring may be established or adjusted in the water management program based on the following:

(1) Lack of historical water quality results
(2) Routine maintenance testing results that support an increased or reduced frequency
(3) Changes in source incoming water (permanent, seasonal, or temporary)
(4) Disruption in water quality due to water main breaks, weather impacts, external construction, or any other factors
(5) Building plumbing modifications
(6) Building use and occupants served

Q 401.4.1 Water Draws for Testing. Water obtained for testing shall be drawn from the fixture in accordance with the following:

(1) First Draw Test. Open faucet and collect water out of fixture to determine disinfectant residual.

(2) Long Draw Test. Determine distance into water main or branch inside building that results are desired for. Calculate the time needed to flush (volume of water based on pipe size, divide by flow rate of fixture) and obtain water from that portion. Flush for the calculated time and collect sample.

Note: First-draw tests will give an impression of water quality that possible users would experience. The longer the flush before the draw, the further upstream in the piping system the test results will describe. Long-draw will give a better indication of the water quality in the water main.

Q 401.4.2 Locations for Testing. Sampling locations shall be in accordance with the CDC guidelines and ASHRAE 188. Testing shall be done at all plumbing fixtures in a building over a given period of time in accordance with the water management program. The following shall be considered when selecting locations:

(1) Test fixtures that are frequently, moderately, and rarely used.

(2) Test sites that are near the building water entrance, sites that are hydraulically remote (i.e., distal sites), and those that are in between.

(a) Hydraulically remote locations shall not be required in the furthest room or sink from the service entrance, but rather those locations that experience the least flow or have the highest-pressure loss through the piping system.

(3) For systems with multiple zones or risers, sampling shall take place in each zone and riser.

(4) Priority should be given to hot-water systems.

(5) The Authority Having Jurisdiction shall be permitted to determine, on a case-by-case basis, where cold-water sampling shall be conducted.

Q 401.5 Water Quality. The building water quality shall be considered in accordance with the Authority Having Jurisdiction and Section Q 401.5.1 through Section Q 401.5.5. Additional monitoring and reporting of water quality shall be in accordance with the Authority Having Jurisdiction.

Q 401.5.1 Disinfectant Residuals Considerations. Disinfectant residuals shall be evaluated in the cold-water and hot-water system. The water system shall be tested for free chlorine or chloramine as required by the water purveyor (water utility). Free chlorine shall be measured where the water utility disinfects using free chlorine. Total chlorine shall be measured where the water utility disinfects using chloramine.

Note: Because chlorine residual is an important factor affecting microbial (Legionella) growth in building plumbing, all buildings should measure and record chlorine residuals. The measured chlorine residual is used to manage plumbing water age.

Q 401.5.2 Temperature. Temperatures shall be evaluated in both cold-water and hot water systems to maintain disinfectant levels.

Note: Because temperature is an important factor affecting microbial (Legionella) growth in building plumbing, all buildings should accurately measure and record water temperatures, and use this data to manage plumbing water age. Temperatures should be evaluated in both cold-water and hot water systems. As disinfectant levels in hot water are more difficult to maintain as oxidizing disinfectants dissipate more rapidly as temperature increases.

Q 401.5.3 Total Suspended Solids (TSS). The total suspended solids (TSS) shall be evaluated and shall be within the requirements as required by the water purveyor.

Note: Sediment in the water has an impact on plumbing systems as it can clog strainers and cause ball valves to seize. It also has an impact on the microbiology and disinfectant of the building as sediment can:

(1) Reduce the residual disinfectant by consuming the disinfectant.

(2) Provide a food source for bacteria, as sediment can and will provide a carbon source of various quantities to support bacteriological life.

(3) Shield bacteria from disinfection as the pathogens can attach themselves to sediment. The sediment can then carry the pathogen into an area in the building where water quality conditions are ideal for its' growth.
Sediment can increase in vacant buildings due to the oxidizing disinfectants corroding the metallic piping as the water is stagnant.

**Q 401.5.4 Legionella.** Water samples for Legionella culture shall be analyzed by an accredited laboratory in which Legionella culture appears on the laboratory’s scope of accreditation or a laboratory as approved by the Authority Having Jurisdiction.

**Note:** Knowing whether a building has Legionella, both in terms of concentrations and frequency of detection, enables an actual data-based assessment of building water quality and can guide appropriate actions to protect water users. This includes number of samples and locations that adequately represent the water system. Consider selecting a laboratory that has Legionella proficiency as demonstrated by Centers for Disease Control and Prevention (CDC) ELITE program certification or another internationally recognized proficiency program (such as the PHE Legionella isolation scheme).

**Q 401.5.5 Water Quality Data Tracking and Evaluation.** The water quality records and data shall be kept on file.

**Q 201.0 Definitions.**

**Q 201.1 General.** For the purposes of this appendix, the following definitions shall apply:

**Building is Vacant or Partially-Occupied.** The state of a building water system when the building is closed and not in use (vacant) or major portions of the building water system is not in use or the typical use is significantly reduced (partially-occupied). This includes the off hours of operation and buildings that are shut down for long periods of time (weeks to years). This could include the construction period before initial opening.

**Construction Activities.** The set of actions that are taken to ready a building for an initial occupancy.

**Interruption to Normal Operations (System Shut Down Process).** The set of actions that should be taken to ready a building for an extended period of no or limited operations.

**Initial/Remedial/Full Flush.** Initial/Remedial/Full flushing is a one-time event intended to replace all the water in the system with fresh water from the water supplier to reduce the presence and/or risk of exposure to contaminants (i.e., turnover approach).

**Normal Operations.** The state of a building water system when the building is open and being used as intended. This includes the normal hours of operation and the number of people that occupy the building.

**Potable Water System.** A building water distribution system that provides hot or cold water intended for direct or indirect human contact or consumption.

**Process Flow Diagram.** A step by step drawing of a building water system that includes the location of all water processing steps – including, but not limited to, conditioning, storing, heating, cooling, recirculation, and distribution – that are part of the building water system.

**System Reopening.** The set of actions that should be taken to ready a building for normal operations after an extended period of no or limited operations.

**SUBSTANTIATION:**
The new section is being added to the UPC Appendix Q to address the safe operation, closure and reopening of building water systems. This proposal describes the general concerns and conditions as it relates to Legionella amplification. These sections are general in nature and will be utilized in the various proposals that follow. The definitions were added as these terms are needed for application and enforceability of the provisions.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  
**AFFIRMATIVE:** 25  **NOT RETURNED:** 1  Daniels
Q 402.0 Construction Activities.
Q 402.1 General. System opening is the set of actions that shall be taken to ready a building for normal operations after an extended period of no or limited operations. Systems that are being reopened after prolonged vacancy or partial vacancy shall comply with ASHRAE 188 and Section Q 402.0.
Q 402.2 Opening Process. The opening process of a building water system shall be in accordance with Section Q 402.2.1 through Section Q 402.6.
Q 402.2.1 Communication. An occupancy date and date of occupancy to all building occupants shall be determined and the steps required from maintenance staff shall be provided and available. The required steps shall provide instructions to occupants on how to avoid hazards and how to report concerns once building is occupied.
Q 402.2.2 Pre-Startup Inspection. The preparation of the documentation and pre-startup inspection shall be conducted by a qualified person or building owner designee. The required inspection shall include, but is not limited to, the following:
(1) Visually assessing the potable water system.
(2) Inspecting all components for the presence of contaminants and other adverse conditions.
(3) Checking that the equipment is working properly.
(4) Ensuring that records are complete.
Q 402.3 During Construction. The potable water system shall be left dry during construction until two weeks prior to occupancy.
Q 402.3.1 Water Fill Procedures. Wetted plumbing systems during construction shall comply with the following:
(1) Actions as described in Section Q 401.4 shall be performed in accordance with the water purveyor.
(2) Once acceptable water quality is verified, the cold and hot water distribution systems shall be filled with cold water. The required disinfectant at the percentage of plumbing fixtures shall be determined as required by the water management program.
Q 402.3.2 Flushing Procedure. Once the plumbing distribution system is filled with water, the following actions shall be taken until two weeks prior to occupancy:
(1) Remove aerators from all faucets and shower heads from all showers prior to commencing flushing.
(2) Turn on all water softeners, water filters, hot water recirculation pumps, etc. in accordance with the water management program. Water heaters shall remain off.
(3) The incoming water temperature and water temperature at plumbing fixtures shall be monitored and the following actions shall be taken:
(a) For parts of the building where the temperature is more than 75°F (24°C) (e.g., unconditioned), identify the temperature of incoming domestic cold water and flush 100 percent of domestic piping systems in these areas daily to maintain within 5°F (2.8°C) of incoming water temperature.
(b) For parts of the building where the temperature is 75°F (24°C) or less (e.g., wintered or conditioned), complete actions Q 402.3.2(4) through Section Q 402.3.2(6).
(4) Flush twice the storage volume of the piping in each area or zone of the building and each plumbing fixture.
(5) The water heater shall have at least 100 percent of water displaced every 7 days.
(6) Flush not less than 15 percent of all plumbing fixtures (hot and cold) per day. Every 7 days at least 100 percent of the building plumbing fixtures (hot and cold) shall be flushed.
**Q 402.3.3 Disinfectant Residual.** Not less than 5 percent and not more than 20 randomly selected plumbing fixtures shall be tested monthly for disinfectant residual. If residual is less than 0.2 ppm of chlorine or chloramine, the following actions shall be taken:

1. The water utility shall be contacted to open the fire hydrant near building. This shall be completed prior to completing any flushing inside the building.
2. Retest water after this step to determine if disinfectant residual is present.
3. If disinfectant residual is still low after repeating the steps above, a supplemental disinfection for the building potable water systems shall be installed.

**Q 402.4 Testing for Legionella.** For buildings with populations that are susceptible to Legionella, at least 5 percent but not more than 20 randomly selected plumbing fixtures shall be tested daily for Legionella.

**Q 402.5 Remedial/Full/Turnover-Approach Flush.** If a building under construction has water in it for more than one week without commencing any daily flushing protocols as indicated in Section 402.3.2, a remedial flush will be needed prior to commencing daily flushing. A remedial flush shall be conducted in the following manner:

1. Remove aerators from all faucets and shower heads from all showers prior to commencing flushing.
2. Turn on all water softeners, water filters, hot water recirculation pumps, etc. in accordance with the water management program. Water heaters shall remain off.
3. Systematically flush each main, branch, and fixture branch on the cold and hot water piping systems.
4. The water shall flow at a rate to scour the pipes at not less than 2 feet per second (ft/s) (0.6 m/s).
5. At least twice the storage volume of the cold and hot water piping in each area or zone of the building and each plumbing fixture shall be flushed. Continue flushing until the disinfectant residual target has been reached for both the cold and hot water.

**Q 402.4.1 Disinfection of Potable Water System.** The disinfection of the potable water systems shall be in accordance with Section 609.10. This procedure applies to hot and cold-water piping systems and shall be performed 7 days prior to opening. The water heater shall remain off.

**Q 402.4.2 Daily Flushing.** A flushing protocol as indicated in Section 402.3.2 shall be implemented. Fixtures that shall be tested monthly for disinfectant residual. If residual is less than 0.2 ppm of chlorine or chloramine, the following actions shall be taken:

1. Contact the water utility to open the fire hydrant near building. This shall be completed prior to completing any flushing inside the building.
2. Retest water after this step to determine if disinfectant residual is present.
3. If disinfectant residual is still low after repeating the steps above, a supplemental disinfection for the building potable water systems shall be installed.

**Q 402.4.4 Testing for Legionella.** For buildings with populations that are susceptible to legionella, test at least 10 randomly selected plumbing fixtures from each hot water system once for legionella. Samples shall be collected at least 2 per floor and shall be hot water. Where applicable, the following actions shall be taken:

1. Coordinate testing with laboratory to determine if expedited results can be provided. Considerations shall be made for utilizing rapid testing methods (qPCR) to supplement laboratory testing during this time.
2. Any further testing shall be dictated by time (extended beyond 2 weeks) or corrective actions. Fixtures that repeatedly test positively for legionella (greater than or equal to 1 CFU/mL) shall be flushed daily in accordance with the flushing protocol until opening. Continue testing these sites. Considerations shall be made for contacting a water treatment professional.
3. Where more than 30 percent of randomly selected sites continually test positive for Legionella (greater than or equal to 1 CFU/mL), a water treatment professional shall be contacted.

**Q 402.5 Hot Water System Start-Up.** The start-up of a water heater shall not be initiated until after the occupancy date has been confirmed and the cold and hot water disinfectant residual meets the requirements as outlined in Section Q 402.4.3 and Section Q 402.4.4 (if applicable). The water heater shall be turned on within one week prior to occupancy and shall be in accordance with the following:

1. Commission hot water system, verifying flow rates, temperatures, and hot water recirculation pumps are operating correctly.
2. The hot water system shall be balanced.
3. Confirm that all thermostatic mixing valves are operational and are not damaged/plugged.
4. Monitor supply and return water temperatures. The temperature shall be not less than 140°F (60°C) on the supply and 122°F (50°C) on the return. If the building owner is utilizing supplemental disinfection, the minimum supply and return temperatures shall be permitted to be lowered in accordance with water treatment professional and/or water management team approval.

**Q 402.6 Complete Installation.** The following installation requirements shall be verified:

1. Faucet aerators and shower heads shall be installed.
2. Hot water delivery times shall be confirmed that all hot water plumbing fixtures meet the manufacturer’s specifications.
SUBSTANTIATION:
The new section is being added to the UPC Appendix Q to address the safe opening of newly constructed building water systems. Flushing protocols have been added to reduce the risk of stagnant waters and microbiological activity amplification during construction. Current construction practices, by not flushing the water daily/weekly allows disinfectant to dissipate and microbiological activity to amplify. By either keeping plumbing systems completely dry or flushing regularly once water is introduced the goal is to minimize biofilm and pathogen growth that could become an issue for building occupants later. This is especially critical for facilities such as healthcare and hospitality facilities where Legionella cases tend to occur the most. Regular flushing of water allows water with dissipated disinfectant to be replaced with water that has disinfectant in it. Additionally, flushing the water lines helps remove the accumulation of sediment and heavy metals, which can reduce residual disinfectant or create health issues themselves. Finally, flushing helps mitigate the accumulation of biofilm in plumbing systems, reducing the potential of future “hosts” of waterborne pathogens. Similar to Section Q 405.0 (Vacant or Partially Occupied Buildings) where a building is shutdown, regular flushing can help reduce the risk of issues.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Q 403.0 Normal Operation.  
Q 403.1 General. System opening is the set of actions that shall be taken to ready a building for normal operations after an extended period of no or limited operations. Normal operation shall be when the state of a building water system is open and being used as intended. Systems that are being reopened after prolonged vacancy or partial vacancy shall comply with ASHRAE 188 and this section.

Q 403.2 Potable Water Supply. The potable water supply system shall include water that is satisfactory for drinking and culinary purposes, and that meets the requirements of the Authority Having Jurisdiction. For the purposes of this appendix, the potable water supply shall be from the meter to the points of use.

Section Q 403.0 shall apply to routine procedures during normal operation that work to maintain safe water qualities in building water systems and to avoid excessive water aging, and the harmful effects of waterborne pathogens. The required routine maintenance, inspection, flushing, and monitoring shall be the responsibility of the property owner unless otherwise required by the Authority Having Jurisdiction.

Q 403.3 Equipment Inspection. Equipment shall be inspected in accordance with the water management program and this Section. The equipment shall be serviced, repaired or replaced as needed. For the purposes of this appendix, equipment shall include, but not be limited to, the following:

(1) Water heaters
(2) Backflow preventers
(3) Water treatment equipment
(4) Other equipment connected at the entrance to the potable water supply system

Equipment in the mechanical room or the entrance to the building potable water supply system shall be checked for physical integrity and general function. Maintenance records shall be checked to confirm maintenance activities are up to date. Service contracts shall be checked to determine that regular service is being performed and that contractor recommendations are implemented. When maintenance is out of date, or a specific issue is identified, the equipment shall be maintained in accordance with the manufacturer’s instructions or the registered design professional’s requirements. Where the manufacturer’s instructions do not provide inspection and maintenance frequency, the potable water systems and components shall be inspected and maintained in accordance with Table Q 403.3.

Inspection, testing and maintenance records shall be maintained.
### TABLE Q 403.3
**MINIMUM POTABLE WATER SOURCE INSPECTION, TESTING AND MAINTENANCE FREQUENCY DURING NORMAL OPERATION**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MINIMUM FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect and verify water softeners and point-of-entry filtration devices are operational and maintaining minimum water quality requirements.</td>
<td>Follow manufacturer instructions.</td>
</tr>
<tr>
<td>Maintain water softeners and point-of-entry filtration devices.</td>
<td>As needed.</td>
</tr>
<tr>
<td>Inspect pumps and valves, and verify operation</td>
<td>After initial installation and every 3 months thereafter</td>
</tr>
<tr>
<td>Maintain pumps and valves</td>
<td>As needed.</td>
</tr>
<tr>
<td>Inspect water heaters or boiler</td>
<td>Every 3 months</td>
</tr>
<tr>
<td>Flush water heater under pressure until water runs clear</td>
<td>Every 12 months</td>
</tr>
<tr>
<td>Maintain water heaters</td>
<td>As needed</td>
</tr>
<tr>
<td>Inspect and test pressure type vacuum breaker, double check, reduce pressure principle backflow prevention devices and test</td>
<td>After initial installation or after any construction renovation or addition, and every 12 months thereafter</td>
</tr>
<tr>
<td>Repair and replace pressure type vacuum breaker, double check, reduce pressure principle backflow prevention devices and test</td>
<td>As needed</td>
</tr>
<tr>
<td>Inspect point-of-use filters and screens including drinking fountain, aerators, and bottle filling stations</td>
<td>Every 3 months</td>
</tr>
<tr>
<td>Clean filters and screens including aerators, drinking fountain and bottle filling stations; and replace</td>
<td>As needed</td>
</tr>
<tr>
<td>Inspect caution labels and markings</td>
<td>After initial installation and every 12 months thereafter</td>
</tr>
<tr>
<td>Replace caution labels and markings</td>
<td>As needed</td>
</tr>
<tr>
<td>Inspect and test eyewash stations and safety showers</td>
<td>At least weekly, in accordance with ISEA Z358.1, the Authority Having Jurisdiction, and the manufactures instructions.</td>
</tr>
<tr>
<td>If installed: Inspect and verify that supplemental disinfection systems are operational and maintaining minimum water quality requirements as determined by the Authority Having Jurisdiction</td>
<td>Follow manufacturer instructions, water treatment guidelines, and Authority Having Jurisdiction requirements</td>
</tr>
<tr>
<td>If installed: Maintain disinfection and water quality treatment devices and systems</td>
<td>As needed</td>
</tr>
</tbody>
</table>

**SUBSTANTIATION:**
The new section is being added to the UPC Appendix Q to address the safe operation of building water systems during normal operating conditions. This section gives a broad overview of procedures and practices to help reduce the risk of a Legionella outbreak.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee's understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  
AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 313
UPC 2024 Section: Q 403.4 – Q 403.4.5

SUBMITTER: Gary Klein
Self
Chair, Potable Water Working Group

RECOMMENDATION:
Add new text

**Q 403.4 Water Quality Monitoring.** The water quality monitoring of the potable water system shall be in accordance with Section Q 403.4.1 through Section Q 403.4.3.

**Q 403.4.1 Building Characterization.** The building types shall be as listed in ASHRAE 188 such as multiple housing units with a centralized water heater system, buildings over 10 stories with plumbing systems, chemotherapy patients, diabetes, and occupants over 65 years old.  

*Note:* Not all buildings are at equal risk for a waterborne pathogen outbreak, specifically Legionella species. The building types that are at highest risk typically encompass complex plumbing systems and/or have populations that are immuno-compromised.

**Q 403.4.2 Sample Protocol.** Samples shall be collected from the same fixture locations and in accordance with Section Q 403.4.3 using first-draw samples in accordance with Section Q 401.4.1(1) and long-draw samples in accordance with Section Q 401.4.1(2).

**Q 403.4.3 Location for Testing.** Testing locations shall be done at one hundred percent of all distal sites in a building over a given period in accordance with the water management program. A certain percentage of strategically selected plumbing fixtures shall be tested per sampling event. Some considerations in selecting locations shall include, but not be limited to, the following:

1. Test fixtures that are frequently, moderately, and rarely used.
2. Test sites that are near the building water entrance, sites that are hydraulically remote (i.e. distal sites), and those that are in between.
3. Locations that experience the least flow or have the highest-pressure loss through the piping system.

**Q 403.4.3.1 Disinfectant Residual Testing Locations.** The building owner shall establish routine monitoring sites as part of the water management program. To determine where to measure chlorine residuals in the building, an initial residual characterization survey shall be conducted in accordance with the following:

1. Measure and record disinfectant residuals at all locations where utility water enters the building(s).
2. Using the list of plumbing fixtures, as described in the water management program, measure and record the disinfectant residual of at least 5 percent of randomly selected faucets, lavatories, showers, drinking fountains, and ornamental fountains throughout the building for both hot and cold water.
3. Determine which plumbing fixture locations require first-draw or long-draw testing, as required in Section Q 401.4.1. Some locations may have both types of water draws.
4. These routine sites shall be chosen to include some sites that had:
   a. The lowest disinfectant residual.
   b. Serve sensitive users.
   c. That will be used for any ongoing microbial monitoring.

**Q 403.4.3.2 Temperature Testing Locations.** The building owner shall establish routine monitoring sites for temperature as part of the water management program. To determine where to measure these temperatures in the building, an initial temperature characterization survey shall be conducted in accordance with the following:

1. Measure and record temperature at all locations where utility water enters the building(s).
2. Using a list of plumbing fixtures (described in the water management program) measure and record the disinfectant residual of at least 5 percent of randomly selected faucets, lavatories, showers, drinking fountains, and ornamental fountains throughout the building for both hot and cold water.
3. The temperature characterization shall be done in conjunction with the disinfectant residual characterization.
(4) Hot water temperatures shall be measured exiting the water heater, exiting the master mixing valve, and if applicable on the hot water recirculation return pipe before entering the water heater.

Q 403.4.3.3 Legionella Testing Locations. For buildings with populations that are susceptible to Legionella, the building owner shall establish routine monitoring sites for Legionella as part of the water management program. To determine where to measure Legionella in the building, an initial characterization survey shall be conducted in accordance with the following:

1. Measure and record legionella (CFU/mL) at all locations where utility water enters the building(s).
2. Using a list of plumbing fixtures, as described in the water management program, measure and record legionella (CFU/mL) of at least 5 percent of randomly selected faucets, lavatories, showers, drinking fountains, and ornamental fountains throughout the building for both hot and cold water.
3. The legionella characterization shall be done in conjunction with the temperature and disinfectant residual characterizations.

Q 403.4.3.4 Supplemental Disinfectant Residual Testing Locations. For buildings that utilize supplemental disinfection technologies, the frequency and locations of testing shall comply with state, federal, and Authority Having Jurisdiction requirements.

Q 403.4.4 Monitoring Frequency. Monitoring and testing frequency shall be in accordance with Section Q 403.4.4.1 through Section Q 403.4.4.4.

Q 403.4.4.1 Disinfectant Residual Frequency. The building owner shall establish routine disinfectant monitoring frequencies as part of the water management program. Routine disinfectant monitoring frequencies shall be in accordance with the following:

1. Measure and record inlet disinfectant residuals as dictated by the water management program but no less than monthly. Adjust applicable control measures based on results.
2. Measure and record disinfectant residuals at the other routine sampling sites 3 days a week or the frequency determined by the water management program, whichever is more frequent. Select the sample time to account for changes in variation of the occupancy. Adjust applicable control measures based on results.
3. Consult with the Authority Having Jurisdiction for appropriate actions based on the result of testing.

Disinfectant residuals shall be maintained to prevent Legionella growth in hot and cold-water systems in accordance with ASHRAE 188, ASHRAE Guideline 12, and the Authority Having Jurisdiction.

Q 403.4.4.2 Temperature Monitoring Frequency. The owner shall establish routine temperature monitoring frequencies as part of the water management program. Routine disinfectant monitoring frequencies shall be in accordance with the following:

1. Measure and record inlet cold water temperature and hot water temperatures exiting the water heater, exiting the master mixing valve, and if applicable on the hot water recirculation return pipe before entering the water heater. This shall be done daily. Adjust applicable control measures based on results.
2. Measure and record the temperature of the cold and hot water at the same time, same location, and frequency as disinfectant residuals are measured. Adjust applicable control measures based on results.
3. Consult with the Authority Having Jurisdiction for appropriate actions based on the result of testing.

Water temperatures shall be maintained to prevent Legionella growth in hot and cold-water systems in accordance with ASHRAE 188, ASHRAE Guideline 12 and Appendix N of this code.

Q 403.4.4.3 Legionella Monitoring Frequency. For buildings with populations that are susceptible to Legionella, the owner shall establish routine Legionella monitoring frequencies as part of the water management program. Routine Legionella monitoring frequencies shall be in accordance with the following:

1. Measure and record every month for the first year. Adjust applicable control measures based on results.
2. Re-evaluate monthly and adjust monitoring frequency based on facility risk assessment and results.
3. Consult with the Authority Having Jurisdiction for appropriate actions based on the result of testing.

Q 403.4.4.4 Supplemental Disinfection Monitoring Frequency. For buildings that utilize supplemental disinfection technologies, the frequency and locations of testing shall comply with state, federal, and the Authority Having Jurisdiction requirements.

Q 403.4.5 Routine Flushing (Normal Operations). Flushing during normal operations shall comply with ASHRAE 188, CDC guidelines, and the building water management program. Flushing considerations shall be made for the following:

1. Flush fixtures that are frequently, moderately, and rarely used.
2. Flush sites that are near the building water entrance, sites that are hydraulically remote (i.e., distal sites), and those that are in between.
3. Locations that experience the least flow or have the highest-pressure loss through the piping system.

SUBSTANTIATION:
The new section is being added to the UPC Appendix Q to address the safe operation of building water systems during normal operating conditions. This section gives better definition to the criteria that should be considered as part of a water management program and the frequency and location of control measures.

COMMITTEE ACTION: REJECT
COMMITTEE STATEMENT:
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee's understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25   NOT RETURNED: 1   Daniels
Proposals

Item #: 314
UPC 2024  Section: Q 403.4.6, Table Q 403.4.6

SUBMITTER: Gary Klein
Self
Chair, Potable Water Working Group

RECOMMENDATION:
Add new text

**Q 403.4.6 Summary of Location and Frequency of Monitoring.** The suggested minimum frequency and locations of monitoring for water quality shall be in accordance with Table Q 403.4.6.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MINIMUM FREQUENCY</th>
<th>SAMPLE AT BUILDING ENTRANCE</th>
<th>SAMPLE AT RANDOMLY SELECTED PLUMBING FIXTURES (INCLUDING DISTAL SITES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disinfectant residuals</td>
<td>Monthly</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Water Temperature (hot and cold)</td>
<td>Weekly</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Legionella</td>
<td>Monthly</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Additional Water Quality Considerations for Improved Control (Not Required)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPC</td>
<td>Quarterly</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Total Suspended Solids (TSS)</td>
<td>Monthly</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>pH</td>
<td>Monthly</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>DBP</td>
<td>Monthly</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Corrosion Inhibitors</td>
<td>Quarterly</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Additional Water Treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplemental Disinfection (If added to building)</td>
<td>In accordance with Authority Having Jurisdiction</td>
<td>In accordance with Authority Having Jurisdiction</td>
<td>In accordance with Authority Having Jurisdiction</td>
</tr>
</tbody>
</table>

**Notes:**

1. Frequencies are based on good results. When unacceptable results are found, seek guidance from the Authority Having Jurisdiction.
2. The target setpoints are based on the water management program.
3. Testing may be performed more frequently than noted above. At a minimum, the testing frequency noted in the table above shall be performed with the laboratories and methods as noted in this appendix.
4. Required only if building population is susceptible to Legionella. If not, then this shall be considered an “Additional Water Quality Considerations for Improved Control” (Not Required) in accordance with Table Q 403.4.6.
5. Also consider sampling near central water heater or hydronic equipment to help determine impact on energy usage.
SUBSTANTIATION:
The new section is being added to the UPC Appendix Q to address the safe operation of building water systems during normal operating conditions. This section summarizes the information in new proposed Section Q 403.4 (Water Quality Monitoring).

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25

NOT RETURNED: 1 Daniels
Q 404.0 Interruption to Normal Operation-System Shutdown Process.

Q 404.1 General. Interruption to normal operations (system shutdown Process) shall be the set of actions that is taken to ready a building for an extended period of no or limited operations. Systems that are being shutdown shall comply with ASHRAE 188 and Section Q 404.0.

Q 404.2 Communication. An announcement of a planned shutdown date of shall be provided to all building occupants with clear communication on what steps maintenance staff will take. The announcement shall include if shut down will be a complete or a partial shutdown.

Q 404.3 Shutdown. System shutdown shall be completed by shutting down the entire system or portions of a system in accordance with Section Q 404.3.1 or Section Q 404.3.2.

Q 404.3.1 Complete Shutdown. During complete shutdown, the building shall be occupied by only maintenance personnel or shall not be occupied. The following actions shall be considered to shut down building water system completely:

(1) Limit use of potable water to one bathroom nearest the building water service entrance.
(2) Turn off water heater, and flush water heater to displace a minimum of 100 percent of water volume in tank. Flush tank under pressure to remove as much biofilm/scale/build-up within tank as possible.
(3) Keep hot water recirculation pump on to circulate non-heater hot water.
(4) Keep any water softener, water filtration device, and any supplemental disinfection equipment on.
(5) Leave booster pump system operational.
(6) Leave all domestic water systems fully pressurized.

Q 404.3.2 Limited Operations-Partial Shutdown. Limited operation shall be when portions of the building are occupied while other portions of the building become unoccupied. Where the majority of the building is unoccupied, but some portion of a building is open to the public or non-staff occupants, the building shall be considered partially occupied.

Note: Partially occupied buildings present one of the greatest challenges to public health and safety, and owners should proceed very carefully when operating their buildings in this manner. The following actions shall be considered to partially shut down building water system:

(1) Limit use of potable water by public or occupants to designated areas only that have regular usage.
(2) Do not isolate one side of the building from the other, all domestic water equipment should remain fully operational.

Q 404.4 Shutdown Testing and Inspection. The shutdown testing and inspection of the building water supply shall be in accordance with Section Q 404.4.1 through Section Q 404.4.3.

Q 404.4.1 System Inspection. On shutdown date, the potable water system shall be inspected in its entirety.

Q 404.4.2 System Documentation. Detailed records of all procedures, actions performed, and test results shall be kept. As-Built drawings of entire system including plans and diagrams shall be obtained. Where as-built drawings are not available, one shall be developed by a registered design professional including the following:

(1) The volume of entire water system including each fixture branch.
(2) The flushing times for the building in its entirety and each individual fixture.
Q 404.4.3 Baseline Test. Water samples from approximately 10 percent of plumbing fixtures and baseline values shall be determined for not less than the following:
(1) Incoming water disinfectant residual
(2) Incoming Legionella positivity
(3) Incoming water turbidity
(4) Ten percent of plumbing fixtures for Legionella positivity

SUBSTANTIATION:
The new section is being added to the UPC Appendix Q to address the safe closure of building water systems. This section was added to specifically indicate the specific set of actions to prepare a building for an extended period of time where a building is either fully or partially vacant. These actions prepare the building in a manner to be more easily maintained, as outlined in new proposed Section Q 405.0.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
**Q 405.0 Vacant or Partially Occupied Buildings.**

**Q 405.1 General.** Buildings shall be considered vacant or partially occupied (system is shutdown) when the building is closed and not in use (vacant) or major portions of the building water system are not in use (partially occupied). This includes the off hours of operation and buildings that are shut down for long periods of time (weeks to years). Systems that are being shutdown shall comply with ASHRAE 188 and Section 405.0.

**Note:** A building may also be considered vacant or partially occupied during the construction period before initial opening.

**Q 405.2 Shutdown.** System shutdown shall occur by shutting down the entire system or portions of a system.

**Q 405.2.1 Complete Shutdown.** Complete shutdown shall be when no one occupies the building other than maintenance personnel. The following protocols and actions shall be taken during complete shutdown:

1. Limit the use of potable water to one bathroom nearest the building water service entrance.
2. Remove aerators from all other faucets and shower heads from all other showers prior to commencing flushing.
3. Turn on or leave on all water softeners, water filters, hot water recirculation pumps, and other similar equipment in accordance with the water management program. Water heaters shall remain off.
4. Monitor incoming water temperature and water temperature at plumbing fixtures. Take the following actions:
   a. For parts of the building where the temperature is above 75°F (24°C) (e.g., unconditioned), identify temperature of incoming domestic cold water, and flush 100 percent of domestic piping systems in these areas daily to maintain within 5°F (2.8°C) of incoming water temperature.
   b. For parts of the building where the temperature is less than or equal to 75°F (24°C) (e.g., wintered or conditioned), complete actions required in Section Q 405.2.1(5) through Section Q 405.2.1(7).
5. Flush twice the storage volume of the piping in each area or zone of the building and each plumbing fixture.
6. The water heater shall still be off and pressurized. The water heater shall have at least 100 percent of water displaced every 7 days.
7. Flush 15 percent of all plumbing fixtures (hot and cold) per day, every 7 days. At least 100 percent of the building plumbing fixtures (hot and cold) shall be flushed.

**Q 405.2.2 Partial Shutdown.** Partial shutdown shall be when portions of the building are occupied while other portions of the building become unoccupied. Where the majority of the building is unoccupied, but some portion of a building is open to the public or non-staff occupants, the building shall be considered partially occupied.

**Note:** Partially occupied buildings present one of the greatest challenges to public health and safety, and owners should proceed very carefully when operating their buildings in this manner.

The following protocols and actions shall be considered during partial shutdown:

1. The building owner shall identify what normal water usage was prior to partial-shutdown and complete a daily flush to simulate typical daily water usage.
2. Limit the use of potable water by public or occupants to designated areas only that have regular usage.
3. Remove aerators from all faucets and shower heads from all showers prior to commencing flushing.
4. Test incoming water for disinfectant residual. If residual reduces from baseline, as measured in Q 404.4.3, or reduces to less than 0.2 ppm of chlorine or chloramine, the following actions shall be taken:
   a. Contact water purveyor to determine the scope of the problem.
   b. Coordinate with water purveyor to determine if they can open fire hydrant near building. This shall be completed prior to completing any flushing inside the building.
(c) Retest water after this step to determine if disinfectant residual is present.

(d) If disinfectant residual is still low after repeating steps in Section Q 405.2.2(1) through Section Q 405.2.2(4), consider installation of a supplemental disinfection for the building potable water systems.

(5) Monitor incoming water temperature and water temperature at plumbing fixtures in accordance with the following actions:

(a) If the building temperature is above 75°F (24°C) (unconditioned), identify temperature of incoming domestic cold water and flush all domestic piping system daily to maintain within 5°F (2.8°C) of incoming water temperature and complete actions as required in Section Q 405.2.2(6) through Section Q 405.2.2(8).

(b) If the building temperature is less than or equal to 75°F (24°C) (wintered, conditioned), complete actions as required in Section Q 405.2.2(6) through Section Q 405.2.2(8).

(6) Flush twice the storage volume of the piping in each area or zone of the building and each plumbing fixture.

(7) Flush 15 percent of all plumbing fixtures (hot and cold) per day; every 7 days. At least 100 percent of the building plumbing fixtures (hot and cold) shall be flushed.

(8) Mimic normal occupation with building flushing.

**Q 405.2.3 Disinfectant Residual.** Testing for disinfectant residual shall be completed at not less than 5 percent and not more than 20 randomly selected plumbing fixtures monthly. If residual reduces from baseline, in accordance with Section Q 404.4.3, or reduces to less than 0.2 ppm of chlorine or chloramine the following actions shall be taken:

(1) Contact the water utility to open the fire hydrant near building. This shall be completed prior to completing any flushing inside the building.

(2) Retest water after this step to determine if disinfectant residual is present.

(3) If disinfectant residual is still low after repeating steps in Section Q 405.2.3(1) and Section Q 405.2.3(2), considerations shall be made for installing a supplemental disinfection for the building potable water systems.

**Q 405.2.4 Legionella Testing.** For buildings with populations that are susceptible to legionella, there shall be test at least 5 percent, but not more than 20 randomly selected plumbing fixtures monthly for legionella.

**Q 405.2.5 Remedial/Full/Turnover-Approach Flush.** If a building is shutdown or partially shut down for more than one week without commencing any daily flushing protocols, as required in Section Q 405.2.1 or Q 405.2.2, a remedial flush shall be applied prior to commencing daily flushing. A remedial flush shall be conducted in accordance with the following:

(1) Remove aerators from all faucets and shower heads from all showers prior to commencing flushing.

(2) Turn on all water softeners, water filters, hot water recirculation pumps, etc. in accordance with the water management program. Water heaters shall remain off.

(3) Systematically flush each main, branch, and fixture branch on the cold and hot water piping systems.

(4) The water shall flow at a rate of not less than 2 feet per second (ft/s) (0.6 m/s) to scour the pipes.

(5) Not less than twice the storage volume of the cold and hot water piping in each area or zone of the building and each plumbing fixture shall be flushed. Continue flushing until the disinfectant residual target has been reached for both the cold and hot water.

**Q 405.3 Flushing Concept.** Flushing while a building is vacant or partially occupied (system is shutdown) shall be done in accordance with Section Q 405.3.1 through Section Q 405.3.4.

**Q 405.3.1 Flushing Protocol.** The flushing of stagnant water of the cold-water system and hot water system shall be conducted for the building water system by turning over the water system through regular use and/or flushing. Faucets, showers, and other distal sites shall be opened to replace water within the building plumbing with fresh water. The flushing method used shall be done in accordance with one of the following methods:

(a) The plume-method using the flush method in accordance with Section Q 405.3.2.

(b) The longest-pull method using the flush method in accordance with Section Q 405.3.3.

**Note:** Flushing (duration, frequency, and repetition) overall has not been validated to prevent/remove WBPs and needs to be determined at the facility-specific level. What amount/level of flushing works for one building may not work for a larger or smaller or more complex building. Consult with the water management team, professional engineer, water treatment professional, or other water/plumbing consultant would be beneficial to determine how well the flushing is working. Additionally, collecting samples of water validation will be needed to verify effectiveness of flushing protocols.

**Q 405.3.2 Plume Method.** The plume method shall be the flushing protocol that proceeds from the service line toward locations farther from the point of entry.

**Note:** The “plume” of water with disinfection is slowly drawn further and further into the building, going from the water service entrance gradually to the furthest distal site.

**Example:** A flushing protocol that pulls water from the ground level, then to the 1st floor, then to the 2nd floor, then to the 3rd floor, and finally to the 4th floor. The flushing protocol shall start on the basement or lowest level of the building at the fixture closest to the incoming flow of water.

**Note:** This will flush the water service line(s), bring fresh utility water into the building and completely flush the hot water system. Utility sink or floor sink faucets, such as those found in basements or janitor closets, typically have higher flow rates to facilitate the fast filling of buckets, etc. This makes them ideal for beginning the flushing process. If a service sink or floor sink is not available, go to the sink.

**Q 405.3.3 Longest-Pull Method.** The longest-pull method shall be the flushing protocol that attempts to pull water from water service entrance directly to furthest distal site.
Note: This is typically done by instituting a longer flush time at the furthest fixture, in order to displace 100 percent of the water in between. Each area between the water service entrance and furthest distal site is flushed at shorter intervals, thereby pulling water with disinfectant residual from the replenished mains.

Example: A flushing protocol that pulls water from the ground level and then proceeds to flush for a longer time the 4th floor. Once this step is complete, flushing occurs at the 2nd and 3rd floor in no particular order.

The flushing protocol shall start on the basement or lowest level of the building at the fixture closest to the incoming flow of water.

Note: This will flush the water service line(s), bring fresh utility water into the building and completely flush the hot water system. Utility sink or floor sink faucets, such as those found in basements or janitor closets, typically have higher flow rates to facilitate the fast filling of buckets, etc. This makes them ideal for beginning the flushing process. If a service sink or floor sink is not available, go to the sink.

Q 405.3.4 Hybrid Method. The hybrid method shall be when the flushing protocol includes any combination of the plume- or longest-pull-methods.

Q 405.4 Flushing Concerns. The following shall be considered when conducting the flushing protocol:

(1) Do not open 100 percent of plumbing fixtures within a building or area of the building when flushing.

Note: This will exceed the design parameters (i.e., Hunter’s Curve) value of the building and could lead to siphoning of the water within the building.

(2) Contact the sewer provider for the building prior to flushing as water with high concentrations of disinfectant in it could create issues at the wastewater treatment plant.

(3) Buildings with a dedicated place to fill water bottles or drinking fountains shall consider making those devices inoperable and placing signage prohibiting public from utilizing devices.

(4) Steps shall be taken to maintain a fluid trap seal on drain waste and vent system. Verify that trap primers are operable and that traps that are served by trap primers (particularly pressure-differential trap primers) are not caused to be inoperable with flushing protocol.

(a) Sewer gases, floor drains and traps: If an overwhelming smell of sewer gas is detected in the building or when entering bathrooms that have been unused for long periods of time, the floor traps or fixture traps shall be checked to determine if they have run dry. If high concentrations of sewer gases are suspected in the building, the building shall be evacuated, and the local fire department shall be contacted to assess the condition.

(b) The plumbing system shall be checked to ensure there no dry traps. The building shall be inspected. Clean water shall be poured into floor drains and sinks to fully restore trap seals.

Note: Any dry trap provides a potential pathway for exposure to the virus and other harmful microorganisms to spread.

(1) The drainage system shall be checked for blockages prior to initiating the flushing process. A room shall not be left unattended while the flushing process is ongoing.

(2) When flushing urinals, consider covering the urinal with a plastic bag to trap aerosols if numerous, repetitive flush activations are required.

SUBSTANTIATION:
The new section is being added to the UPC Appendix Q to address the safe closure and reopening of building water systems. This new proposed Section Q 405.0 (Vacant or Partially Occupied Buildings), addresses the actions a building should take during extended partial or full vacancy to prevent the amplification of waterborne pathogen and the deterioration of water quality. Regular flushing of water allows water with dissipated disinfectant to be replaced with water that has disinfectant in it. Additionally, flushing the water lines helps remove the accumulation of sediment and heavy metals, which can reduce residual disinfectant or create health issues themselves. Finally, flushing helps mitigate the accumulation of biofilm in plumbing systems, reducing the potential of future “hosts” of waterborne pathogens. Similar to Section Q 402.0 (Construction Activities), regular flushing during extended shutdown can help reduce the risk of future issues.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 317
UPC 2024 Section: Q 405.5 – Q 405.6.2.2

SUBMITTER: Gary Klein
Self
Chair, Potable Water Working Group

RECOMMENDATION:
Add new text

Q 405.5 Flushing Consideration. Flushing considerations when the building is vacant or partially shutdown (system is shutdown) shall be in accordance with Section Q 405.5.1 through Section Q 405.5.4.

Q 405.5.1 Flushing Times and Cycle. Stagnant water shall be removed from potable water supply lines. A registered design professional or plumbing professional shall be consulted to determine the number of flushes and flush times required to remove the stagnant water from the water supply lines.

Q 405.5.2 Faucet Flushing. When flushing faucets, the faucet aerator shall be removed, where applicable. The flushing shall be done as follows:
(1) Open the sink faucet’s cold-water valve first to the highest flow rate possible without creating excessive splashing.
(2) Ensure that the sink drain can handle the flow of water without backing up and overflowing the sink. Using a digital thermometer to check water temperature, flush until the water temperature stabilizes.
(3) Turn off the cold valve and repeat the above process with the hot water valve.
(4) Flush the hot water system until the temperature reaches the same temperature as the cold water.
Note: This may take considerably longer depending on the volume of water in the hot water system.
(5) Clean and replace the faucet aerator.

Q 405.5.3 Bathroom-Group, Plumbing Fixture Flushing. When flushing bathroom-groups, the following flushing protocol shall be conducted:
(1) Flush toilet and urinal supply lines first, where applicable. Start with the fixture that is farthest away from the incoming flow of water and work back towards the incoming flow of water. The stagnant water shall be removed from the potable water supply lines. A registered design professional or plumbing professional shall be consulted to determine the number of flushes required to remove the stagnant water from the water supply lines.

The water lines servicing toilets or water closets can be flushed without excessive repetitive flush activations.
Note: The water closet tank flapper can be removed or the flushometer-valve can be temporarily disabled to provide for a run-on condition. This will flush cold water lines directly into the sanitary drain quickly and efficiently, and will also reduce the generation of aerosols. It is not recommended to put flushometer-valves servicing urinals into a run-on condition due to small trap diameters in urinal fixtures which could result in overflows. Consult manufacturer to determine if this is an option.
(1) Using the appropriate tool, the aerator from faucets shall be removed. The flushing shall be done as follows:
(a) Flush the cold water. Ensure that the sink drain can handle the flow of water without backing up and overflowing the sink.
(b) Using a digital thermometer, the water temperature shall be checked. Flush until the water temperature stabilizes.
(c) The hot water line shall be flushed using the same process in Section 405.5.3(2)(a) and Section 405.5.3(2)(b).
(d) Test for residual chlorine. Using an approved chlorine testing device, check for the presence of residual chlorine at several bathroom locations. The location farthest away from the incoming flow of water shall be tested. Additional flushing shall be required until a chlorine residual is determined at all outlets. If, after additional flushing, residual chlorine is still not present, the water utility shall be contacted to report the lack of residual chlorine in the building after extensive flushing. The required chlorine levels and any remedies shall be in accordance with the Authority Having Jurisdiction.
(e) Clean and replace aerators. Remove, clean, and replace showerheads. Check all fixtures for proper functionality.
(f) After flushing, ensure that the presence of residual chlorine has been verified at the fixtures farthest away from the incoming flow of water. Where residual chlorine is not verified, additional flushing of those fixtures shall be required.
(g) Water cooler/fountain filters and aerators shall be cleaned.

**Note:** Any disruption of supply pressure that may have occurred while the building was shut down can dislodge particulates, including lead, which can get trapped in aerators and filters, spiking lead levels and reducing water quality.

**Q 405.5.4 Water Treatment Systems and Drinking Water Filters.** Where there are water treatment or filtration products used in the plumbing system, such systems shall be regenerated, flushed, or require filter replacement. The flushing and disinfection shall be done in accordance with the manufacturer’s instructions.

Water lines shall be flushed, and the filters shall be cleaned leading to coffee makers, ice makers, dishwashers, clothes washing machines, and water fountains/coolers.

**Note:** Clean coffee makers and ice makers and run for a minimum of three cycles, discarding the water and ice. Contact the manufacturers of carbonated beverage machines and follow their flushing and disinfection instructions. In hair salons, special care should be taken to thoroughly flush and clean hand-held showerheads and hoses. All outdoor utilities and hose bibs should also be flushed.

**Q 405.6 Flushing Consideration-Various Plumbing Distribution Types.** Flushing procedures consideration when the building is vacant or partially shutdown (system is shutdown) for various premise plumbing system distribution types shall be in accordance with Section Q 405.6.1 and Section Q 405.6.2.

**Q 405.6.1 Horizontal Distribution Systems.** Horizontal distribution systems shall be flushed in accordance with the following:

1. Flush furthest ends of water system on ground floor.
2. Upon completion of first floor flush, continue flushing the furthest point on each floor to the highest floor.

**Q 405.6.2 Vertical Distribution Systems.** Flushing considerations for simple and complex vertical distribution systems shall be in accordance with Section Q 405.6.2.1 and Section Q 405.6.2.2.

**Q 405.6.2.1 Simple Vertical Distribution.** Simple vertical distribution systems shall be flushed in accordance with the following:

1. Flush furthest ends of water system on ground floor.
2. Upon completion of first floor flush, flushing the furthest point on the highest floor that is also the furthest horizontal distance from the mechanical room.

**Q 405.6.2.2 Complex Vertical Distribution.** Complex vertical distribution systems shall be flushed in accordance with the following:

1. **Top Feed:**
   (a) Flush the furthest room and most hydraulically remote location on each lateral branch.
   (b) Flush the furthest point on each vertical stack (not express main) on floors below distribution floor.
   (c) Utilize programmable faucets with a flushing protocol available to assist.
2. **Bottom Feed:**
   (a) Flush the furthest room and most hydraulically remote location on each lateral branch.
   (b) Flush the furthest point on each vertical stack (not express main) on floors above distribution floor.
   (c) Utilize programmable faucets with a flushing protocol available to assist.

**SUBSTANTIATION:**
The new section is being added to the UPC Appendix Q to address the safe closure and reopening of building water systems. Proposed Section Q 405.5 (Flushing Consideration), is in addition to Section Q 405.0 (Vacant or Partially Occupied Buildings), and addresses some of the additional considerations owners shall take to reduce the risk of health issues stemming from water distribution systems. This section also helps provide further considerations for various types of common distribution systems (although not all distribution system types) to give further detailed explanation.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** **AFFIRMATIVE:** 25  **NOT RETURNED:** 1  Daniels
Proposals

Item #: 318

UPC 2024  Section: Q 406.0 – Q 406.3.3

SUBMITTER:  Gary Klein
   Self
   Chair, Potable Water Working Group

RECOMMENDATION:
Add new text

**Q 406.0 System Reopening.**
**Q 406.1 General.** System reopening shall be the set of actions taken to ready a building for normal operations after an extended period of no or limited operations. Systems that are being reopened after prolonged vacancy or partial vacancy shall comply with ASHRAE 188 and Section Q 406.0.

**Q 406.2 Testing.** The incoming water to the building shall be tested to determine disinfectant residual and waterborne pathogen (e.g., legionella) concentrations. The testing results shall be compared against baseline measurements.

**Q 406.3 Reopening Process.** The reopening process of the potable water supply systems shall be in accordance with Section Q 406.3.1 through Section Q 406.3.6.

**Q 406.3.1 Communication.** An occupancy date shall be determined and communicated to all building occupants. Clear communication for requirements of maintenance staff shall be provided. Clear instructions shall be provided to occupants for avoiding hazards and reporting concerns once the building is occupied.

**Q 406.3.2 Pre-Startup Inspection.** The following pre-startup inspection shall be done by a qualified person and shall include the following:
(1) Visually assessing the potable water system;
(2) Inspecting all components for the presence of contaminants and other adverse conditions;
(3) Checking that the equipment is working properly; and
(4) Ensuring that records are complete.

**Q 406.3.3 Disinfection.** New or repaired potable water systems shall be disinfected in accordance with Section 619.0. This procedure shall apply to the hot and cold-water piping systems and shall be performed 7 days prior to reopening. The water heater shall remain off.

SUBSTANTIATION:
The new section is being added to the UPC Appendix Q to address the safe reopening of building water systems after prolonged partial or full vacancy. The actions listed in the first part of Section Q 406.0 (System Reopening) are the general criteria that building owners are to take.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee's understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Item #: 319

UPC 2024  Section: Q 406.3.4 – Q 406.3.6

SUBMITTER: Gary Klein
Self
Chair, Potable Water Working Group

RECOMMENDATION:
Add new text

Q 406.3.4 Two Weeks of Reopening. The following testing protocol shall be done within two weeks of reopening,
Q 406.3.4.1 Daily Flushing. Implement flushing protocol as indicated in accordance with Section Q 405.2.1 or Section
Q 405.2.2.
Q 406.3.4.2 Testing for Chlorine. Test at least 5 percent and not more than 20 randomly selected plumbing fixtures
monthly for disinfectant residual. If residual reduces from baseline in accordance with Section Q 404.4.3, or is less than
0.2 ppm of chlorine or chloramine, the following actions shall be taken:
(1) Contact the water utility to open the fire hydrant near building. This shall be completed prior to completing any
flushing inside the building,
(2) Retest water after this step to determine if disinfectant residual is present,
(3) If disinfectant residual is still low after repeating the steps above, install a supplemental disinfection for the building
potable water systems.
Q 406.3.4.3 Testing for Legionella. For buildings with populations that are susceptible to Legionella, at least 5 percent
but no more than 20 randomly selected plumbing fixtures shall be tested daily for legionella. Where applicable, the
following actions shall be taken:
(1) Coordinate testing with laboratory to determine if expedited results can be provided. Considerations shall be made
for utilizing rapid testing methods (qPCR) to supplement laboratory testing during this time.
(2) Any further testing shall be dictated by time (extended beyond 2 weeks) or corrective actions. Fixtures that
repeatedly test positively for legionella (greater than or equal to 1 CFU/mL) shall be flushed daily in accordance with the
flushing protocol until opening. Testing shall be continued at these sites. Considerations shall be made for contacting a
water treatment professional.
(3) Where more than 30 percent of randomly selected sites continually test positive for Legionella (greater than or equal
to 1 CFU/mL), a water treatment professional shall be contacted.
Note: Initial re-occupancy date may need to be rescheduled or certain areas of the building may need to have restricted
access.
Q 406.3.5 Hot Water System Start-Up. Where applicable, the start-up of a water heater shall not be initiated until after
the occupancy date has been confirmed and the cold and hot water disinfectant residual meets the requirements of
Section Q 406.3.4.2 and Section Q 406.3.4.3. The water heater shall be turned on within one week prior to occupancy.
The start-up of a water heater shall be completed in accordance with the following:
(1) Recommission the hot water system. Verify the flow rates, temperatures, and hot water recirculation pumps are
operating correctly.
(2) The hot water system shall be rebalanced where necessary.
(3) Confirm that all thermostatic mixing valves are operational and are not damaged/plugged.
(4) Monitor supply and return water temperatures. The temperature shall be not less 140°F (60°C) on the supply and
122°F (50°C) on the return. If the building owner is utilizing supplemental disinfection, the minimum supply and return
temperatures shall be permitted to be lowered in accordance with the water treatment professional and/or water
management team approval.
Q 406.3.6 Complete Reopening. Complete reopening shall be in accordance with the following:
(1) Faucet aerators and shower heads that were removed during the shutdown process shall be reinstalled.
(2) Confirm hot water delivery times at all hot water plumbing fixtures meet specifications throughout building.
SUBSTANTIATION:
The new section is being added to the UPC Appendix Q to address the safe reopening of building water systems after prolonged partial or full vacancy. The actions listed in the second part of Section Q 406.0 are the more specific criteria that building owners are to take within two weeks of reopening. This includes flushing and testing of water to verify that incoming and building water criteria meets minimum requirements and turning on and recommissioning the hot water system (if applicable).

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

TOTAL ELIGIBLE TO VOTE: 26
VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 320
UPC 2024  Section: Q 501.0 – Q 502.2, Table Q 502.2

SUBMITTER: Ramiro Mata
Self
Chair, Nonpotable Water Working Group

RECOMMENDATION:
Add new text


Q 501.0 Nonpotable Water Systems.
Q 501.1 General. Section Q 501.0 through Section Q 504.0 shall apply to the continuous maintenance (normal operation), interruption to normal operation (system shutdown), and reopening of the nonpotable water system. For the purposes of Part III of this appendix, alternate water sources apply to nonpotable water applications. Closed systems shall be systems that are not open to atmosphere and do not require a supply or replenishment of water. Open systems shall be systems that are open to atmosphere or require a supply or replenishment of water.

Q 502.0 Normal Operation.
Q 502.1 General. Non-potable water shall include, but not be limited to, gray water, on-site treated nonpotable water, rainwater, process water and reclaimed water. Section Q 502.2 through Section Q 502.4 shall apply to alternate water source other than rainwater catchment system. Rainwater catchment systems shall comply with Section Q 502.5 through Section Q 502.5.5.
Q 502.2 Equipment Inspection. Equipment shall be checked for physical integrity and general function. Maintenance records shall be checked to confirm maintenance activities are up to date. Service contracts shall be checked to determine that regular service is being performed and that contractor recommendations are implemented. When maintenance is out of date, or specific issue is identified, the equipment shall be maintained in accordance with the manufacturer’s instructions or the registered design professional’s requirements. Where the manufacturer’s instructions do not provide inspection and maintenance frequency, the nonpotable water systems and components shall be inspected and maintained. The alternate water source testing, inspection and maintenance frequency shall be performed in accordance with Table Q 502.2.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MINIMUM FREQUENCY-OPEN SYSTEM</th>
<th>MINIMUM FREQUENCY-CLOSED SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect and clean filters and screens, and replace (if necessary)</td>
<td>Monthly</td>
<td>Every 3 months</td>
</tr>
<tr>
<td>Inspect and verify that disinfection, filters and water quality treatment devices and systems are operational and maintaining minimum water quality requirements as determined by the Authority Having Jurisdiction</td>
<td>In accordance with manufacturer’s instructions, and the Authority Having Jurisdiction</td>
<td>In accordance with manufacturer’s instructions, and the Authority Having Jurisdiction</td>
</tr>
<tr>
<td>Inspect pumps and verify operation</td>
<td>After initial installation and every 3 months thereafter</td>
<td>After initial installation and every 12 months thereafter</td>
</tr>
<tr>
<td>Inspect valves and verify operation</td>
<td>After initial installation and every 3 months thereafter</td>
<td>After initial installation and every 12 months thereafter</td>
</tr>
</tbody>
</table>
Clear debris from and inspect storage tanks, locking devices, and verify operation

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
</tr>
</thead>
</table>
| After initial installation and every 12 months thereafter

Inspect caution labels and marking

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
</tr>
</thead>
</table>
| After initial installation and every 12 months thereafter

Inspect and maintain mulch basins for gray water irrigation systems

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
</tr>
</thead>
</table>
| As needed to maintain mulch depth and prevent ponding and runoff

Cross-connection inspection and test*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
</tr>
</thead>
</table>
| After initial installation and every 12 months thereafter

* The cross-connection test shall be performed in the presence of the Authority Having Jurisdiction in accordance with the requirements of this code.

SUBSTANTIATION:
With buildings are being shutdown, or in low use as a response to COVID-19, the need to establish minimum requirements for managing building water systems to mitigate health effects to building occupants has become critically important. Understandably, potable water systems are the primary focus in this effort. However, nonpotable water systems such as water features, cooling and produce sprays, and rainwater catchment systems, may also pose a significant risk to building occupants. Although there have been several published guidance to address building shutdowns, all are focused on the potable water system. This proposal is intended to be used by building owners and managers as a resource to safely operate and manage nonpotable water systems and by local jurisdictions as a tool to establish and enforce minimum requirements for nonpotable water systems during normal operation, building shutdowns and building re-openings. Except for the rainwater catchment system requirements which were derived from existing language in the UPC, requirements for nonpotable water systems were derived using potable water system requirements as a starting point.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee's understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 321
UPC 2024  Section: Q 502.3 – Q 502.5.3, Table Q 502.5.3

SUBMITTER: Ramiro Mata
Self
Chair, Nonpotable Water Working Group

RECOMMENDATION:
Add new text

Q 502.3 Water Quality Monitoring. The maintenance procedures shall be followed to maintain the minimum water quality of the nonpotable water system. The minimum water quality for nonpotable water systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction or the registered design professional’s requirements as approved by the Authority Having Jurisdiction.
Water quality shall be checked at the following:
The most distant point in the nonpotable water distribution system
In areas that are known to be low or no-use
Before and after any water treatment and filtration system
Storage tanks or vessels

Q 502.4 Routine Flushing. The nonpotable water system shall be routinely flushed as required by the Authority Having Jurisdiction for bacterial control and to meet the water quality as stated in Section Q 504.1.2.

Q 502.5 Rainwater Catchment Systems. The rainwater catchment conveyance system shall be equipped with a debris excluder or other approved means to prevent the accumulation of leaves, needles, other debris, and sediment from entering the storage tank. Devices or methods used to remove debris or sediment shall be accessible and sized and installed in accordance with manufacturer’s installation instructions.

Q 502.5.1 Water Treatment and Filtration Equipment. A filter permitting the passage of particulates not larger than 100 microns (100 µm) shall be provided for rainwater supplied to water closets, urinals, trap primers, and drip irrigation system. The water treatment and filtration shall be maintained in accordance with the manufacturer’s installation instructions.

Q 502.5.2 Water Quality Monitoring. The minimum water quality for harvested rainwater shall meet the applicable water quality requirements for the intended applications as determined by the Authority Having Jurisdiction. In the absence of water quality requirements determined by the Authority Having Jurisdiction, the minimum treatment and water quality shall be in accordance with Table Q 502.5.3.

Exception: No treatment is required for rainwater used for subsurface or non-sprinkled surface irrigation where the maximum storage volume is less than 360 gallons (1363 L).

Q 502.5.3 Minimum Water Quality. Where the water quality is not acceptable as required in Section Q 502.5.2, determine whether routine flushing is needed. Where completed, routine flushing shall be done in accordance with Section Q 502 5.5. Where the water quality of the tested water cannot consistently be maintained at the minimum levels specified in Table Q 502.5.3, the system shall be equipped with an appropriate treatment device meeting applicable NSF standards or equivalent.
Water quality shall be checked at the following locations:
(1) The most distant point in the rainwater catchment distribution system,
(2) In areas that are known to be low or no-use,
(3) Before and after any water treatment and filtration system, and
(4) Storage tanks or vessels.
### Table Q 502.5.3
#### Minimum Water Quality for Rainwater Catchment Systems

<table>
<thead>
<tr>
<th>Application</th>
<th>Minimum Treatment</th>
<th>Minimum Water Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car washing</td>
<td>Debris excluder or other approved means in accordance with Section Q 502.5, and 100 microns in accordance with Section Q 502.5.1 for drip irrigation.</td>
<td>N/A</td>
</tr>
<tr>
<td>Subsurface and drip irrigation</td>
<td>Debris excluder or other approved means in accordance with Section Q 502.5, and 100 microns in accordance with Section Q 502.5.1 for drip irrigation.</td>
<td>N/A</td>
</tr>
<tr>
<td>Spray irrigation where the maximum storage volume is less than 360 gallons</td>
<td>Debris excluder or other approved means in accordance with Section Q 502.5, and disinfection in accordance with Section Q 502.5.4.</td>
<td>N/A</td>
</tr>
<tr>
<td>Spray irrigation where the maximum storage volume is equal to or more than 360 gallons</td>
<td>Debris excluder or other approved means in accordance with Section Q 502.5.</td>
<td>Escherichia coli: &lt; 100 CFU/100 mL, and Turbidity: &lt; 10 NTU</td>
</tr>
<tr>
<td>Urinal and water closet flushing, clothes washing, and trap priming</td>
<td>Debris excluder or other approved means in accordance with Section Q 502.5, and 100 microns in accordance with Section Q 502.5.1.</td>
<td>Escherichia coli: &lt; 100 CFU/100 mL, and Turbidity: &lt; 10 NTU</td>
</tr>
<tr>
<td>Ornamental fountains and other water features</td>
<td>Debris excluder or other approved means in accordance with Section Q 502.5.</td>
<td>Escherichia coli: &lt; 100 CFU/100 mL, and Turbidity: &lt; 10 NTU</td>
</tr>
<tr>
<td>Cooling tower make-up water</td>
<td>Debris excluder or other approved means in accordance with Section Q 502.5, and 100 microns in accordance with Section Q 502.5.1.</td>
<td>Escherichia coli: &lt; 100 CFU/100 mL, and Turbidity: &lt; 10 NTU</td>
</tr>
</tbody>
</table>

For SI units: 1 micron = 1 µm, 1 gallon = 3.785 L

**Q 502.5.4 Water Quality Devices and Equipment.** Devices and equipment used to treat rainwater to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) and approved for the intended application.

**Q 502.5.5 Routine Flushing.** The rainwater catchment system shall be routinely flushed as required by the Authority Having Jurisdiction for bacterial control and to meet water quality in accordance with Table Q 502.5.3.

**Substantiation:**
With buildings being shut down or in low use as a response to COVID-19, the need to establish minimum requirements for managing building water systems to mitigate health effects to building occupants has become critically important. Understandably, potable water systems are the primary focus in this effort. However, nonpotable water systems such as water features, cooling and produce sprays, and rainwater catchment systems, may also pose a significant risk to building occupants. Although there have been several published guidance to address building shutdowns, all are focused on the potable water system. This proposal is intended to be used by building owners and managers as a resource to safely operate and manage nonpotable water systems and by local jurisdictions as a tool to establish and enforce minimum requirements for nonpotable water systems during normal operation, building shutdowns and building reopenings. Except for the rainwater catchment system requirements which were derived from existing language in the UPC, requirements for nonpotable water systems were derived using potable water system requirements as a starting point.

**Committee Action:** REJECT

**Committee Statement:**
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such sections are currently going through a peer review. Therefore, at this time, the
Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  
**AFFIRMATIVE:** 25  
**NOT RETURNED:** 1  
Daniels
**Proposals**

**Item #: 322**

UPC 2024  Section: Q 503.0 – Q 503.4.1, Table Q 503.1

**SUBMITTER:** Ramiro Mata
Self
Chair, Nonpotable Water Working Group

**RECOMMENDATION:**
Add new text

**Q 503.0 Interruption to Normal Operation (System Shutdown Process).**

**Q 503.1 General.** This section shall apply to the closure strategies of the building water system for nonpotable systems when the normal operation is interrupted. The required inspection prior to shutting down the nonpotable water system shall be in accordance with Table Q 503.1.

**Note:** These procedures are general guidelines intended to supplement the requirements set forth by the registered design professional and the Authority Having Jurisdiction.

**Q 503.2 Without Draining (Except Rainwater Catchment Systems).** When the nonpotable water system is shutdown without draining of the system, the following shall be done:

1. Prior to system shutdown, verify operation of bypass system.
2. Inspect bypass system and verify proper operation at a minimum of every three months.
3. Where applicable, implement procedures to prevent pipes from freeze damage.
4. Use proper lockout/tagout procedures and follow manufacturer’s instructions to remove stored energy from equipment.

**Q 503.3 Shutting Down with System Draining.** When the nonpotable water system is shutdown with draining of the system, the following shall be done:

1. Shut off water supply and drain the tank.
2. Drain the system following the manufacturer’s instructions, the water management program, and the registered design professional or the Authority Having Jurisdiction.
3. Close supply valves to storage water tanks and drain the tanks until the water runs clear.
4. Shutoff and drain the water supply system.

**Note:** Unless the system can be physically dried, it is likely that pockets of water and condensation will remain even after the system is drained. These remaining pockets of water may be sufficient to allow waterborne pathogens to grow, including Legionella.

**Q 503.4 Rainwater Catchment Systems.** Rainwater harvesting systems shall be maintained in accordance with ARCSA/ASPE 63 and in functioning order for the life of the system. Failure to properly maintain such a system shall require the owner to abandon the system. Refer to Section Q 502.5 for continuous maintenance procedures during normal operation.

**Q 503.4.1 System Bypass.** Rainwater harvesting systems shall be placed in bypass mode and not be completely shutdown, even while the primary water supply system is shutdown during low use or building closure.
### TABLE Q 503.1
**REQUIRED INSPECTION PRIOR TO SYSTEM INTERRUPTION**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>Open System</th>
<th>Closed System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect and clean filters and screens, and replace (if necessary)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Inspect and verify that disinfection, filters and water quality treatment devices and systems are operational and maintaining minimum water quality requirements as determined by the Authority Having Jurisdiction</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Inspect pumps and verify proper operation (for bypass systems)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Inspect valves and verify proper operation</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Clear debris from and inspect storage tanks, locking devices, and verify operation</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Inspect caution labels and markings</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Inspect and maintain mulch basins for gray water irrigation systems</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Inspect flushing system and verify proper operation</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cross-connection inspection and test*</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

* The cross-connection test shall be performed in the presence of the Authority Having Jurisdiction in accordance with the requirements of the plumbing code.

**SUBSTANTIATION:**
With buildings being shutdown or in low use as a response to COVID-19, the need to establish minimum requirements for managing building water systems to mitigate health effects to building occupants has become critically important. Understandably, potable water systems are the primary focus in this effort. However, nonpotable water systems such as water features, cooling and produce sprays, and rainwater catchment systems, may also pose a significant risk to building occupants. Although there have been several published guidance to address building shutdowns, all are focused on the potable water system. This proposal is intended to be used by building owners and managers as a resource to safely operate and manage nonpotable water systems and by local jurisdictions as a tool to establish and enforce minimum requirements for nonpotable water systems during normal operation, building shutdowns and building reopenings. Except for the rainwater catchment system requirements which were derived from existing language in the UPC, requirements for nonpotable water systems were derivied using potable water system requirements as a starting point.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such section are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  
**AFFIRMATIVE:** 25  
**NOT RETURNED:** 1  
Daniels
Proposals

Item #: 323

UPC 2024  Section: Q 504.0 – Q 504.2.5

SUBMITTER: Ramiro Mata
Self
Chair, Nonpotable Water Working Group

RECOMMENDATION:
Add new text

Q 504.0 Reopening of Nonpotable Water Systems.
Q 504.1 General Systems. The reopening of nonpotable water systems shall be in accordance with Section Q 504.1.1 through Section Q 504.1.3. The reopening of the nonpotable rainwater systems shall be in accordance with Section Q 504.2 through Section Q 504.2.5.
Q 504.1.1 Equipment Inspections. Equipment shall be checked for physical integrity and general function. Equipment shall be inspected in accordance with the manufacturer’s start up procedures. The alternate water source testing, inspection and maintenance frequency shall be performed in accordance with Section Q 502.2.
Q 504.1.2 Water Quality Testing. The water quality shall be tested until it meets the minimum water quality parameters of the non-potable water system. The minimum water quality for non-potable water systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction or the registered design professional’s requirements approved by the Authority Having Jurisdiction.
Water quality shall be checked at the following locations:
(1) The most distant point in the nonpotable water distribution system,
(2) In areas that are known to be low or no-use,
(3) Before and after any water treatment and filtration system, and
(4) Storage tanks or vessels.
Q 504.1.3 System Flushing. The nonpotable water system shall be flushed as required by the Authority Having Jurisdiction for bacterial control and to meet water quality in accordance with Section Q 504.1.2.
Q 504.2 Rainwater Catchment Systems. The rainwater catchment conveyance system shall be equipped with a debris excluder or other approved means to prevent the accumulation of leaves, needles, other debris and sediment from entering the storage tank. Devices or methods used to remove debris or sediment shall be accessible and sized and installed in accordance with manufacturer’s installation instructions.
Q 504.2.1 Water Treatment and Filtration Equipment. A filter permitting the passage of particulates not larger than 100 microns (100 µm) shall be provided for rainwater supplied to water closets, urinals, trap primers, and drip irrigation system. The water treatment and filtration shall be maintained in accordance with the manufacturer’s installation instructions.
Q 504.2.2 Water Quality Monitoring. The minimum water quality for harvested rainwater shall meet the applicable water quality requirements for the intended applications as determined by the Authority Having Jurisdiction. In the absence of water quality requirements determined by the Authority Having Jurisdiction, the minimum treatment and water quality shall be in accordance with Table Q 502.5.3.
Exception: No treatment is required for rainwater used for subsurface or nonsprinkled surface irrigation where the maximum storage volume is less than 360 gallons (1363 L).
Q 504.2.3 Minimum Water Quality. Where the water quality is not acceptable as required in Section Q 504.2.2, it shall be determined whether routine flushing is needed. Where completed, routine flushing shall be done in accordance with Section Q 504.2.5. Where the water quality of the tested water cannot consistently be maintained at the minimum levels specified in Table Q 502.5.3, then the system shall be equipped with an appropriate treatment device meeting applicable NSF standards or equivalent.
Water quality shall be checked in accordance with the following:
(1) At the most distant point in the rainwater catchment distribution system,
(2) In areas that are known to be low or no-use,
(3) Before and after any water treatment and filtration system, and
(4) Storage tanks or vessels.

**Q 504.2.4 Water Quality Devices and Equipment.** Devices and equipment used to treat rainwater to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) and approved for the intended application.

**Q 504.2.5 Routine Flushing.** The rainwater catchment system shall be routinely flushed as required by the Authority Having Jurisdiction for bacterial control and to meet water quality in accordance with Table Q 502.5.3.

**SUBSTANTIATION:**
With buildings being shutdown or in low use as a response to COVID-19, the need to establish minimum requirements for managing building water systems to mitigate health effects to building occupants has become critically important. Understandably, potable water systems are the primary focus in this effort. However, nonpotable water systems such as water features, cooling and produce sprays, and rainwater catchment systems, may also pose a significant risk to building occupants. Although there have been several published guidance to address building shutdowns, all are focused on the potable water system. This proposal is intended to be used by building owners and managers as a resource to safely operate and manage nonpotable water systems and by local jurisdictions as a tool to establish and enforce minimum requirements for nonpotable water systems during normal operation, building shutdowns and building reopenings. Except for the rainwater catchment system requirements which were derived from existing language in the UPC, requirements for nonpotable water systems were derived using potable water system requirements as a starting point.

**COMMITTEE ACTION:** REJECT

**COMMITTEE STATEMENT:**
Proposals # 308 through Item # 323 address provisions for the safe closure and reopening of potable and nonpotable water systems. They are good proposal that address stagnant water conditions which can lead to the growth of harmful pathogens. However, it is the Committee’s understanding that there were some disagreements in the potable water sections and such section are currently going through a peer review. Therefore, at this time, the Committee is rejecting Item # 308 through Item # 323 as some contents may change. We do ask that a public comment is submitted to address any peer review comments.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
APPENDIX R

TINY HOUSES

R 101.0 Tiny Houses.
R 101.1 Applicability. The tiny house plumbing systems shall be designed and installed in accordance with the requirements of this appendix and the requirements of this code, where applicable. Part I of this appendix shall apply to a single tiny house. Part II of this appendix shall apply to tiny house communities. The provisions of this appendix shall apply to permanent structures of 400 square feet (37 m²) or less. The provisions of this appendix shall not apply to recreational vehicles as defined in NFPA 1192. The provisions of this appendix shall not apply to recreational vehicle parks and campgrounds as defined in NFPA 1194 or to manufactured homes as defined in NFPA 501A.

R 102.0 Definitions.
R 102.1 General. For purposes of this appendix, the following definitions shall apply:

Tiny House. A structure, where erected, is 400 square feet (37 m²) or less.

Tiny House, Community. A structure(s), where erected, is 400 square feet (37 m²) or less, and of not less than two structures in the same lot.

Tiny House, Single. A structure, where erected, is 400 square feet (37 m²) or less, and of not more than 1 structure in a lot.

R 103.0. General.
R 103.1 Construction Documents. Before plumbing or sewage disposal facilities are installed or altered in a tiny house, duplicate construction documents shall be filed, and proper permits obtained from the department or departments having jurisdiction. Plans shall show in detail:

1. Plot plan drawn to scale, indicating elevations, property lines, driveways, existing or proposed buildings, and the sizes of the tiny house lots.

2. Complete specification and piping layout of proposed plumbing systems or alteration.

3. Complete specification and layout of proposed sewage disposal system or alteration.

4. The nature and extent of the work proposed, showing that such work will comply to the provisions of this appendix and this code, where applicable.

R 103.2 Fuel-Gas Piping System. The size of each section of a gas piping system shall be determined in accordance with this code, NFPA 54, or by engineering methods acceptable to the Authority Having Jurisdiction. Liquid Petroleum Gas (LP-Gas) piping systems shall be sized in accordance with NFPA 58. Oil burning systems and equipment shall be installed in accordance with NFPA 31. Gas piping systems shall be of such size and so installed as to provide a supply of gas sufficient to meet the maximum demand and supply gas to each appliance inlet at not less than the minimum supply pressure required by the appliance.

R 103.3 Water Heaters. Water heaters shall be applied, sized, and installed in accordance with the manufacturer's recommendations and instructions.

R 103.4 Potable Water Sources. Where an approved public water supply system is available, it shall be used. Alternate water sources shall be approved by a regulating agency. The supply or supplies of water shall comply with the potable water standards of the state, local health authority.
R 103.5 Water Supply to Fixtures. Except where not deemed necessary for safety or sanitation by the Authority Having Jurisdiction, each plumbing fixture shall be provided with an adequate supply of potable running water piped thereto in an approved manner.

R 103.5.1 Hot and Cold Water Required. Where plumbing fixtures are installed for private use, hot water shall be required for bathing, washing, laundry, cooking purposes, dishwashing or maintenance.

R 103.6 Storage Tanks. Where installed, water storage tanks shall be constructed of impervious materials, protected against contamination, and provided with locked, watertight covers. Overflow or ventilation openings shall be down-facing and provided with a corrosion-resistant screening of not less than number 24 mesh to prevent the entrance of insects and vermin. Water storage tanks shall not have direct connections to sewers.

R 103.7 Prohibited Connections. The potable water supply shall not be connected to a nonpotable or unapproved water supply, nor be subjected to backflow or back siphonage.

R 103.8 Backflow Prevention. No plumbing fixture, device, or construction shall be installed or maintained, or shall be connected to a domestic water supply, where such installation or connection provides a possibility of polluting such water supply or cross-connection between a distributing system of water for drinking and domestic purposes and water that becomes contaminated by such plumbing fixture, device, or construction unless there is provided a backflow prevention device approved for the potential hazard.

R 103.9 Shutoff Valve. A separate water shutoff valve shall be installed in each water service outlet at each tiny house. Where a backflow protective device is installed, the service shutoff shall be located upstream to the backflow protection device.

R 103.10 Mechanical Protection. Water service outlets, backflow preventers, and pressure-relief valves shall be protected from damage by vehicles or other causes. Such protection shall be permitted to consist of posts, fencing, or other permanent barriers.

R 103.11 Water-Treatment Equipment. Where installed, water-treatment equipment shall comply with the requirements of Section 611.0.

R 103.12 Testing. Installations of water supply, drainage, and venting systems shall be tested and inspected in accordance with this code.

Part I – Single Tiny House

R 201.0 Tiny House Fixtures.

R 201.1 Kitchen. Each tiny house shall be provided with a kitchen area and every kitchen area shall be provided with a sink in accordance with Section 420.0.

R 201.3 Bathrooms Group. Every tiny house shall contain not less than one water closet, one lavatory, and one bath, shower or combination bath/shower. The walls and shower floors shall be water-tight and waterproof in accordance with Section 408.5 and Section 408.7.

R 201.3.1 Bathroom group Clearance. Bathrooms shall have a minimum ceiling height of not less than 6 feet 8 inches (2032 mm) from the floor when measured at the center, front area of the fixtures. The ceiling height above fixtures shall not interfere with the fixture's intended purpose.

R 201.3.2 Bathtubs. Where installed, bathtubs or combination bath/showers shall be in accordance with Section 409.0.

R 201.3.3 Whirlpool Baths. Where installed, whirlpool baths shall be in accordance with Section 409.0.

R 201.3.4 Showers Compartments. Where installed, shower compartments, enclosures or field-constructed tile walled showers, shall be capable of fitting 30 inch diameter circle, flat on the shower base.

R 201.3.5 Water Closet. Water closets shall be in accordance with Section 411.0.

R 201.3.6 Bidets. Where installed, bidets shall be in accordance with Section 410.0.

R 201.3.7 Lavatories. Lavatories shall be in accordance with Section 407.0.

R 202.0 Tiny House Water Supply System.

R 202.1 Potable Water Supply. An accessible and approved supply of potable water shall be provided in each tiny house. Where an approved public water supply is not available, a private water supply system shall be developed and used as approved by the Authority Having Jurisdiction.

R 202.2 Water Service Outlet. Each tiny house shall be provided with a water service outlet delivering potable water. The water service outlet riser shall be not less than ¾ of an inch (20 mm) nominal pipe size and capable of delivering 12 water supply fixture units.

R 202.2.1 Water Supply Fixture Units. Water distribution systems shall be designed to deliver not less than 12 water supply fixture units to each tiny house. Plumbing materials shall be installed with materials in accordance with Chapter 3 for piping, and Chapter 4 for joints and connections.

R 202.2.2 Pressure. Each tiny house water distribution system shall be so designed and maintained at not less than 15 psig at each fixture inlet in accordance with Section 608.1. Pressures exceeding 80 psig, shall be limited in accordance with Section 608.2.
R 203.0 Tiny House Drainage System.
R 203.1 General. Plumbing fixtures shall be drained to a public sanitary waste system by gravity in accordance with Chapter 7. Private sanitary waste systems shall be in accordance with Chapter 7 or other method approved by the Authority Having Jurisdiction. See Appendix H for private sewage disposal system general guidelines.
R 203.2 Vents. All venting systems shall be in accordance with Chapter 9.
R 203.3 Engineered Design. Alternate engineered designed systems shall be in accordance with Section 301.3.
R 203.4 Materials. Drainage pipe and fittings installed underground shall be of a material approved for the purpose. Material for sanitary waste and drainage piping shall be in accordance with Table 701.2 of this code.

Part II – Tiny House Community.

R 301.0 Tiny House Community Plumbing System and Fixtures.
R 301.1 Community Facilities. Where provided, facilities for a community of tiny houses shall be in accordance with Section R 301.2 through Section R 301.7.1.
R 301.2 Toilet Facilities. Toilet facilities shall be provided at not less than one location, located within a 500 foot (152 m) radius from a tiny house.
R 301.2.2 Interior Finish. The interior finish of walls shall be moisture resistant to a height of not less than 4 feet (1219 mm) to facilitate washing and cleaning.
R 301.2.3 Receptacle. Each toilet room for women shall be provided with a receptacle for sanitary napkins. The receptacle shall be of durable, impervious, readily cleanable material, and shall be provided with a lid.
R 301.3 Water Closets. Public water closets shall be of an elongated bowl type and shall be provided with seats with open fronts. Water closets shall be in accordance with Section 411.0.
R 301.3.1 Size. Water closet compartments shall be not less than 30 inches (762 mm) in width. No water closet shall be set closer than 15 inches (381 mm) from its center to a side wall and shall have not less than 30 inches (762 mm) of clear space in front of each water closet.
R 301.4 Lavatories. Where water-supplied water closets are provided, an equal number of lavatories shall be provided for up to six water closets. One additional lavatory shall be provided for each two water closets where more than six water closets are required. Lavatories shall be in accordance with Section 407.0.
R 301.5 Urinals. Where separate facilities are provided for men and women, urinals shall be acceptable for not more than one-third of the water closets required in the men’s facilities, except that one urinal shall be permitted to be used to replace a water closet. Individual stall or wall-hung types of urinals shall be in accordance with Section 412.0.
R 301.6 Floors and Drains. The floors shall be constructed of material impervious to water and shall be easily cleanable. A building having water-supplied water closets shall be provided with a floor drain in the toilet room. This drain shall be provided with means to protect the trap seal in accordance with this code.
R 301.7 Shower Compartments. Where installed, shower compartments, regardless of shape, shall have a minimum finished interior of 1024 square inches (6.606 m²) and shall also be capable of encompassing a 30 inch (762 mm) circle. The minimum required area and dimensions shall be measured at a height equal to the top of the threshold and a point tangent to its centerline. The area and dimensions shall be maintained to a point of not less than 70 inches (1778 mm) above the shower drain outlet with no protrusions other than the fixture valve or valves, showerheads, soap dishes, shelves, and safety grab bars, or rails. Fold-down seats in accessible shower stalls shall be permitted to protrude into the 30 inch (762 mm) circle.

Exceptions:
(1) Showers that are designed to be in accordance with ICC A117.1.
(2) The minimum required area and dimension shall not apply for a shower receptor having overall dimensions of not less than 30 inches (762 mm) in width and 60 inches (1524 mm) in length.
R 301.7.1 Drainage Connection. Shower sanitary drainage systems shall be in accordance with Chapter 7 and vents in accordance with Chapter 9. Each such area shall have an impervious, skid-resistant surface. Wooden racks (duckboards) over shower floors shall be prohibited.
R 301.8 Drinking Fountains. Where provided, drinking fountains shall be in accordance with Section 415.0.

R 302.0 Tiny House Community Potable Water Supply and Distribution.
R 302.1 Potable Water Required. Except where not deemed necessary for safety or sanitation by the Authority Having Jurisdiction, each plumbing fixture shall be provided with an adequate supply of potable running water piped thereto in an approved manner, so arranged as to flush and keep it in a clean and sanitary condition without danger of backflow or cross-connection.

Exception: Listed fixtures that do not require water for their operation and are not connected to the water supply.
R 302.2 Water Riser Pipe. Each potable water connection shall consist of a water riser pipe that is equipped with a threaded male spigot located not less than 12 inches (305 mm) but not more than 24 inches (610 mm) above grade level for the attachment of a standard water hose. The water riser pipe shall be protected from physical damage in accordance with this code. This connection shall be equipped with a listed antisiphon backflow prevention device.
R 302.3 Water Supply and Distribution. Water supply and distribution systems shall be in accordance with Chapter 6.
R 302.3.1 Water Supply Fixture Units. Water distribution systems shall be designed to deliver not less than 12 water supply fixture units to each tiny house. Plumbing materials shall be installed with materials in accordance with Chapter 6 for piping, and joints and connections.

R 302.4 Approval by Authority. No water piping supplied by a private water supply system shall be connected to any other source of supply without the approval of the Authority Having Jurisdiction, Health Department, or other department having jurisdiction.

R 303.0 Tiny House Community Drainage System.
R 303.1 Required Sanitary Drainage. Where available, tiny houses shall be connected to a public sanitary drainage system.
R 303.2 Materials. Pipe and fittings installed in the drainage system shall be of material conforming to the requirements of Table 701.2 or as approved by the Authority Having Jurisdiction. The drainage system shall be installed in accordance with this code.
R 303.3 Pipe Sizes. Water supply and distribution lines shall be sized in accordance with Chapter 6, Appendix A, Appendix C, or Appendix M of this code.
R 303.4 Traps and Cleanouts. Traps and cleanouts shall be provided in accordance with Chapter 7 of this code. Traps shall also be in accordance with Chapter 10.
R 303.5 Vents. All venting systems shall be in accordance with Chapter 9 of this code.
R 303.6 Protection. The sewer riser pipes not in use shall be firmly embedded in the ground and protected against damage from movement. Unused sewer riser pipes shall be capped or plugged with a tight-fitting plug or cap, to prevent gases from escaping. The cap or plug shall be secured by a durable chain (or equivalent) to prevent loss.

**TABLE 1701.2**

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFPA 1194-2021</td>
<td>Standard for Recreational Vehicle Parks and Campgrounds</td>
<td>Recreational Vehicles</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
This appendix for Tiny Houses will correlate with the approved appendix accepted by the NSPC Technical Committee for their 2021 Edition of the NSPC.

The proposed appendix will assist a builder or enforcing agency ensure that plumbing systems for tiny houses are being installed in a safe manner with listed fixtures. Currently, no provisions exist to assist the end user building a tiny house with regards to minimum plumbing standards, and safe practices. Providing guidance for the tiny house communities will provide safe and reliable plumbing systems by requiring appropriate listed fixtures that are known to have to approved type of materials to prevent any contamination to the potable water system. Additionally, potable water should be protected, and regulations towards protecting the potable water system is not only important to the end user, but the water supplier as well. This appendix gives a foundation to establish safe practices and requirements that will keep habitants safe, healthy, and ensure a reliable plumbing system.

Tiny homes are becoming more popular and a need to address plumbing provisions is required for these specific types of structures since they are not considered Manufactured homes, Recreational Vehicles, or campgrounds. These homes are unique as classified by the building code and plumbing provisions specifically addressing these types of homes is required as no provisions address these specific dwellings.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The proposal is being rejected as there are extensive modifications required. The Committee requests that the proposed modifications be submitted as a public comment.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
APPENDIX S
COMPOSTING TOILET AND URINE DIVERSION SYSTEMS

S 101.0 General.
S 101.1 Applicability. The provisions of this section shall apply to the design, construction, performance, alteration, and repair of composting toilet and urine diversion systems.

S 201.0 Definition of Terms. For the purposes of this code, the definitions in Section S 201.1 shall apply to this appendix.
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 appendix to avoid misunderstanding.
The definitions of terms are arranged alphabetically according to the first word of the term.

S 201.1 Definitions.

Commode. The composting toilet fixture for collecting, containing, or transporting excreta to the compost processor.
Compost Additives. Any material such as sawdust, wood shavings, and other compostable material added to the commode or compost processor to maintain operational conditions within the composting toilet system.
Composting Toilet System. A system designed to safely collect and process excreta and compost additives into humus through aerobic decomposition.
Compost Processor. The site of aerobic decomposition transforming excreta and compost additives into humus.
Desiccation. The process of dehydrating excreta or leachate.
Diverted Urine. Urine that is collected and has not made contact with feces.
Excreta. Includes but is not limited to urine, feces, menses, toilet paper, and other human body emissions and biodegradable cleaning products.
Humus. The biologically decomposed, soil-like output of the compost processor.
Leachate. Liquid draining from the compost processor.
Secondary Composting. Additional retention and continued decomposition of humus removed from compost processors in order to meet a safe retention time.
Site-Built. Constructed at the site of use.
Transfer. The controlled transfer of excreta or partially processed humus between commode and composting processor or between multi-stage composting processors.
Urine Diversion. Separation of urine from other excreta that occurs at the commode.
Vectors. An organism that has the potential to transmit disease.

S 301.0 Design and Construction.
S 301.1 Requirements. Composting toilets, composting toilet systems, and urine diversion systems shall meet the design, construction, and performance requirements of Section S 301.1.1 or Section S 301.1.2.
S 301.1.1 Listed Composting Toilets and Composting Toilet Systems. Composting toilets and composting toilet systems shall be listed to NSF 41.
S 301.1.2 Alternative Design Systems. Where approved by the Authority Having Jurisdiction, composting toilet and urine diversion systems for residential and commercial applications shall comply with the provisions of Section S 301.2 through Section S 501.1.

S 301.2 System Materials and Components. Pipe, pipe fittings, traps, fixtures, materials, and devices used in composting toilet and urine diversion systems that are expected to contact leachate or diverted urine shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body), unless otherwise approved by the Authority Having Jurisdiction. Materials and components shall comply to approved applicable recognized standards referenced in this code and shall be free from defects. Unless otherwise provided for in this code, materials, fixtures, or devices used or entering into the construction of plumbing systems, or parts thereof, shall be submitted to the Authority Having Jurisdiction for approval.

S 301.3 System Design. Composting toilet and urine diversion systems complying with Section S 301.1 shall be designed by a person registered or licensed to perform plumbing design work or who demonstrates competency to design composting toilet and urine diversion systems.

S 301.4 Permit. It shall be unlawful for any person to construct, install, alter, or cause to be constructed, installed, or altered any composting toilet and urine diversion system in a building or on a premise without first obtaining a permit to do such work from the Authority Having Jurisdiction.

S 301.5 Maintenance and Inspection. Composting toilet and urine diversion systems and components shall be maintained and inspected in accordance with Section S 301.5.1 through Section S 301.5.3.

S 301.5.1 Maintenance Responsibility. The required maintenance and inspection of composting toilet and urine diversion systems shall be the responsibility of the property owner, unless otherwise required by the Authority Having Jurisdiction. The property owner is responsible for retaining test result records in accordance with Section S 401.6.2 and making them available to the Authority Having Jurisdiction upon request. Upon transfer of property or tenancy, all test records shall be transferred and humus shall be re-tested after its first treatment period and a record retained.

S 301.5.2 Operation. Composting toilet and urine diversion systems shall be operated in a safe and sanitary condition in accordance with the owner’s manual in accordance with Section S 301.6.

S 301.5.3 Inspection. In the event of a nuisance complaint or documented system failure, the composting toilet and urine diversion system shall be made available for inspection and the owner or owner’s agent shall conduct sufficient repairs or alterations to the composting toilet system. At the request of the Authority Having Jurisdiction, results of all laboratory testing and new tests in accordance with Section S 401.6 following repairs to alleviate dangerous or unsanitary conditions shall be provided at the owner’s expense.

S 301.6 Operation and Maintenance Manual. An owner’s manual shall present clear instructions for maintenance and be transferred to the new owner upon transfer of property or tenancy. The owner’s manual shall include:

1. Schedule for addition of necessary compost additives.
2. Source or provider of necessary compost additives. Source may be on-site.
3. Schedule and instructions for all regular maintenance tasks.
4. Expected input of and capacity for excreta and compost additives to compost toilet system specifying loading of commode(s) and compost processor(s).
5. Plan for container transfer and cleaning where transfer is used.
6. Expected schedule for removing humus from composting processors and where used secondary composting bins.
7. Plan for on-site disposal of humus or professional removal.
9. Plan for microbial testing in accordance with Section S 401.6.2.

S 401.0 Composting Toilet System Design.

S 401.1 Requirements. The design and installation of composting toilet systems shall be in accordance with Section S 401.2 through Section S 401.7.

S 401.2 Corrosion Resistance. All components expected to contact excreta or leachate shall be constructed of corrosion-resistant material such as stainless steel or durable polymers. Concrete in contact with excreta or leachate shall meet requirements of Section S 401.3.

S 401.3 Concrete Construction. Concrete construction shall be reinforced, watertight and able to withstand loading weight. Where drainage is required, the processor floor shall be sloped not less than ¼-inch per foot (20.8 mm/m). The flange of each sub-drain shall be set level.

S 401.4 Commodes.

S 401.4.1 Odor. Commode design or use shall mitigate the infiltration of odors into the building during normal operation and in the event of temporary power failure.

S 401.4.2 Contact. Commodes shall transport excreta into the compost processor or contain excreta for transfer as designed according to the owner’s manual.

S 401.4.3 Vectors. Commodes shall limit vectors and prevent human contact except for regular maintenance as designed according to the owner’s manual.

S 401.5 Compost Processors. Compost processors shall be designed in accordance with Sections S 401.5.1 through S 401.5.9 and shall maintain unsaturated aerobic composting conditions within the compost mass, through the drainage, absorption, or desiccation of leachate, and aeration of the processor.
S 401.5.1 Leachate. Leachate shall be collected for removal or recirculation within the processor, evaporated, or drained to an approved plumbing drainage system or other location approved by the Authority Having Jurisdiction. Leachate storage tanks shall be constructed and installed in accordance with the following:

S 401.5.1.1 Venting. Leachate storage tanks shall be vented as required for pressure equalization. When required, vents shall be installed on leachate storage tanks and shall extend from the top of the tank. The connection of storage tank vents to the plumbing venting system shall be 6 inches (152 mm) above the flood level rim of the highest fixture. Vents extending to the outdoor shall terminate no less than 12 inches (305 mm) above grade. The vent terminal shall be directed downward and covered with a 3/32 inch (2.38 mm) mesh screen to prevent the entry of vermin and insects.

S 401.5.1.2 Overflow. Where storage tank overflows are installed, they shall be connected to the plumbing drainage system.

S 401.5.1.2.1 Backwater Valve. Storage tank overflows, when subject to backflow, shall be provided with a backwater valve at the point of connection to the plumbing drainage system. The backwater valve shall be accessible for inspections and maintenance.

S 401.5.1.3 Construction. Leachate storage tanks shall be constructed of polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polyamide (Nylon) or a blend of PET, PEN, ethyl vinyl alcohol (EVOH), Nylon, HDPE, or other tanks listed or certified to US 49 CFR 178.274 Specifications for UN?Portable Tanks.

S 401.5.1.4 Above Grade. Above grade storage tanks are prohibited where subject to freezing conditions, or shall be provided with an adequate means of freeze protection. The above grade leachate storage tank shall be provided with an audible and visual high-water alarm.

S 401.5.1.5 Below Grade. Leachate storage tanks installed below grade shall be structurally designed to withstand all anticipated earth or other loads. Tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²), (1465 kg/m²) when the tank is designed for underground installation. Below grade leachate tanks installed underground shall be provided with manholes. The manhole opening shall be a minimum diameter of 20 inches (508 mm) and located a minimum of 4 inches (102 mm) above the surrounding grade. The surrounding grade shall be sloped away from the manhole. Underground tanks shall be ballasted, anchored, or otherwise secured to prevent the tank from floating out of the ground when empty. The combined weight of the tank and hold down system should meet or exceed the buoyancy force of the tank. The below grade leachate storage tank level shall be provided with an audible and visual high-water alarm.

S 401.5.1.6 Marking. Where openings are provided to allow a person to enter the tank, the opening shall be marked with the following words: “DANGER – CONFINED SPACE.”

S 401.5.1.7 Openings. All openings shall be covered and secured to prevent tampering. Openings shall be screened or covered to prevent rodent, vermin, and insect infiltration and be protected against unauthorized human entry.

S 401.5.1.8 Vectors. The compost processor shall be designed and installed to limit vector access through management as required in the owner's manual.

S 401.5.1.9 Transfer. Where unfinished excreta or diverted urine is transferred between processors or from commode to processor, transfer and cleaning of containers and provisions for limiting user exposure shall be according to the owner’s manual.

S 401.5.1.10 Watertightness. Processors shall be constructed of watertight material in accordance with Section S 401.2.

S 401.5.1.11 Vermin (Rodent) Proofing. The compost processor shall be protected to prevent the entrance of rodents, vermin, and insects. No unsecured opening other than vents, drainage, or commode may exceed ½ inch (12.7 mm) in the least dimension.

S 401.5.6 Active Conditions. The compost processor or processors shall be sized to compost excreta for a minimum of one year of biologically active conditions. Biologically active conditions are at or above a daily average of 42°F (5.5°C).

Exception: Systems with shorter retention shall be permitted where either,

1. Humus from the compost processor has been tested according to Section S 401.6.2 and there is either a secondary composting stage where humus is retained in a well maintained compost bin or other facility designated for the exclusive purpose of containing humus removed from the compost processor, or
2. Humus is removed off site for processing or disposal at an approved facility.

S 401.5.7 Secondary Composting. Humus to be transferred to secondary composting shall first be tested according to Section S 401.6.2. Secondary composting shall be labeled and protected from human contact. Contact with precipitation and surface waters is prohibited.

S 401.5.8 Ventilation. Negative ventilation between the commode and compost processor shall be provided when the compost processor is connected directly to the commode without a trap. Commodes that are not connected to the compost processor do not require a vent.

S 401.5.8.1 Vent Terminals. Vent stacks shall terminate exterior the building as required by the plumbing or mechanical code.

S 401.5.9 Sizing. The compost processor shall be sized to accommodate the maximum daily adult usage as specified by the manufacturer’s published ratings. Site built compost processors shall be sized to hold a minimum of 10 gallons (37.8 L) of material per person per year while allowing for the removal of the humus, or as specified by the system designer.
S 401.6 Testing. Composting toilet systems shall be tested in accordance with Section S 401.6.1 and Section S 401.6.2.

S 401.6.1 Compost Processors. Compost processors shall be tested for water tightness by filling the system to the maximum designed liquid storage capacity of the unit for a duration of 24 hours.

S 401.6.2 Humus. The owner or owner’s agent of the composting toilet system shall verify user’s compliance with the manufacturer’s maintenance and operation manual in accordance with Section S 403.7 by submitting a sample of the humus from the first treatment period after a minimum of one year of biologically active conditions to a certified laboratory before removal of humus from the composting processor. Where multiple compost processors are used, the humus sample shall be removed from the last compost processor. The sample collection shall be tested in accordance with EPA/625/R-92/013, Appendix F, Section 1.2. Humus shall not have a moisture content exceeding 75 percent by weight and shall not exceed 200 fecal coliforms/gram.

S 401.7 Humus Removal. Humus shall be removed according to the owner’s manual. Humus from the compost processor shall be removed when the compost processor is saturated or when the point of connection to the plumbing drainage system when connected to a public sewer system or on-site wastewater system. The backwater valve shall be accessible for inspections and maintenance.

Exception:

Piping shall remain submerged during use and after pumpout.

S 501.0 Urine Diversion System Design.

S 501.1 Requirements. The design and installation of urine diversion systems shall be in accordance with Section S 501.2 through Section S 501.14.

S 501.2 Purpose. The purpose of this section is to enable the installation of urine diversion and collection systems to improve the function of composting toilet systems and prevent nutrient pollution of ground and surface waters.

S 501.3 Material Requirements. Material used for urine diversion shall be impermeable and resistant to corrosion from urine.

S 501.4 Identification. All urine diversion piping shall be identified.

S 501.5 Change of Direction. Changes in direction of urine diversion piping shall be made by a long-sweep 90 degree (1.57 rad) fitting or other approved fittings of equivalent sweep.

S 501.6 Sizing. Pipe sizes shall be in accordance with the plumbing code. Each urine diversion fixture shall be sized as one drainage fixture unit. Piping or tubing for urine diversion that is less than the minimum pipe diameter required in the plumbing code shall be approved by the Authority Having Jurisdiction.

S 501.7 Traps. Fixtures discharging into urine diversion piping connected to the plumbing drainage system shall be trapped and vented according to the plumbing code.

S 501.8 Grade of Horizontal Piping. Urine diversion piping shall be installed at a minimum grade of ½ inch per foot (41.6 mm/m), or 4 percent toward the point of disposal.

S 501.9 Cleanouts. A cleanout shall be provided at the upper terminal of each drain line, every 50 feet (15 240 mm) and at an aggregate horizontal change of direction exceeding 135 degrees (2.36 rad).

S 501.10 Venting. Commode fixtures without traps that require ventilation shall be connected to either a dry toilet ventilation stack or a urine diversion ventilation stack. Nonwater urinals used as urine diversion systems shall be connected to a dry toilet ventilation stack or a urine diversion ventilation stack.

S 501.11 Discharge. A urine-diversion system shall be diverted to a storage tank or discharge to an approved plumbing drainage system.

S 501.12 Urine Storage Tanks. Urine storage tanks shall be constructed and installed in accordance with Section S 501.12.1 through Section S 501.12.8.

S 501.12.1 Venting. Urine storage tanks shall be vented as required for pressure equalization. When required, vents shall be installed on urine storage tanks and shall extend from the top of the tank. The connection of storage tank vents to the plumbing venting system shall be six inches above the flood level rim of the highest fixture. Vents extending to the outdoor shall terminate no less than 12 inches (305 mm) above grade. The vent terminal shall be directed downward and covered with a 3/32 inch (2.38 mm) mesh screen to prevent the entry of vermin and insects.

S 501.12.1.1 Vent Size. Pressure equalization vents that prevent nitrogen loss by the use of restrictions, or of piping or tubing that is less than the minimum pipe diameter required in the plumbing code shall be approved by the Authority Having Jurisdiction.

S 501.12.2 Traps. Urine storage tanks shall prevent odors and nitrogen loss from the tank inlet by means of a P-trap, mechanical trap, submerged inlet piping, or other means approved by the Authority Having Jurisdiction. Submerged inlet piping shall remain submerged during use and after pumpout.

Exception: Tanks of five gallons or less connected to fixtures with active ventilation or having an integrated seal.

S 501.12.3 Overflow. Where storage tank overflows are installed, they shall be connected to a plumbing drainage system.

S 501.12.3.1 Backwater Valve. Storage tank overflows subject to backflow shall be provided with a backwater valve at the point of connection to the plumbing drainage system when connected to a public sewer system or on-site wastewater system. The backwater valve shall be accessible for inspections and maintenance.

S 501.12.4 Construction. Urine storage tanks shall be constructed of polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polyamide (Nylon) or a blend of PET, PEN, ethyl vinyl alcohol (EVOH), Nylon, HDPE, or other tanks listed or certified to US 49 CFR 178.274 Specifications for UN?Portable Tanks.
S 501.12.5 Above Grade. Above grade storage tanks shall be prohibited where subject to freezing conditions, or shall be provided with an adequate means of freeze protection. The above grade urine storage tank shall be provided with an audible and visual high-water alarm.

S 501.12.6 Below Grade. Urine storage tanks installed below grade shall be structurally designed to withstand all anticipated earth or other loads. Tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²) (1465 kg/m²) when the tank is designed for underground installation. Below grade urine tanks installed underground shall be provided with manholes. The manhole opening shall be a minimum diameter of 20 inches (508 mm) and located a minimum of 4 inches (102 mm) above the surrounding grade. The surrounding grade shall be sloped away from the manhole. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground when empty. The combined weight of the tank and hold down system should meet or exceed the buoyancy force of the tank. The below grade urine storage tank level shall be provided with an audible and visual high-water alarm.

S 501.12.7 Marking. Where openings are provided to allow a person to enter the tank, the opening shall be marked with the following words: “DANGER – CONFINED SPACE.”

S 501.12.8 Openings. All openings shall be covered and secured to prevent tampering. Openings shall be screened or covered to prevent rodent infiltration and be protected against unauthorized human entry.

S 501.13 Maintenance Plan. Every urine diversion system shall have a maintenance plan that includes both a pumpout schedule and contract, or an onsite discharge plan. The maintenance plan shall also include a pipe cleaning schedule.

S 501.14 Treatment, Reuse, and Disposal. Where urine is to be reused onsite, a treatment method for sanitization shall be included in the owner’s manual. Approved methods of treatment shall include:

1. Retention without addition for six months before usage. Two or more holding tanks shall be required for retention.
2. Application to the compost processor.
3. Pasteurization to 158°F (70°C) for thirty minutes, or
4. Other method approved by the Authority Having Jurisdiction.

S 601.0 Composting Toilet and Urine Diversion Inspection Checklist.

S 601.1 Applicability. This appendix provides an inspection checklist for composting toilet and urine diversion systems designed in accordance with Section S 301.1.2. This is only a general checklist and is not intended to address all the provisions required by Section S 301.1.2.

S 601.2 Composting Toilet and Urine Diversion Inspection Checklist. This section includes the inspection checklist form.

COMPOSTING TOILET AND UREINE DIVERSION INSPECTION CHECKLIST

System Materials and Components
- Verify that the system is approved by the Authority Having Jurisdiction as indicated in the approved design.
- All components expected to contact excreta or leachate shall be constructed of corrosion resistant material such as stainless steel or durable polymers (ABS, PVC Schedule 40, Polypropylene, High-density polyethylene, Fiber-reinforced polyester, or material of equivalent durability).

Concrete Construction
- Verify site built concrete mix, loading weight.
- Site built concrete construction shall be reinforced and without cracking, spalling or other observed faults.
- Verify site built concrete watertightness.
- Verify site built concrete adequate drainage where required; Floors of processors shall be sloped not less than ¼-inch per foot (20.8 mm/m). Note: The flange of each sub-drain shall be set level.

Commode
- If commode uses repurposed container for transporting excreta into compost processor, container meets third part listing by a listing agency, including US 49 CFR 178.274 Specifications for UN Portable Tanks.

Compost Processors
- Compost processors shall have a leachate collection, recirculation, evaporation, or drainage system. See also Leachate Storage Tank checklist.
- Compost processor is rodent proof. No unsecured opening other than vents, drainage, or commode may exceed ½ inch (12.7 mm) in the least dimension.
- All composting processors shall be labeled and protected from human contact, surface water and precipitation.
- Compost processor must pass a water tightness test by filling the system to the maximum designed liquid storage capacity of the unit for a duration of 24 hours.
- Where unprocessed excreta or diverted urine is transferred from commode to processor(s), provide tools and cleaning materials as described in the owner’s manual.
- ComMODEs connected to compost processor without a trap shall maintain negative ventilation. If compost processor is not connected to the commode no vent is required.
Vent stacks terminate at exterior of the building as required by the plumbing or mechanical code.
The compost processor is sized in accordance with the approved design.

Leachate Storage Tanks
Leachate storage tanks, where provided, shall be constructed of polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polyamide (Nylon) or a blend of PET, PEN, ethyl vinyl alcohol (EVOH), Nylon, HDPE, or other tanks listed or certified to US 49 CFR 178.274 Specifications for UN Portable Tanks.
Above grade storage tanks are prohibited where subject to freezing conditions or shall be provided with an adequate means of freeze protection. The above grade leachate storage tank shall be provided with a high-water alarm. The alarm shall report when 80 percent volume is reached.
Where openings are provided to allow a person to enter the tank, the opening is marked "DANGER – CONFINED SPACE."
All openings are covered and secured to prevent tampering. Openings shall be screened or covered to prevent rodent infiltration and be protected against unauthorized human entry.
Below grade storage tanks shall be in accordance with the approved design.
If pressure equalization vents are specified in the design, they are installed as designed.
The connection of storage tank vents to the plumbing venting system shall be six inches above the flood level rim of the highest fixture.
Vents extending to the outdoor shall terminate no less than 12 inches (305 mm) above grade.
The vent terminal shall be directed downward and covered with a 3/32 inch (2.38 mm) mesh screen to prevent the entry of vermin and insects.
Where storage tank overflows are installed they shall be connected to the plumbing drainage system.
All leachate storage tanks shall have a high-water alarm. The alarm shall report when 80 percent volume is reached.
Storage tank overflows shall be provided with a backwater valve or check valve at the point of connection to the plumbing drainage system when connected to a public sewer system. The backwater valve shall be accessible for inspections and maintenance.

Leachate Storage Tanks
Leachate storage tanks, where provided, shall be constructed of polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polyamide (Nylon) or a blend of PET, PEN, ethyl vinyl alcohol (EVOH), Nylon, HDPE, or other tanks listed or certified to US 49 CFR 178.274 Specifications for UN Portable Tanks.
Above grade storage tanks are prohibited where subject to freezing conditions or shall be provided with an adequate means of freeze protection. The above grade leachate storage tank shall be provided with a high-water alarm. The alarm shall report when 80 percent volume is reached.
Where openings are provided to allow a person to enter the tank, the opening is marked "DANGER – CONFINED SPACE."
All openings are covered and secured to prevent tampering. Openings shall be screened or covered to prevent rodent infiltration and be protected against unauthorized human entry.
Below grade storage tanks shall be in accordance with the approved design.
If pressure equalization vents are specified in the design, they are installed as designed.
The connection of storage tank vents to the plumbing venting system shall be six inches above the flood level rim of the highest fixture.
Vents extending to the outdoor shall terminate no less than 12 inches (305 mm) above grade.
The vent terminal shall be directed downward and covered with a 3/32 inch (2.38 mm) mesh screen to prevent the entry of vermin and insects.
Where storage tank overflows are installed they shall be connected to the plumbing drainage system.
All leachate storage tanks shall have a high-water alarm. The alarm shall report when 80 percent volume is reached.
Storage tank overflows shall be provided with a backwater valve or check valve at the point of connection to the plumbing drainage system when connected to a public sewer system. The backwater valve shall be accessible for inspections and maintenance.

Leachate Storage Tanks
Leachate storage tanks, where provided, shall be constructed of polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polyamide (Nylon) or a blend of PET, PEN, ethyl vinyl alcohol (EVOH), Nylon, HDPE, or other tanks listed or certified to US 49 CFR 178.274 Specifications for UN Portable Tanks.
Above grade storage tanks are prohibited where subject to freezing conditions or shall be provided with an adequate means of freeze protection. The above grade leachate storage tank shall be provided with a high-water alarm. The alarm shall report when 80 percent volume is reached.
Where openings are provided to allow a person to enter the tank, the opening is marked "DANGER – CONFINED SPACE."
All openings are covered and secured to prevent tampering. Openings shall be screened or covered to prevent rodent infiltration and be protected against unauthorized human entry.
Below grade storage tanks shall be in accordance with the approved design.
If pressure equalization vents are specified in the design, they are installed as designed.
The connection of storage tank vents to the plumbing venting system shall be six inches above the flood level rim of the highest fixture.
Vents extending to the outdoor shall terminate no less than 12 inches (305 mm) above grade.
The vent terminal shall be directed downward and covered with a 3/32 inch (2.38 mm) mesh screen to prevent the entry of vermin and insects.
Where storage tank overflows are installed they shall be connected to the plumbing drainage system.
All leachate storage tanks shall have a high-water alarm. The alarm shall report when 80 percent volume is reached.
Storage tank overflows shall be provided with a backwater valve or check valve at the point of connection to the plumbing drainage system when connected to a public sewer system. The backwater valve shall be accessible for inspections and maintenance.

Urine Storage Tanks
Below grade urine storage tanks shall be in accordance with the approved design.
Above grade storage urine storage tanks are constructed of polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polyamide (Nylon) or a blend of PET, PEN, ethyl vinyl alcohol (EVOH), Nylon, HDPE, or other tanks listed or certified to US 49 CFR 178.274 Specifications for UN Portable Tanks.
Above grade storage tanks are prohibited where subject to freezing conditions or shall be provided with an adequate means of freeze protection.
If a vent is required for pressure equalization, then the vent shall extend above the top of the tank.
The connection of storage tank vents to the plumbing venting system shall be six inches above the flood level rim of the highest fixture.
Vents extending to the outdoor shall terminate no less than 12 inches (305 mm) above grade.
Vent terminal is directed downward and covered with a 3/32 inch (2.38 mm) mesh screen to prevent the entry of vermin and insects.
Pressure equalization vents that prevent nitrogen loss by the use of restrictions or use of piping or tubing that is less than the minimum pipe diameter required in the plumbing code shall be approved by the Authority Having Jurisdiction.
If storage tank overflows are installed they shall be connected to a plumbing drainage system.
Storage tank overflows have a backwater valve or check valve at the point of connection to the plumbing drainage system when connected to a public sewer system.
The backwater valve is accessible for inspections and maintenance.
Storage tank trap is a P-trap, mechanical trap, submerged inlet piping, or other means approved by the Authority Having Jurisdiction. Urine storage tanks of five gallons or less connected to fixtures with active ventilation or having an integrated seal do not require traps.
If submerged inlet piping is used as trap, the inlet piping must remain submerged during use and after pumpout.

Urine Diversion System
Material used for urine diversion shall be stainless steel or non-metallic pipe. Concrete piping is prohibited.
Urine diversion piping is identifiable and labeled. Pipe diameters are sized in accordance with Authority Having Jurisdiction and the plumbing code.
Where unprocessed urine is transferred from commode to processor(s), provide tools and cleaning materials as described in the owner's manual.
Changes in direction of urine diversion piping shall be made by a long-sweep 90 degree (1.57 rad) fitting or other approved fittings of equivalent sweep.
Fixtures discharging into urine diversion piping connected to the plumbing drainage system shall be trapped and vented according to the plumbing code.
Urine diversion piping is installed at a minimum grade of ½ inch per foot (41.6 mm/m), or 4 percent toward the point of disposal.
Urine is diverted to a storage tank or an approved plumbing drainage system. A maintenance plan shall be included per the design system.

**Cleanouts**
- Cleanouts installed at each aggregate horizontal change of direction exceeding 135 degrees (2.36 rad).
- A cleanout provided at the upper terminal of each drain line every 50 feet (15 240 mm).

**Venting**
- Commode fixtures connected directly to compost processor(s) without traps require a ventilation system.
- Nonwater urinals used as urine diversion systems shall be connected to a dry toilet ventilation stack or a urine diversion ventilation stack.

**Operation and Maintenance Manual.** An owner's manual is on site and accessible to the inspector and includes the following:

**Product information**
- Model/Serial number.
- Product certification references.
- Intended treatment capacity with regard to number of users and uses per day.
- Initial setup.

**Start up and operation**
- Schedule for addition of necessary compost additives.
- Source or provider of necessary compost additives. Source may be on-site.
- Schedule and instructions for all regular maintenance tasks.
- Expected input of and capacity for excreta and compost additives to compost toilet system specifying loading of commode(s) and compost processor(s).

**Annual Maintenance**
- Plan for container transfer and cleaning where transfer is used.
- Expected schedule for removing humus from composting processors and where used secondary composting bins.
- Plan for on-site disposal of humus or professional removal.
- Plan for managing leachate.
- Special conditions: cold climate operation and/or winterization.

**Testing**
- Plan for microbial testing.
- Humus Sampling.
- A laboratory is under contract to perform testing of finished compost.
- A sample of the previous treatment period shall be on-hand with fecal coliform/gram results.

**Troubleshooting**
- Guide to troubleshooting basic operating functions.

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**TABLE 1701.2**
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

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<tr>
<th>DOCUMENT NUMBER</th>
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<tr>
<td>49 CFR 178.274</td>
<td>Specifications for UN portable tanks</td>
<td>Miscellaneous</td>
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<tr>
<td>EPA/625/R-92/013-2003</td>
<td>Control of Pathogens and Vector Attraction in Sewage Sludge</td>
<td>Miscellaneous</td>
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</tbody>
</table>

(portions of table not shown remain unchanged)

**SUBSTANTIATION:**
Composting toilets are widely used as an alternative where direct connection to private or local sewer systems are just not feasible. These provisions are important to persons who run into this situation and the addition of these established code requirements that have been in the WeStand will assist the end user to design and take the appropriate steps in designing a safe system. Dealing with waste is a serious health concern and should be referenced in the UPC as a new appendix. These provision will harmonize with the latest WeStand provision for composting toilets.

**COMMITTEE ACTION:** REJECT
COMMITTEE STATEMENT:
The substantiation is not sufficient to justify the addition of this language. These systems may not apply the DWV provisions in the code.

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 22  NEGATIVE: 3  NOT RETURNED: 1  Daniels

EXPLANATION OF NEGATIVE:

BALLANCO: This is a good change that should be included in the appendix.

GORSUCH: This proposal provides important information for those who live in conditions that lack hard piped plumbing facilities, and provides guidance to safeguard public health; it should be in an appendix.

KREITENBERG: This is an item for the appendix of the Code.
Proposals

Item #: 326
UPC 2024  Section: Table 1701.1

SUBMITTER: Gretchen Pienta
ARCSA/ASPE

RECOMMENDATION:
Revise text

TABLE 1701.1
REFERENCED STANDARDS

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<td>ARCSA/ASPE 63-2013-2020</td>
<td>Rainwater Catchment Systems</td>
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(portions of table not shown remains unchanged)

Note: ARCSA/ASPE 63 meets the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revision reflects the latest update to the ARCSA/ASPE standard that is referenced in Table 1701.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 327
UPC 2024  Section: Table 1701.1, Table 1701.2

SUBMITTER: Carlton Ramcharran/Angel Guzman
ASME

RECOMMENDATION:
Revise text

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<tr>
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<td><strong>ASSE 1070-2016-2020/ASME A112.1070-2016-2020/CSA B125.70-2016-2020</strong></td>
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<td><strong>ASME A13.1-2015-2020</strong></td>
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<td><strong>Piping</strong></td>
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<td><strong>ASME B16.39-2014-2019</strong></td>
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<td><strong>ASME B31.1-2018-2020</strong></td>
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(Note: The ASME standards meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.)

**TABLE 1701.2**

<table>
<thead>
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<tr>
<td>ASME BPVC Section IV-2015-2019</td>
<td>Rules for Construction of Heating Boilers</td>
<td>Miscellaneous</td>
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(portions of table not shown remains unchanged)

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the ASME standards that are referenced in Table 1701.1 and Table 1701.2.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 328
UPC 2024 Section: Table 1701.1

SUBMITTER: Gretchen Pienta
ASPE

RECOMMENDATION:
Revise text

TABLE 1701.1
REFERENCED STANDARDS

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<tr>
<td>ASPE 45-2019-2018</td>
<td>Siphonic Roof Drainage</td>
<td>Storm Drainage</td>
<td>1106.2</td>
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(portions of table not shown remains unchanged)

Note: ASPE 45 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revision reflects the latest edition to the ASPE standard that is referenced in Table 1701.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25 NOT RETURNED: 1 Daniels
Proposals

Item #: 329
UPC 2024 Section: Table 1701.1, Table 1701.2

SUBMITTER: Terry Burger
ASSE

RECOMMENDATION:
Revise text

### TABLE 1701.1
REFERENCED STANDARDS

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<td>ASSE 1002-2020/ASME A112.1002-2020/CSA B125.12-2015 (R2020)</td>
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<td>ASSE 1003-2009-2020</td>
<td>Water Pressure Reducing Valves for Domestic Potable Water Distribution Systems</td>
<td>Valves</td>
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<td>ASSE 1008-2006-2020</td>
<td>Plumbing Aspects of Residential Food Waste Disposer Units</td>
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<td>ASSE 1020-2004-2020</td>
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<td>ASSE 1022-2017</td>
<td>Backflow Preventer for Beverage Dispensing Equipment</td>
<td>Backflow Protection</td>
<td>Table 603.2, 603.5.12</td>
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<td>ASSE 1023-1979-2020</td>
<td>Hot Water Dispensers Household Storage Type – Electrical Electrically Heated or Cooled Water Dispensers</td>
<td>Appliances</td>
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<td>ASSE 1035-2008-2020</td>
<td>Laboratory Faucet Backflow Preventers</td>
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<td>ASSE 1044-2015 (R2020)</td>
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<td>ASSE 1053-2004-2019</td>
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<td>ASSE/ IAPMO 1055-2018-2020</td>
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<td>ASSE 1064-2006 (R2011) 2020</td>
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### TABLE 1701.2

#### STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

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<tr>
<td>ASSE 1032-2004</td>
<td>Dual Check Valve Type Backflow Preventers for Carbonated Beverage Dispensers, Post Mix Type</td>
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(portion of table not shown remain unchanged)

**Note:** The ASSE standards meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.
SUBSTANTIATION:
The above revisions reflect the latest updates to the ASSE standards that are referenced in Table 1701.1 and Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 330
UPC 2024  Section: Table 1701.1, Table 1701.2

SUBMITTER: Steve Mawn
ASTM

RECOMMENDATION:
Revise text

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<td>ASTM A53/A53M-2018 2020</td>
<td>Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless</td>
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<td>ASTM B88-2016-2020</td>
<td>Seamless Copper Water Tube</td>
<td>Piping</td>
<td>Table 604.1, 604.4, 903.2.3, 1208.6.4.3, 1319.1.1(1)(a)</td>
</tr>
<tr>
<td>ASTM B152/B152M-2013-2019</td>
<td>Copper Sheet, Strip, Plate, and Rolled Bar</td>
<td>Miscellaneous</td>
<td>408.7.4</td>
</tr>
<tr>
<td>ASTM B210/B210M-2012-2019a</td>
<td>Aluminum and Aluminum-Alloy Drawn Seamless Tubes</td>
<td>Piping</td>
<td>1208.6.4.4</td>
</tr>
<tr>
<td>ASTM B280-2018-2020</td>
<td>Seamless Copper Tube for Air Conditioning and Refrigeration Field Service</td>
<td>Piping</td>
<td>1208.6.4.3, 1319.1.1(1)(b)</td>
</tr>
<tr>
<td>ASTM B306-2013-2020</td>
<td>Copper Drainage Tube (DWV)</td>
<td>Piping</td>
<td>Table 701.2, 903.2.3</td>
</tr>
<tr>
<td>ASTM B819-2018-2019</td>
<td>Seamless Copper Tube for Medical Gas Systems</td>
<td>Piping</td>
<td>1318.4, 1318.5, 1319.1.1(1)(c), 1319.1.1</td>
</tr>
<tr>
<td>ASTM C564-2014-2020a</td>
<td>Rubber Gaskets for Cast Iron Soil Pipe and Fittings</td>
<td>Joints</td>
<td>705.2.2</td>
</tr>
<tr>
<td>ASTM C1277-2018-2020</td>
<td>Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings</td>
<td>Fixtures</td>
<td>301.2.4, 705.2.2</td>
</tr>
<tr>
<td>ASTM C1540-2018-2020</td>
<td>Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings</td>
<td>Joints</td>
<td>705.2.2</td>
</tr>
<tr>
<td>ASTM D2241-2015-2020</td>
<td>Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)</td>
<td>Piping</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>ASTM D2467-2015-2020</td>
<td>Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80</td>
<td>Fittings</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>ASTM D2513-2018a-2019</td>
<td>Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings</td>
<td>Piping</td>
<td>1208.6.5, 1208.6.7.2, 1208.6.11.2, 1210.1.7.1(1)</td>
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<tr>
<td>ASTM D2665-2014-2020</td>
<td>Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings</td>
<td>Piping</td>
<td>Table 701.2, Table 707.2</td>
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<tr>
<td>ASTM D2680-2014 (R2014)-2020</td>
<td>Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping</td>
<td>Piping</td>
<td>Table 701.2</td>
</tr>
<tr>
<td>ASTM D2846/D2846M-2019a</td>
<td>Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems</td>
<td>Piping</td>
<td>Table 604.1, 605.2.2, 605.3.1</td>
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<tr>
<td>ASTM E84-2018b-2020</td>
<td>Surface Burning Characteristics of Building Materials</td>
<td>Miscellaneous</td>
<td>701.2(2), 903.1(2), 1101.4</td>
</tr>
<tr>
<td>ASTM F439-2013-2019</td>
<td>Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80</td>
<td>Fittings</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>ASTM F441/F441M-2016-2020</td>
<td>Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80</td>
<td>Piping</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>ASTM F442/F442M-2013-2020</td>
<td>Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)</td>
<td>Piping</td>
<td>Table 604.1, 605.2.2</td>
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<tr>
<td>ASTM F493-2014-2020</td>
<td>Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings</td>
<td>Joints</td>
<td>605.2.2, 605.3.1</td>
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<tr>
<td>Standard Number</td>
<td>Publication Year</td>
<td>Description</td>
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<td>ASTM F714-2021</td>
<td>2013-2021</td>
<td>Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter</td>
<td>Piping</td>
</tr>
<tr>
<td>ASTM F876-2020</td>
<td>2014-2020</td>
<td>Crosslinked Polyethylene (PEX) Tubing</td>
<td>Piping</td>
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<tr>
<td>ASTM F877-2019</td>
<td>2018</td>
<td>Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems</td>
<td>Piping</td>
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<tr>
<td>ASTM F894-2019</td>
<td>2014</td>
<td>Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe</td>
<td>Piping, Plastic</td>
</tr>
<tr>
<td>ASTM F1760-2017</td>
<td>2018-2019</td>
<td>Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed Recycled Content</td>
<td>Piping</td>
</tr>
<tr>
<td>ASTM F1807-2019</td>
<td>2019</td>
<td>Metal Insert Fittings Utilizing a Copper Crimp Ring, or Alternate Stainless Steel Clamps, for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing</td>
<td>Fittings</td>
</tr>
<tr>
<td>ASTM F1960-2016</td>
<td>2019</td>
<td>Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing</td>
<td>Fittings</td>
</tr>
<tr>
<td>ASTM F1970-2019</td>
<td>2019</td>
<td>Special Engineered Fittings, Appurtenances or Valves for Use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems</td>
<td>Piping</td>
</tr>
<tr>
<td>ASTM F1974-2009</td>
<td>2016-2020</td>
<td>Metal Insert Fittings for Polyethylene/Aluminum/Polyethylene and Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe</td>
<td>Fittings</td>
</tr>
<tr>
<td>ASTM F1986-2011</td>
<td>2011</td>
<td>Multilayer Pipe Type 2, Compression Fittings, and Compression Joints for Hot and Cold Drinking-Water Systems (WITHDRAWN)</td>
<td>Fittings</td>
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<tr>
<td>ASTM F2080-2019</td>
<td>2019</td>
<td>Cold-Expansion Fittings with Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe and SDR9 Polyethylene of Raised Temperature (PE-RT) Pipe</td>
<td>Fittings</td>
</tr>
<tr>
<td>ASTM F2098-2015</td>
<td>2018</td>
<td>Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) to Metal Insert and Plastic Insert Fittings</td>
<td>Fittings</td>
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<tr>
<td>ASTM F2159-2019</td>
<td>2019</td>
<td>Plastic Insert Fittings Utilizing a Copper Crimp Ring, or Alternate Stainless Steel Clamps, for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing</td>
<td>Fittings</td>
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<tr>
<td>ASTM F2389-2017</td>
<td>2017</td>
<td>Pressure-Rated Polypropylene (PP) Piping Systems</td>
<td>Piping</td>
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<tr>
<td>ASTM F2434-2018</td>
<td>2019</td>
<td>Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Tubing</td>
<td>Fittings</td>
</tr>
<tr>
<td>ASTM F2561-2019</td>
<td>2020</td>
<td>Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner</td>
<td>Piping</td>
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<tr>
<td>ASTM F2599-2020</td>
<td>2019</td>
<td>The Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner</td>
<td>Piping</td>
</tr>
<tr>
<td>ASTM F2620-2019</td>
<td>2019</td>
<td>Heat Fusion Joining of Polyethylene Pipe and Fittings</td>
<td>Joints</td>
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<tr>
<td>DOCUMENT NUMBER</td>
<td>DOCUMENT TITLE</td>
<td>APPLICATION</td>
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<tr>
<td>ASTM F2831-2012 (R2017)-2019</td>
<td>Internal Non-Structural Non Structural Epoxy Barrier Coating Material Used in Rehabilitation of Metallic Pressurized Piping Systems</td>
<td>Miscellaneous 320.1</td>
<td></td>
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<tr>
<td>ASTM F2855-2019</td>
<td>Chlorinated Poly (Vinyl Chloride)/Aluminum/Chlorinated Poly (Vinyl Chloride) (GPVC/AL/CPVC-AL-CPVC) Composite Pressure Tubing</td>
<td>Piping Table 604.1, 605.3.1</td>
<td></td>
</tr>
<tr>
<td>ASTM F3226/F3226M-2018</td>
<td>Metallic Press-Connect Fittings for Piping and Tubing Systems</td>
<td>Fittings Table 604.1</td>
<td></td>
</tr>
<tr>
<td>ASTM F3240-2019</td>
<td>Installation of Seamless Molded Hydrophilic Gaskets (SMHG) for Long-Term Watertightness of Cured-in-Place Rehabilitation of Main and Lateral Pipelines</td>
<td>Piping 715.3</td>
<td></td>
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</tbody>
</table>

( порtions of table not shown remains unchanged)

Note: The ASTM standards meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

### TABLE 1701.2

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM A479/A479M-2018-2020</td>
<td>Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels</td>
<td>Piping, Ferrous</td>
</tr>
<tr>
<td>ASTM B29-2014-2019</td>
<td>Refined Lead</td>
<td>Joints</td>
</tr>
<tr>
<td>ASTM B370-2012 (R2019)</td>
<td>Copper Sheet and Strip for Building Construction</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>ASTM C14-2015a-2020</td>
<td>Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe</td>
<td>Piping, Non-Metallic</td>
</tr>
<tr>
<td>ASTM C412-2015-2019</td>
<td>Concrete Drain Tile</td>
<td>Piping, Non-Metallic</td>
</tr>
<tr>
<td>ASTM C443-2012 (R2017)-2020</td>
<td>Joints for Concrete Pipe and Manholes, Using Rubber Gaskets</td>
<td>Joints</td>
</tr>
<tr>
<td>ASTM C478/C478M-2014-2020</td>
<td>Circular Precast Reinforced Concrete Manhole Sections</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>ASTM C1227-2013 2020</td>
<td>Precast Concrete Septic Tanks</td>
<td>DWV Components</td>
</tr>
<tr>
<td>ASTM D2774-2012 2020</td>
<td>Underground Installation of Thermoplastic Pressure Piping</td>
<td>Piping, Plastic</td>
</tr>
<tr>
<td>ASTM D2855-2015 2020</td>
<td>The Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets</td>
<td>Joints</td>
</tr>
<tr>
<td>ASTM F1924-2012-2019</td>
<td>Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing</td>
<td>Fittings</td>
</tr>
<tr>
<td>ASTM F1948-2016-2020</td>
<td>Metallic Mechanical Fittings for Use on Outside Diameter Controlled Thermoplastic Gas Distribution Pipe and Tubing</td>
<td>Fittings</td>
</tr>
<tr>
<td>ASTM F2206-2014-2019</td>
<td>Fabricated Fittings of Butt-Fused Polyethylene (PE)</td>
<td>DWV Components</td>
</tr>
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</table>
SUBSTANTIATION:
The above revisions reflect the latest updates to the ASTM standards that are referenced in Table 1701.1 and Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

The TCC has the responsibility to resolve conflicts and achieve correlation among the recommendations of the Technical Committee. The TCC has the authority to choose between alternative text recommended by the Technical Committee, but only as necessary for correlation, consistency, and the correction of errors and omissions in accordance with Section 3-4 of the Regulations Governing Committee Projects.

Actions taken on UPC Item # 330, Table 1701.1 (Referenced Standards) and UPC Table 604.1 (Materials for Building Supply and Water Distribution Piping and Fittings) resulted in conflicting language within the code. In order to correlate the language, the Technical Correlating Committee proposed the following modifications to the UPC:

**TABLE 604.1**
MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>BUILDING SUPPLY PIPE AND FITTINGS</th>
<th>WATER DISTRIBUTION PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE-AL-PEX</td>
<td>X</td>
<td>X</td>
<td>ASTM-F1986</td>
<td>ASTM-F1986</td>
</tr>
</tbody>
</table>

TCC ACTION: ACCEPT AS SUBMITTED

TCC STATEMENT:
The reference to ASTM F1986 standard in UPC Table 604.1 (Materials for Building Supply and Water Distribution Piping and Fittings) is being stricken to correlate with the action taken by the UPC TC for Item # 330, Table 1701.1 (Referenced Standards) as the ASTM F1986 standard has been withdrawn by the promulgator.

The action moves forward as approved by the TCC and supersedes the recommendation from the UPC TC for actions taken for Table 604.1 regarding the ASTM F1986 standard that has been withdrawn by the promulgator.
Proposals

Item #: 331
UPC 2024  Section: Table 1701.1

SUBMITTER: Peter Portela
AWS

RECOMMENDATION:
Revise text

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS A5.8M/A5.8-2011-AMD 1-2019</td>
<td>Filler Metals for Brazing and Braze Welding</td>
<td>Joints</td>
<td>605.1.1, 705.3.1, 1321.3</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: AWS A5.8M/A5.8 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revision reflects the latest update to the AWS standard that is referenced in Table 1701.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 332
UPC 2024  Section: Table 1701.1

SUBMITTER: Paul Olson
AWWA

RECOMMENDATION:
Revise text

<table>
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<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>AWWA C153-2011-2019</td>
<td>Ductile-Iron Compact Fittings</td>
<td>Fittings</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>AWWA C500-2009-2019</td>
<td>Metal-Seated Gate Valves for Water Supply Service</td>
<td>Valves</td>
<td>606.1</td>
</tr>
<tr>
<td>AWWA C507-2015-2018</td>
<td>Ball Valves, 6 in. through 60 in. (150 mm through 1,500 mm)</td>
<td>Valves</td>
<td>606.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: AWWA C153, AWWA C500, and AWWA C507 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revisions reflect the latest updates to the AWWA standards that are referenced in Table 1701.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 333
UPC 2024  Section: Table 1701.1, Table 1701.2

SUBMITTER: Tom Deary
CGA (Compressed Gas Association)

RECOMMENDATION:
Revise text

TABLE 1701.1
REFERENCED STANDARDS

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<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>CGA V-5-2008 (R2013)-2019</td>
<td>Diameter Index Safety System (Noninterchangeable Low Pressure Connections for Medical Gas Applications)</td>
<td>Connections</td>
<td>1315.5</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

Note: CGA G-4.1 and CGA V-5 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
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<th>DOCUMENT NUMBER</th>
<th>Document Title</th>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>CGA C-9-2013-2019</td>
<td>Standard Color Marking of Compressed Gas Containers for Medical Use</td>
<td>Miscellaneous</td>
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<tr>
<td>CGA S-1.3-2009-2020</td>
<td>Pressure Relief Device Standards-Part 3-Stationary Storage Containers for Compressed Gases</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>CGA V-1-2013-2019</td>
<td>Compressed Gas Cylinder Valve Outlet and Inlet Connections</td>
<td>Valves</td>
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(portions of table not shown remain unchanged)

SUBSTANTIATION:
The above revisions reflect the latest updates to the CGA standards that are referenced in Table 1701.1 and Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 334

UPC 2024  Section: Table 1701.1

SUBMITTER: David Parney
CISPI

RECOMMENDATION:
Revise text

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>CISPI 301-2017-2018</td>
<td>Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications</td>
<td>Piping, Ferrous</td>
<td>301.2.4, Table 701.2, Table 707.2</td>
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<tr>
<td>CISPI 310-2017-2020</td>
<td>Couplings for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications</td>
<td>Joints</td>
<td>301.2.4, 705.2.2</td>
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(portions of table not shown remains unchanged)

Note: CISPI 301 and CISPI 310 meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The above revisions reflect the latest updates to the CISPI standards that are referenced in Table 1701.1.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 335
UPC 2024  Section: Table 1701.1, Table 1701.2

**SUBMITTER:** Lauro Pilla / Nikki Kidd
CSA

**RECOMMENDATION:**
Revise text

<table>
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<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>ASME A112.4.2-2015 (R2020)/CSA B45.16-2015 (R2020)</td>
<td>Personal Hygiene Devices for Water Closets</td>
<td>Fixtures</td>
<td>411.4</td>
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<tr>
<td>ASME A112.18.2-2015-2020/CSA B125.2-2014-2020</td>
<td>Plumbing Waste Fittings</td>
<td>Fittings</td>
<td>404.1</td>
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<tr>
<td>ASME A112.19.7-2012-2020/CSA B45.10-2012-R2017-2020</td>
<td>Hydromassage Bathtub Systems</td>
<td>Fixtures</td>
<td>409.1, 409.6</td>
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<td>ASSE 1002-2020/ASME A112.1002-2020/CSA B125.12-2014-2020</td>
<td>Anti-Siphon Fill Valves for Water Closet Tanks</td>
<td>Backflow Protection</td>
<td>413.3, Table 603.2</td>
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<tr>
<td>CSA B45.12-2013 (R2018)/IAPMO Z402-2013 (R2018)</td>
<td>Aluminum and Copper Plumbing Fixtures</td>
<td>Fixtures</td>
<td>407.1, 408.1, 409.1, 420.1</td>
</tr>
<tr>
<td>CSA B137.1-2017-2020</td>
<td>Polyethylene (PE) Pipe, Tubing, and Fittings for Cold-Water Pressure Services</td>
<td>Piping</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>CSA B137.5-2017-2020</td>
<td>Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications</td>
<td>Piping</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>CSA B137.6-2017-2020</td>
<td>Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot- and Cold-Water Distribution Systems</td>
<td>Piping, Fittings</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>CSA B137.9-2017-2020</td>
<td>Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-Pipe Systems</td>
<td>Piping</td>
<td>Table 604.1</td>
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<tr>
<td>CSA B137.10-2017-2020</td>
<td>Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Composite Pressure-Pipe Systems</td>
<td>Piping</td>
<td>Table 604.1</td>
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<tr>
<td>CSA B137.11-2017-2020</td>
<td>Polypropylene (PP-R &amp; PP-RCT) Pipe and Fittings for Pressure Applications</td>
<td>Piping</td>
<td>Table 604.1, 605.11.1</td>
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<tr>
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<td>APPLICATION</td>
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<td>CSA B137.18-2017-2020</td>
<td>Polyethylene of Raised Temperature Resistance (PE-RT) Tubing Systems for Pressure Applications</td>
<td>Piping, Fittings</td>
<td>Table 604.1</td>
</tr>
<tr>
<td>CSA/ANSI Z21.10.3-2017-2019/CSA 4.3-2019</td>
<td>Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous <em>(same as CSA 4.3)</em></td>
<td>Fuel Gas, Appliances</td>
<td>Table 501.1(1)</td>
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<tr>
<td>CSA/ANSI Z21.54-2014-2019/CSA 8.4-2019</td>
<td>Gas Hose Connectors for Portable Outdoor Gas-Fired Appliances <em>(same as CSA 8.4)</em></td>
<td>Fuel Gas</td>
<td>1212.3.2</td>
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</table>

(portions of table not shown remains unchanged)

**Note:** The CSA standards meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.
|-----------------------------------------------------------|--------------------------------------------------|----------|

(portions of table not shown remains unchanged)

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the CSA standards that are referenced in Table 1701.1 and Table 1701.2.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 336
UPC 2024 Section: Table 1701.1, Table 1701.2

SUBMITTER: Robert Pickering
EPA

RECOMMENDATION:
Revise text

TABLE 1701.1
REFERENCED STANDARDS

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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</thead>
</table>

(portions of table not shown remains unchanged)

Note: EPA/600/R-12/618 does not meet the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>EPA/600/R-12/618-2012</td>
<td>Guidelines for Water Reuse</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>EPA WaterSense-2015</td>
<td>Specification for Flushometer-Valve Water Closets</td>
<td>Fixtures</td>
</tr>
<tr>
<td>EPA WaterSense-2018</td>
<td>Specification for Showerheads</td>
<td>Fixtures</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
The above revisions reflect the latest updates to the EPA standards that are referenced in Table 1701.1 and Table 1701.2.

Both of the WaterSense standard specifications added to Table 1701.2 are mentioned in Appendix L of the UPC, but their associated reference in Table 1701.2 does not exist. The WaterSense Specification for Flushometer-Valve Water Closets is mentioned in L 402.2.2. The WaterSense Specification for Showerheads is mentioned in L 402.6.

COMMITTEE ACTION: ACCEPT AS AMENDED BY THE TC
Amend proposal as follows:

### TABLE 1701.1
**REFERENCED STANDARDS**

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<td>EPA/600/R-12/618-2012</td>
<td>Guidelines for Water Reuse</td>
<td>Miscellaneous</td>
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### TABLE 1701.2
**STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES**

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<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>EPA WaterSense-2015</td>
<td>Specification for Flushometer-Valve Water Closets</td>
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<tr>
<td>EPA WaterSense-2018</td>
<td>Specification for Showerheads</td>
<td>Fixtures</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

**COMMITTEE STATEMENT:**
Based on previous actions, the EPA standard was removed from Table 1701.1. The remaining changes were approved.

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS: **AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
### Proposals

**Item #: 337**

UPC 2024  Section: Table 1701.1, Table 1701.2

**SUBMITTER:** Kyle Thompson  
IAPMO

**RECOMMENDATION:**  
Revise text

<table>
<thead>
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<th>STANDARD TITLE</th>
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<th>REFERENCED SECTION</th>
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<tr>
<td>IAPMO IGC 78-2018</td>
<td>Drain, Waste and Vent (DWV) Internal Cleanout Fittings</td>
<td>DWV Components</td>
<td>Table 707.2</td>
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<td>IAPMO IGC 349-2018</td>
<td>Electronic Plumbing Supply System Integrity Protection Devices</td>
<td>Miscellaneous</td>
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<td>IAPMO IGC 352-2018</td>
<td>Diverter Valves for Diversion of Rainwater or Storm-Water for Use in Alternate Nonpotable Water Source Systems</td>
<td>Valves</td>
<td>1503.2.4</td>
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<tr>
<td>IAPMO PS 65-2019</td>
<td>Airgap Units for Water Conditioning Equipment Installation</td>
<td>Backflow Protection</td>
<td>611.2</td>
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<tr>
<td>IAPMO PS 117-2019</td>
<td>Press and Nail Connections</td>
<td>Fittings</td>
<td>Table 604.1</td>
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<tr>
<td>IAPMO Z124.5-2013</td>
<td>Plastic Toilet Seats</td>
<td>Appurtenance</td>
<td>411.3</td>
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<tr>
<td>IAPMO Z1033-2015</td>
<td>Flexible PVC Hoses and Tubing for Pools, Hot Tubs, Spas, and Jetted Bathtubs</td>
<td>Tubing</td>
<td>409.6.1</td>
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<td>IAPMO Z1088-2014</td>
<td>Pre-Pressurized Water Expansion Tanks</td>
<td>Miscellaneous</td>
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<td>IAPMO Z1157-2014</td>
<td>Ball Valves</td>
<td>Valves</td>
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(portions of table not shown remains unchanged)

**Note:** The IAPMO standards meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.
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<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
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<tr>
<td>IAPMO IGC 109-2017</td>
<td>Water Distribution Manifolds</td>
<td>Valves</td>
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<tr>
<td>IAPMO IGC 193-2019</td>
<td>Safety Plates, Plate Straps, Notched Plates and Safety Collars</td>
<td>Miscellaneous</td>
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<tr>
<td>IAPMO IGC 226-2019</td>
<td>Drinking Water Fountains With or Without Chiller or Heater</td>
<td>Fixtures</td>
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<tr>
<td>IAPMO IGC 276-2019</td>
<td>Bundled Expanded Polystyrene (EPS) Synthetic Aggregate Units</td>
<td>DWV Components</td>
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<tr>
<td>IAPMO IGC 330-2018</td>
<td>Recirculating Shower Systems</td>
<td>Fixtures</td>
</tr>
<tr>
<td>IAPMO PS 1-2007</td>
<td>Tank Risers</td>
<td>DWV Components</td>
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<tr>
<td>IAPMO PS 23-2006</td>
<td>Dishwasher Drain Airgaps</td>
<td>Backflow Protection</td>
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<tr>
<td>IAPMO PS 25-2002</td>
<td>Metallic Fittings for Joining Polyethylene Pipe for Water Service and Yard Piping</td>
<td>Joints</td>
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<tr>
<td>IAPMO PS 34-2003</td>
<td>Encasement Sleeves for Potable Water Pipe and Tubing</td>
<td>Piping</td>
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<tr>
<td>IAPMO PS 37-2002</td>
<td>Black Plastic PVC or PE Pressure-Sensitive Corrosion Preventive Tape</td>
<td>Miscellaneous</td>
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<tr>
<td>IAPMO PS 50-2019</td>
<td>Flush Valves with Dual Flush Device for Water Closets or Water Closet Tanks with an Integral Flush Valves with a Dual Flush Device</td>
<td>Fixtures</td>
</tr>
<tr>
<td>IAPMO PS 52-2009</td>
<td>Pump/Dose, Sumps and Sewage Ejector Tanks with or without a Pump</td>
<td>DWV Components</td>
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<tr>
<td>IAPMO PS 53-2010</td>
<td>Grooved Mechanical Pipe Couplings and Grooved Fittings</td>
<td>Joints</td>
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<tr>
<td>IAPMO PS 56-2002</td>
<td>PVC Hydraulically Actuated Diaphragm Type Water Control Valves (WITHDRAWN)</td>
<td>Valves</td>
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<tr>
<td>IAPMO PS 63-2014</td>
<td>Plastic Leaching Chambers</td>
<td>DWV Components</td>
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<td>IAPMO PS 67-2019</td>
<td>Early-Closure Replacement Flappers or Early-Closure Replacement Flapper with Mechanical Assemblies</td>
<td>Fixtures</td>
</tr>
<tr>
<td>IAPMO PS 69-2006</td>
<td>Bathwaste and Overflow Assemblies with Tub Filler Spout</td>
<td>DWV Components</td>
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<tr>
<td>IAPMO PS 72-2002</td>
<td>Valves with Atmospheric Vacuum Breakers</td>
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<td>IAPMO PS 79-2006</td>
<td>Multiport Electronic Trap Primers</td>
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<td>Clarifiers</td>
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<td>IAPMO PS 81-2006</td>
<td>Precast Concrete Seepage Pit Liners and Covers</td>
<td>DWV Components</td>
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<td>IAPMO PS 82-1995</td>
<td>Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Fittings (WITHDRAWN)</td>
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<td>IAPMO PS 85-1996</td>
<td>Tools for Mechanically Formed Tee Connections in Copper Tubing</td>
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<td>IAPMO PS 86-1996</td>
<td>Rainwater Diverter Valves for Non-Roofed Area Slabs</td>
<td>DWV Components</td>
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<td>IAPMO PS 89-1996</td>
<td>Soaking and Hydrotherapy (Whirlpool) Bathtubs with Hydraulic Seatlift (WITHDRAWN)</td>
<td>Fixtures</td>
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<td>IAPMO PS 91-2005</td>
<td>Plastic Stabilizers for Use with Plastic Closet Bends</td>
<td>DWV Components</td>
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<td>IAPMO PS 95-2016</td>
<td>Pipe Support Hangers and Hooks</td>
<td>DWV Components</td>
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<td>IAPMO PS 98-1996</td>
<td>Prefabricated Fiberglass Church Baptisteries (WITHDRAWN)</td>
<td>Fixtures</td>
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<td>IAPMO PS 100-1996</td>
<td>Porous Filter Protector for Sub-Drain Weep Holes (WITHDRAWN)</td>
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<td>Suction Relief Valves</td>
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<td>IAPMO PS 104-1997</td>
<td>Pressure Relief Connection for Dispensing Equipment Valves</td>
<td>Valves</td>
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<tr>
<td>IAPMO PS 105-1997</td>
<td>Polyethylene Distribution Boxes (WITHDRAWN)</td>
<td>DWV Components</td>
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<td>IAPMO PS 110-2006a 2019</td>
<td>PVC Cold Water Compression Fittings</td>
<td>Fittings</td>
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<td>IAPMO PS 111-1999 2019</td>
<td>PVC Cold Water Gripper Fittings</td>
<td>Fittings</td>
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<tr>
<td>IAPMO PS 113-2010</td>
<td>Hydraulically Powered Household Food Waste Disposers (WITHDRAWN)</td>
<td>Appliances</td>
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<tr>
<td>IAPMO PS 114-1999 (WITHDRAWN)</td>
<td>Remote Floor Box Industrial Water Supply, Air Supply, Drainage (WITHDRAWN)</td>
<td>Miscellaneous</td>
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<td>IAPMO PS 115-2007 2019</td>
<td>Hot Water On-Demand or Automatic Activated Hot Water Pumping Systems</td>
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<td>IAPMO PS 116-1999</td>
<td>Hot Water Circulating Devices Which Do Not Use a Pump (WITHDRAWN)</td>
<td>Miscellaneous</td>
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<td>IAPMO Z124.7-2013 (R2018)</td>
<td>Prefabricated Plastic Spa Shells</td>
<td>Fixtures, Swimming Pools, Spas, and Hot Tubs</td>
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<tr>
<td>IAPMO Z124.8-2013 (R2018)</td>
<td>Plastic Liners for Bathtubs and Shower Receptors</td>
<td>Fixtures</td>
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<tr>
<td>IAPMO Z1000-2014-2019</td>
<td>Prefabricated Septic Tanks</td>
<td>DWV Components</td>
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Substantiation:
The above revisions reflect the latest updates to the IAPMO standards that are referenced in Table 1701.1 and Table 1701.2.

Committee Action: Accept as Submitted

Total Eligible to Vote: 26

Voting Results: Affirmative: 25  Not Returned: 1  Daniels
Proposals

Item #: 338

UPC 2024  Section: Table 1701.1, Table 1701.2

SUBMITTER: Kaley Garubba
Manufacturers Standardization Society (MSS)

RECOMMENDATION:
Revise text

### TABLE 1701.1
REFERRED STANDARDS

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<tr>
<th>STANDARD NUMBER</th>
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<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>MSS SP-80-2013-2019</td>
<td>Bronze Gate, Globe, Angle, and Check Valves</td>
<td>Valves</td>
<td>606.1</td>
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</table>

(portions of table not shown remains unchanged)

Note: MSS SP-80 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

### TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
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<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
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<tbody>
<tr>
<td>MSS SP-44-2016 (R2017)-2019</td>
<td>Steel Pipeline Flanges</td>
<td>Fittings</td>
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<tr>
<td>MSS SP-106-2012-2019</td>
<td>Cast Copper Alloy Flanges and Flanged Fittings: Class 125, 150, and 300</td>
<td>Fittings</td>
</tr>
<tr>
<td>MSS SP-123-2013-2018</td>
<td>Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube</td>
<td>Joints</td>
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(portions of table not shown remains unchanged)

SUBSTANTIATION:
The above revisions reflect the latest updates to the MSS standards that are referenced in Table 1701.1 and Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
## TABLE 1701.1
### REFERENCED STANDARDS

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<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tbody>
<tr>
<td>NFPA 31-2016-2020</td>
<td>Installation of Oil-Burning Equipment</td>
<td>Fuel Gas, Appliances</td>
<td>505.3, 1201.1</td>
</tr>
<tr>
<td>NFPA 58-2017-2020</td>
<td>Liquefied Petroleum Gas Code</td>
<td>Fuel Gas</td>
<td>1208.5(7), 1208.6.7.3, 1208.6.11.4, 1212.11</td>
</tr>
<tr>
<td>NFPA 70-2017-2020</td>
<td>National Electrical Code</td>
<td>Miscellaneous</td>
<td>1210.12.5(2), 1211.2.4, 1211.7, 1317.1(11), 1323.3.1</td>
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<td>NFPA 99-2018-2021</td>
<td>Health Care Facilities Code</td>
<td>Miscellaneous</td>
<td>1301.3, 1309.13(2), 1317.1(9), 1324.5.9.4, 1327.1</td>
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<td>NFPA 780-2017-2020</td>
<td>Installation of Lightning Protection Systems</td>
<td>Fuel Gas</td>
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</table>

(portions of table not shown remains unchanged)

Note: NFPA standards meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

## TABLE 1701.2
### STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
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(portions of table not shown remains unchanged)

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the NFPA standards that are referenced in Table 1701.1 and Table 1701.2.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED
TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 340
UPC 2024  Section: Table 1701.1, Table 1701.2

SUBMITTER: Jeremy Brown
NSF

RECOMMENDATION:
Revise text

<table>
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<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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<tr>
<td>NSF/ANSI 3-2017-2019</td>
<td>Commercial Waremashing Equipment Appliances</td>
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<tr>
<td>NSF/ANSI 42-2018-2019</td>
<td>Drinking Water Treatment Units – Aesthetic Effects Appliances</td>
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<td>Table 611.1</td>
</tr>
<tr>
<td>NSF/ANSI 55-2018-2019</td>
<td>Ultraviolet Microbiological Water Treatment Systems Appliances</td>
<td></td>
<td>Table 611.1</td>
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<tr>
<td>NSF/ANSI 58-2017-2019</td>
<td>Reverse Osmosis Drinking Water Treatment Systems Appliances</td>
<td></td>
<td>611.2, Table 611.1</td>
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<tr>
<td>NSF/ANSI/350-2017</td>
<td>Drinking Water System Components – Health Effects Miscellaneous</td>
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<td>415.1, 417.1, 604.1, 604.9, 606.1, 607.2, 608.2, 609.8.2, Table 611.1</td>
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(portion of the table not shown remains unchanged)

Note: NSF standards meet the requirements for mandatory referenced standards in accordance with Section 3.3.7.1 of IAPMO’s Regulations Governing Committee Projects.
TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
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<tr>
<th>DOCUMENT NUMBER</th>
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<tbody>
<tr>
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<td>Food Equipment</td>
<td>Appliances</td>
</tr>
<tr>
<td>NSF/ANSI 4-2016</td>
<td>Commercial Cooking, Rethermalization, and Powered Hot Food Holding and Transportation Equipment</td>
<td>Appliances</td>
</tr>
<tr>
<td>NSF/ANSI 5-2016</td>
<td>Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment</td>
<td>Appliances</td>
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<td>NSF/ANSI 12-2018</td>
<td>Automatic Ice Making Equipment</td>
<td>Appliances</td>
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<tr>
<td>NSF/ANSI 18-2016</td>
<td>Manual Food and Beverage Dispensing Equipment</td>
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<tr>
<td>NSF/ANSI 29-2017</td>
<td>Detergent and Chemical Feeders for Commercial Spray-Type Dishwashing Machines</td>
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<td>NSF/ANSI 40-2018</td>
<td>Residential Wastewater Treatment Systems</td>
<td>DWV Components</td>
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<tr>
<td>NSF/ANSI 41-2018</td>
<td>Non-Liquid Saturated Treatment Systems</td>
<td>DWV Components</td>
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<tr>
<td>NSF/ANSI 46-2018</td>
<td>Evaluation of Components and Devices Used in Wastewater Treatment Systems</td>
<td>DWV Components</td>
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<tr>
<td>NSF/ANSI 169-2016</td>
<td>Special Purpose Food Equipment and Devices</td>
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(portions of table not shown remains unchanged)

SUBSTANTIATION:
The above revisions reflect the latest updates to the NSF standards that are referenced in Table 1701.1 and Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 341
UPC 2024  Section: Table 1701.1

SUBMITTER: Max Weiss
Plumbing and Drainage Institute (PDI)

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDI G-102-2009-2009</td>
<td>Testing and Certification for Grease Interceptors with FOG Sensing and Alarm Devices</td>
<td>Certification</td>
<td>1014.1</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: PDI G-102 meets the requirements for a mandatory referenced standard in accordance with Section 3-3.7.1 of IAPMO's Regulations Governing Committee Projects.

SUBSTANTIATION:
The PDI G-102 standard is being modified to reflect the correct edition in Table 1701.1

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 342
UPC 2024  Section: Table 1701.1, Table 1701.2

SUBMITTER: John Taecker
UL LLC

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>STANDARD NUMBER</th>
<th>STANDARD TITLE</th>
<th>APPLICATION</th>
<th>REFERENCED SECTION</th>
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</thead>
<tbody>
<tr>
<td>UL 174-2004</td>
<td>Household Electric Storage Tank Water Heaters (with revisions through December 15, 2016-September 15, 2020)</td>
<td>Appliances</td>
<td>Table 501.1(1)</td>
</tr>
<tr>
<td>UL 399-2017</td>
<td>Drinking Water Coolers (with revisions through August 29, 2018-July 31, 2020)</td>
<td>Fixtures</td>
<td>415.1</td>
</tr>
<tr>
<td>UL 467-2013</td>
<td>Grounding and Bonding Equipment (with revisions through June 7, 2017)</td>
<td>Miscellaneous</td>
<td>1211.2.5</td>
</tr>
<tr>
<td>UL 651-2011</td>
<td>Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings (with revisions through June 15, 2016-March 24, 2020)</td>
<td>Piping</td>
<td>1208.6.6</td>
</tr>
<tr>
<td>UL 778-2016</td>
<td>Motor-Operated Water Pumps (with revisions through January 17, 2019-August 11, 2020)</td>
<td>Appliances</td>
<td>1101.14</td>
</tr>
<tr>
<td>UL 921-2016-2020</td>
<td>Commercial Dishwashers (with revisions through September 20, 2017)</td>
<td>Appliances</td>
<td>414.1</td>
</tr>
<tr>
<td>UL 959-2010</td>
<td>Medium Heat Appliance Factory-Built Chimneys (with revisions through June 12, 2014-August 28, 2019)</td>
<td>Fuel Gas, Appliances</td>
<td>509.5.1</td>
</tr>
<tr>
<td>UL 1738-2010</td>
<td>Venting Systems for Gas-Burning Appliances, Categories II, III, and IV (with revisions through November 7, 2014-February 6, 2020)</td>
<td>Fuel Gas, Appliances</td>
<td>509.4.1, 509.4.2, 509.4.3</td>
</tr>
<tr>
<td>UL 1777-2015</td>
<td>Chimney Liners (with revisions through April 11, 2019)</td>
<td>Chimney Liners</td>
<td>509.5.3(2)</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

Note: The UL standards meet the requirements for mandatory referenced standards in accordance with Section 3-3.7.1 of IAPMO’s Regulations Governing Committee Projects.
<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL 80-2007</td>
<td>Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids (with revisions through January 16, 2014 - April 26, 2019)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 144-2012</td>
<td>LP-Gas Regulators (with revisions through November 5, 2014 - December 10, 2019)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 296-2017</td>
<td>Oil Burners (with revisions through November 29, 2017 - January 8, 2021)</td>
<td>Fuel Gas, Appliances</td>
</tr>
<tr>
<td>UL 429-2013</td>
<td>Electrically Operated Valves (with revisions through January 16, 2020)</td>
<td>Valves</td>
</tr>
<tr>
<td>UL 536-2014</td>
<td>Flexible Metallic Hose (with revisions through December 10, 2019)</td>
<td>Fuel Gas</td>
</tr>
<tr>
<td>UL 563-2009</td>
<td>Ice Makers (with revisions through August 30, 2018 - July 23, 2020)</td>
<td>Appliances</td>
</tr>
<tr>
<td>UL 1331-2005</td>
<td>Station Inlets and Outlets (with revisions through May 12, 2017 - February 5, 2020)</td>
<td>Medical Gas</td>
</tr>
<tr>
<td>UL 1951-2011</td>
<td>Electric Plumbing Accessories (with revisions through August 26, 2017 - June 27, 2020)</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>UL 2157-2018</td>
<td>Electric Clothes Washing Machines and Extractors (with revisions through September 20, 2019)</td>
<td>Appliances</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

**SUBSTANTIATION:**
The above revisions reflect the latest updates to the UL standards that are referenced in Table 1701.1 and Table 1701.2.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:** AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 343

UPC 2024  Section: Table 1701.2

SUBMITTER: Emily Toto
ASHRAE

RECOMMENDATION:
Revise text

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
The above revisions reflect the latest updates to the ASHRAE standards that are referenced in Table 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS:  AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
**Proposals**

**Item #: 344**

UPC 2024  Section: Table 1701.2

**SUBMITTER:** Robert Pickering  
Eastern Research Group, Inc.  
Rep. EPA WaterSense

**RECOMMENDATION:**  
Add new text

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA WaterSense-2018</td>
<td>Specification for Showerheads</td>
<td>Fixtures</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

**SUBSTANTIATION:**  
EPA's WaterSense Specification for Showerheads is referenced in Section L 402.6.

**COMMITTEE ACTION:** ACCEPT AS SUBMITTED

**TOTAL ELIGIBLE TO VOTE:** 26

**VOTING RESULTS:**  
AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proposals

Item #: 345
UPC 2024  Section: Table 1701.2

SUBMITTER: Robert Pickering
Eastern Research Group, Inc.
Rep. EPA WaterSense

RECOMMENDATION:
Add new text

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA WaterSense-2015</td>
<td>Specification for Flushometer-Valve Water Closets</td>
<td>Fixtures</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
EPA's WaterSense Specification for Flushometer-Valve Water Closets is referenced in Section L 402.2.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels
Proopsals

Item #: 346
UPC 2024  Section: Table 1701.2

SUBMITTER: Ken Cornwall
ProVent Systems

RECOMMENDATION:
Add new text

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAPMO IGC 359-2019a</td>
<td>Flexible Expansion Couplings for DWV Stack Applications</td>
<td>Thermal Expansion</td>
</tr>
</tbody>
</table>

(portions of table not shown remain unchanged)

SUBSTANTIATION:
IAPMO IGC 327 and IAPMO PS 51 are already addressed in Table 1701.2 as standards that cover expansion of piping. IAPMO IGC 359 is designed for thermal expansion in high-rise buildings and will benefit the end user as option for controlling thermal expansion.

COMMITTEE ACTION: REJECT

COMMITTEE STATEMENT:
The substation does not provide technical justification to warrant the addition of the proposed standard regarding expansion joints.
<table>
<thead>
<tr>
<th>TOTAL ELIGIBLE TO VOTE: 26</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOTING RESULTS: \textbf{AFFIRMATIVE}: 25 \textbf{NOT RETURNED}: 1 Daniels</td>
</tr>
</tbody>
</table>
Proposals

Item #: 347
UPC 2024  Section: 1701.2

SUBMITTER: Jeremy Brown
NSF International

RECOMMENDATION:
Add new text

TABLE 1701.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

<table>
<thead>
<tr>
<th>DOCUMENT NUMBER</th>
<th>DOCUMENT TITLE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF/ANSI/CAN 372-2020</td>
<td>Drinking Water System Components - Lead Content</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

(portions of table not shown remains unchanged)

SUBSTANTIATION:
When Section 604.2 Lead Content was added to the code, it was set up to mirror the language in the US Safe Drinking Water Act. At that time, NSF/ANSI 372 was not referenced in the code because some proponents felt there could be other ways to demonstrate compliance with the code without using this standard. NSF/ANSI/CAN 372 is the American and Canadian National Standard for determining lead content and the vast majority of products on the market do use this standard for determining lead content. Therefore it is appropriate to be referenced in 1701.2.

COMMITTEE ACTION: ACCEPT AS SUBMITTED

TOTAL ELIGIBLE TO VOTE: 26

VOTING RESULTS: AFFIRMATIVE: 25  NOT RETURNED: 1  Daniels

EXPLANATION OF AFFIRMATIVE:

GORSUCH: I would recommend adding a note: "If a product is NSF 61 listed, it will automatically meet NSF 372." So manufacturers can understand that if the products have NSF 61 certificates, there is no need to apply for separate NSF 372 certificates.
Technical Correlating Committee Report for UPC/UMC
2021 IAPMO UPC-UMC Technical Correlation Committee (TCC) Report
Correlation Items Between the UPC and UPC
**TCC ITEM # 001**

2024 UNIFORM PLUMBING CODE

**ITEM # 160**

**RECOMMENDATION:**

**608.0 Water Pressure, Pressure Regulators, Pressure Relief Valves, and Vacuum Relief Valves.**

**608.3 Expansion Tanks, and Combination Temperature and Pressure-Relief Valves.** A water system provided with a check valve, backflow preventer, or other normally closed device that prevents dissipation of building pressure back into the water main, independent of the type of water heater used, shall be provided with an approved, listed, and adequately sized expansion tank or other approved device having a similar function to control thermal expansion. Prepressurized water expansion tanks shall comply with IAPMO Z1088. Such expansion tank or other approved device shall be installed on the building side of the check valve, backflow preventer, or other device and shall be sized, securely fastened to the structure, and installed in accordance with the manufacturer’s installation instructions.

A water system containing storage water heating equipment shall be provided with an approved, listed, adequately sized combination temperature and pressure-relief valve, except for listed nonstorage instantaneous heaters having an inside diameter of not more than 3 inches (80 mm). Each such approved combination temperature and pressure-relief valve shall be installed on the water-heating device in an approved location based on its listing requirements and the manufacturer’s installation instructions. Each such combination temperature and pressure-relief valve shall be provided with a drain in accordance with Section 608.5.

---

**X | Accept recommendation as submitted.**

**No action needed.**

---

**Substantiation:**

The language in UPC Item # 161, Section 608.3 (Expansion Tanks, and Combination Temperature and Pressure-Relief Valves) is being revised to correlate with the action taken by the UPC TC for Item # 160, Section 608.3 (Expansion Tanks, and Combination Temperature and Pressure-Relief Valves) regarding expansion tanks being “securely fastened to the structure.”

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 160 of the UPC is as follows:** Expansion tanks range in sizes and types. Many tanks are being left to be supported by the piping onto which it is mounted, however this is a concern as piping is not meant to be a supporting device, actually piping is required to be supported, not the other way around. The addition of this language will require that all expansion tanks be supported where the installation instructions fail to mention this.

**The substantiation provided for proposal Item # 161 of the UPC is as follows:** Water does not compress so when it is heated and it expands it can create damaging pressure. Expansion tanks are designed to compensate for this. Instantaneous water heaters do not store water so there is no water to expand and create the excess pressure. Water is heated on demand only so there is no issue of the water heating, expanding and building pressure as the water is flowing out by the demand.
**RECOMMENDATION:**

**1501.7 Minimum Water Quality Requirements.** The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, for on-site treated nonpotable systems, the water quality requirements of IAPMO IGC 324 or NSF 350 shall apply.

**Exception:** Water treatment is not required for gray water used for subsurface irrigation.

<table>
<thead>
<tr>
<th>Action</th>
<th>Recommendation</th>
<th>Substantiation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>X</strong></td>
<td>Accept as submitted</td>
<td>No action needed</td>
</tr>
</tbody>
</table>

**Substantiation:**

The language in UPC Item # 257, Section 1501.7 (Minimum Water Quality Requirements) is being revised to correlate with the action taken by the UPC TC for Item # 256, Section 1501.7 (Minimum Water Quality Requirements) regarding the reference to IAPMO IGC 324.

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 256 of the UPC is as follows:** The 2019 edition of the IAPMO IGC 324 has been greatly improved. There was input from the San Francisco Department of Public Health (SFDPH) in developing this latest edition.

In addition to the below substantiation, please see support letter from LADWP for the Technical Committee review.

IAPMO IGC 324 covers residential, multi-family, and commercial use applications intended to process water from alternate water sources such as greywater, rainwater, stormwater air conditioning condensate, cooling tower makeup, vehicle wash and other non-potable reuse applications not specifically listed, for use in subsurface and/or surface irrigation and toilet/urinal flushing applications, and specifies requirements for materials, physical characteristics, performance testing, and markings. The standard also covers test plans and safety check (failure modes effects) that ensures the safety of the treated water.

Additionally, Section 1603.5.1 is being stricken as appropriate references are being proposed for inclusion in Section 1603.5. The proposed text in Section 1603.5 will provide guidance to the standards that apply to water treatment as options for harvested rainwater.

Supporting document(s) has been provided to the Technical Committee for review.

**The Committee Statement provided for amending proposal Item # 256 by the UPC TC is as follows:** The modification removes reference to EPA/600/R-12/618-2012 as it is not written in mandatory language. EPA/600/R-12/618-2012 will remain as a reference guide in Table 1701.2. Also, in Section 1506.7, the phrase “listed or labeled” is being updated to “listed and labeled” for consistency in the code.

The 2019 edition of the IAPMO IGC 324 has been greatly improved. There was input from the San Francisco Department of Public Health (SFDPH) in developing this latest edition.

In addition to the below substantiation, please see support letter from the Los Angeles Department of Water and Power (LADWP) for the Technical Committee review.

IAPMO IGC 324 covers residential, multi-family, and commercial use applications intended to process water from alternate water sources such as greywater, rainwater, stormwater air conditioning condensate, cooling tower makeup, vehicle wash and other non-potable reuse applications not specifically listed, for use in subsurface and/or surface irrigation and toilet/urinal flushing applications, and specifies requirements for materials, physical charac-
The standard also covers test plans and safety check (failure modes effects) that ensures the safety of the treated water.

Additionally, Section 1603.5.1 is being stricken as appropriate references are being proposed for inclusion in Section 1603.5. The proposed text in Section 1603.5 will provide guidance to the standards that apply to water treatment as options for harvested rainwater.

The substantiation provided for proposal Item # 257 of the UPC is as follows: The above revisions reflect the latest edition (title) to the EPA standard (Guidelines for Water Reuse) that is referenced in Table 1701.1 and Table 1701.2. EPA/600/R-12/618-2012 is the latest edition of EPA/625/R04-108-2004. Since the latest standard edition is being updated in Table 1701.1 and being removed from Table 1701.2 since it is used in the body of the code. Additionally, two sections (1501.7 and K 101.7) are being revised to show the latest edition of the Guidelines for Water Reuse standard. All provisions remain the same, this is just a clean up for the latest document.

The Committee Statement provided for amending proposal Item # 257 by the UPC TC is as follows: The modification removes reference to EPA/600/R-12/618-2012 from Section 1501.7 as it is not written in mandatory language. The reference for EPA/600/R-12/618-2012 will remain in that appendix in Section K 101.7 and in Table 1701.2.
RECOMMENDATION:

Table 1701.1 is being shown for informational purposes only:

<table>
<thead>
<tr>
<th>TABLE 1701.1 REFERENCE STANDARDS</th>
<th>TABLE 604.1 MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS</th>
</tr>
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<tbody>
<tr>
<td><strong>STANDARD NUMBER</strong></td>
<td><strong>STANDARD TITLE</strong></td>
</tr>
<tr>
<td>ASTM F1986-2001 (R2011)</td>
<td>Multilayer Pipe Type 2, Compression Fittings, and Compression Joints for Hot and Cold Drinking Water Systems (Withdrawn)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

X Accept recommendation as submitted. No action needed.

Substantiation:
The row containing the ASTM F1986 standard in UPC Table 604.1 (Materials for Building Supply and Water Distribution Piping and Fittings) is being stricken to correlate with the action taken by the UPC TC for Item # 330, Table 1701.1 (Referenced Standards) as the ASTM F1986 standard has been withdrawn by the promulgator.

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 330 of the UPC is as follows: The above revisions reflect the latest updates to the ASTM standards that are referenced in Table 1701.1 and Table 1701.2.
Correlation Items Between the UMC and UMC
RECOMMENDATION:

E 503.6.5.3 System Balancing. Construction documents shall require that HVAC systems be balanced in accordance with generally accepted engineering standards. Construction documents shall require that a written balance report be provided to the building owner or the designated representative of the building owner for HVAC systems serving zones with a total conditioned space or zone exceeding 5000 square feet (464.52 m²). {ASHRAE 90.1:6.7.2.3.1}

E 503.6.5.3 System Balancing. Construction documents shall require that HVAC systems be balanced in accordance with generally accepted engineering standards. Construction documents shall require that a written balance report be provided to the building owner or the designated representative of the building owner for HVAC systems serving zones with a total conditioned area space or zone exceeding 5000 square feet (464.52 m²). [{ASHRAE 90.1: 6.7.3.3.1}]

Accept recommendation as submitted.

Substantiation:
The language in UMC Item # 289, Section E 503.6.5.3 (System Balancing) is being revised to correlate with the action taken by the UMC TC for Item # 009, Section E 503.6.5.3 (System Balancing) regarding the reference to conditioned “space or zone.” Additionally, the TCC further modified UMC Item # 289 by striking out the phrase “zones with” to correct a grammatical error in redundancy.

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 009 of the UMC is as follows: This proposal changes all phrasing of “conditioned area” to “conditioned space” as there is no definition for “conditioned area” but there is a definition for “conditioned space.”

The Committee Statement provided for amending proposal Item # 009 by the UMC TC is as follows: A modification is being made to add the wording “or zone” wherever the term “conditioned space” is used. This will allow for consistency throughout the code.

The substantiation provided for proposal Item # 289 of the UMC is as follows: In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Appendix E is being revised to the latest edition of ASHRAE 90.1-2019 with Addenda by, ck, and cp published on August 3, 2020.
RECOMMENDATION:

403.0 Ventilation Rates.

403.10 Air Balance. All mechanical ventilation systems shall be tested, balanced, and operated to demonstrate that the installation and performance of the systems are in accordance with the design intent. All testing and balancing shall be performed by a technician certified by the Associated Air Balance Council (AABC), the National Environmental Balancing Bureau (NEBB), the Testing, Adjusting and Balancing Bureau (TABB), or other ANSI-accredited equivalent approved agencies.

Exception: For single family residential, compliance with Section 403.10 shall not be required.

504.0 Environmental Air Ducts.

504.3 Domestic Range Hoods. All kitchen exhaust ducts used in domestic range hoods shall be constructed of metal and shall have a smooth surface, fastened and sealed with duct mastic or metal tapes that meet the requirements of UL 181. Range hoods shall discharge to the outdoors through a single wall duct and shall not terminate in an attic or crawl space.

A physical verification of air volume, operation, and design intent shall be performed by a certified Testing, Adjusting, and Balancing (TAB) technician. The TAB technician shall be certified by the Associated Air Balance Council (AABC), the National Environmental Balancing Bureau (NEBB), or the Testing, Adjusting and Balancing Bureau (TABB), or other equivalent approved agencies.

Exception: Ducts for domestic kitchen downdraft grill-range ventilation installed under a concrete slab floor shall be permitted to be of approved Schedule 40 PVC provided:

1. The under-floor trench in which the duct is installed shall be completely backfilled with sand or gravel.
2. Not more than 1 inch (25.4 mm) of 6 inch diameter (152 mm) PVC coupling shall be permitted to protrude above the concrete floor surface.
3. PVC pipe joints shall be solvent cemented to provide an air and greasetight duct.
4. The duct shall terminate above grade outside the building and shall be equipped with a backdraft damper.

603.0 Installation of Ducts.

603.9 Joints and Seams of Ducts. (remaining text unchanged)

603.9.2 Duct Leakage Tests. Ductwork shall be leak-tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual. Duct leakage tests shall be performed by a technician certified by the Associated Air Balance Council (AABC), the National Environmental Balancing Bureau (NEBB), or the Testing, Adjusting and Balancing Bureau (TABB), or other equivalent approved agencies. Representative sections totaling not less than 10 percent of the total installed duct area shall be tested. Where the tested 10 percent fail to comply with the requirements of this section, then 40 percent of the total installed duct area shall be tested. Where the tested 40 percent fail to comply with the requirements of this section, then 100 percent of the total installed duct area shall be tested. Sections shall be selected...
by the building owner or designated representative of the building owner. Positive pressure leakage testing shall be permitted for negative pressure ductwork. The permitted duct leakage shall be not more than the following:

<table>
<thead>
<tr>
<th>X</th>
<th>Accept recommendation as submitted.</th>
<th>No action needed.</th>
</tr>
</thead>
</table>

**Substantiation:**
The language in UMC Item # 097, Section 403.10 (Air Balance) modifies the phrase "or other ANSI accredited agencies" to "or other equivalent approved agencies" to comply with the ANSI Essential Requirements for referencing products or services. Additionally, UMC Item # 110, Section 504.3 (Domestic Range Hoods) and UMC Item # 161, Section 603.9.2 (Duct Leakage Tests) were modified to correlate with the updated UMC Item # 097 by adding the phrase "or other equivalent approved agencies."

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 097 of the UMC is as follows:** Concerns over airborne transmission of pathogens and the benefits of proper ventilation have highlighted the need for verified adequate ventilation. Inadequate ventilation is a recognized and documented concern (See Supporting Material: CEC-500-2020-049). If the ventilation system is not tested, adjusted, and balanced by a skilled, trained, and certified technician the public has little assurance that the ventilation system conforms to design intent. The listed organizations have significant certification programs which ensure the certified technician, and associated contractors, have the knowledgebase and skillset to accurately perform the Air Balance. (See Supporting Material:TAB-Technical-Report-051220) Section E 802.1 (Commissioning Requirements) of the Uniform Mechanical Code set a precedent for similar requirements where an accurate verification of design intent is required.

[Supporting documentation provided in KAVI for TC review]

**The Committee Statement provided for amending proposal Item # 097 by the UMC TC is as follows:** Modifications have been made by the Technical Committee to add the language “or other ANSI-accredited agencies” to prevent overly restrictive language.

**The substantiation provided for proposal Item # 110 of the UMC is as follows:** There are currently no provisions to properly seal and test range hoods and ducts. This also clarifies that ducts shall terminate outside and be tested in accordance with the nationally recognized testing standards.

**The substantiation provided for proposal Item # 161 of the UMC is as follows:** Duct Air Leakage Testing should be limited to a certified Testing, Adjusting, and Balancing Technician (AABC, NEBB, or TABB). To provide accurate testing results, certified technicians must complete extensive training in the proper use of the SMACNA test methods, mechanical system understanding and the knowledge of the principles of air flow and pressure measurements. The listed certification organizations have proven methods for quality control. (See Supporting Material:TAB-Technical-Report-051220)

**The Committee Statement provided for accepting proposal Item # 161 by the UMC TC is as follows:** The Technical Committee recommends adding the language “or other ANSI-accredited agencies” via public comment.
RECOMMENDATION:

508.0 Type I Hoods.  
508.1 Where Required. Type I hoods shall be installed at or above commercial-type deep-fat fryers, broilers, grills, hot-top ranges, ovens, barbecues, rotisseries, and similar equipment that emits comparable amounts of smoke or grease in a food-processing establishment. For the purpose of this section, a food-processing establishment shall include a building or portion thereof used for the processing of food, but shall not include a dwelling unit.

Exceptions:
(1) Cooking appliances that comply with UL 197 for reduced emissions where the grease discharge does not exceed 2.9 E-09 ounces per cubic inch (oz/in³) (5.0 E-06 kg/m³) where operated with a total airflow of 500 cubic feet per minute (CFM) (0.236 m³/s).
(2) Recirculating systems listed in accordance with UL 710B and installed in accordance with Section 516.0.
(3) Solid-fuel-fired ovens that comply with UL 2162 and that are vented in accordance with the manufacturer’s instructions with venting systems complying with UL 103 and UL 1978.
(4) Listed and labeled cooking appliances with integral downdraft systems that comply with Section 518.0.

X Accept recommendation as submitted.  
No action needed.

Substantiation:
The language in UMC Item # 125, Section 508.1 (Where Required) is being revised to correlate with the action taken by the UMC TC for Item # 124, Section 508.1 (Where Required) regarding the reference to UL 197, the term “comply,” and the addition of Exceptions (3) and (4).

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 124 of the UMC is as follows: The requirements for the reduced emissions testing for cooking appliances, as covered by Exception 1, have been incorporated into UL 197. NFPA 96 includes requirements for cooking appliances with integral downdraft exhaust systems which do not require a Type I hood above. Solid fuel fired ovens that are listed and labeled to UL 2162 that have been evaluated for connection with venting systems that comply with both UL 103 (chimneys) and UL 1978 (grease ducts) do not need to have a Type I hood above. The downdraft appliances covered in Section 518.0 of this code do not need a Type I hood above.

The Committee Statement provided for amending proposal Item # 124 by the UMC TC is as follows: The proposal is being modified to change "listed and labeled" to "comply" since "comply" already implies that the product must be listed and labeled in accordance with the referenced standard. Also, Chapter 3 already has listing and marking requirements.

The substantiation provided for proposal Item # 125 of the UMC is as follows: Section 508.1 exception (1) is being revised as exception (1) is creating confusion during plan check and in the field for AHJs. Many in the field are interpreting this section as excepting hoods altogether. However, this section only exempts the use of Type I hoods, not the use of Type II hoods. Type II hoods shall be required when excessive heat and/or steam is being emitted. UL 710B only tests hoods to be exempt from grease applications but not for excessive heat or steam such as bread ovens. In addition, exception (1) does not have language specifying that the cooking appliance must be "listed" in accordance with UL 710B, which is causing issues for AHJs. The phrase "listed in accordance with" should be used in exception (1) the same way as exception (2).
Correlation Items Between the UPC and UMC
**TCC ITEM # 007**

**RECOMMENDATION:**

210.0  — H —

**Heat-Fusion Weld Joints.** A joint used in some thermoplastic systems to connect the pipe to fittings or pipe lengths directly to one another (butt-fusion). This method of joining pipe to fittings includes butt-fusion, socket-fusion, electro-fusion, and saddle-fusion. This method of welding involves the application of heat and pressure to the components, allowing them to fuse together forming a bond between the pipe and fitting.

212.0  — J —

**Joint, Heat Fusion.** A joint used in some thermoplastic systems to connect the pipe to fittings or pipe lengths directly to one another (butt-fusion) by applying heat and pressure to the components to form a bond between the materials. This joining method includes butt-fusion, socket-fusion, and electro-fusion. This method of welding involves the application of heat and pressure to the components, allowing them to fuse together forming a bond between the pipe and fitting.

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<thead>
<tr>
<th>Accept recommendation as submitted.</th>
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<tbody>
<tr>
<td><strong>Substantiation:</strong></td>
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<tr>
<td>The definition for “Joint, Heat Fusion” in UMC Item # 037 is being revised to correlate with the definition found in the 2021 UPC for “Heat-Fusion Weld Joints.”</td>
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<td>The following is provided for informational purpose only:</td>
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<tr>
<td><strong>The substantiation provided for proposal Item # 037 of the UMC is as follows:</strong> A new definition for “Heat Fusion Joint” is being added as it is currently used in the code but not defined. See Sections 1211.11, 1308.5.8.2, and F 201.6.2. Section F 104.4.1.1 lists butt-fusion, socket-fusion, and electro-fusion as acceptable heat fusion methods. The definition is based on the existing definition in the UPC with improvements.</td>
<td></td>
</tr>
<tr>
<td><strong>The Committee Statement provided for amending proposal Item # 037 by the UMC TC is as follows:</strong> The proposed definition is being modified to clarify that heat fusion joints connect the pipe to fittings or pipe lengths &quot;directly to one another by applying&quot; heat and pressure.</td>
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</table>
**RECOMMENDATION:**

<table>
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<tr>
<th>Item</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>224.0 – V –</td>
<td>Vent Connector, Gas. That portion of a gas venting system that connects a listed gas appliance beginning at the draft hood or flue collar to a gas vent and is installed entirely within the space or area in which the appliance is located.</td>
</tr>
</tbody>
</table>

**Substantiation:**

The definition for “Vent Connector, Gas” in UMC Item # 052 is being revised to correlate with the action taken by the UPC TC for Item # 027 by adding the term “entirely.”

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 027 of the UPC is as follows:** The current simple definition of a vent connector is not clear. It can be interpreted under the current language that you could install a single wall vent for a water heater starting in the garage and run it up into the attic. This change state specifically where it begins and that it remains in the space where it begins.

**The substantiation provided for proposal Item # 052 of the UMC is as follows:** A simple definition of a vent connector is elusive. You will know it when you see it, but accurately defining it is difficult. However, we can state specifically where it begins and that it remains in the space where it begins.
RECOMMENDATION:

508.4 Appliances in Attics and Under-Floor Spaces. An attic or under-floor space in which an appliance is installed shall be accessible through an opening and passageway at least as large as larger than 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}

304.4 Appliances in Attics and Under-Floor Spaces. An attic or under-floor space in which an appliance is installed shall be accessible through an opening and passageway not less larger than 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}

Substantiation:

The language in UPC Item # 101, Section 508.4 (Appliances in Attics and Under-Floor Spaces) is being revised to correlate with the action taken by the UMC TC Item # 056, Section 304.4 (Appliances in Attics and Under-Floor Spaces) regarding the phrase "or under-floor space."

Additionally, the TCC further modified UPC Item # 101 to change the phrase "at least as large as" to "larger than" and UMC Item # 056 from "not less than" to "larger than" as the TCC felt such revision of text was necessary to correct an error in the original text as sufficient accessibility through an opening is required.

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 101 of the UPC is as follows: The above sections have been revised to correlate with NFPA 54-2021 (latest version) in accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines).

The substantiation provided for proposal Item # 056 of the UMC is as follows: In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Chapter 3 is being revised to the latest edition of NFPA 54-2021.
RECOMMENDATION:

**507.26 Accessibility for Service.** All appliances shall be located with respect to building construction and other equipment so as to permit access for repair or replacement of the appliance. *Sufficient clearance* shall be maintained to permit removal of the appliance; cleaning of heating surfaces; the replacement of filters, blowers, motors, burners, controls, and vent connections; the lubrication of moving parts where necessary; the adjustment and cleaning of burners and pilots; and the proper functioning of explosion vents, if provided. For attic installation, the passageway and servicing area adjacent to the appliance shall be floored in accordance with Section 508.4. {NFPA 54:9.2.1}

Unless otherwise specified, clearances of not less than 30 inches (762 mm) in depth, width, and height of working space shall be maintained.

**304.1 General.** All appliances shall be located with respect to building construction and other equipment so as to permit access for repair or replacement of the appliance. Clearance shall be maintained to permit removal of the appliance; cleaning of heating surfaces; the replacement of filters, blowers, motors, burners, controls, and vent connections; the lubrication of moving parts where necessary; the adjustment and cleaning of burners and pilots; and the proper functioning of explosion vents, if provided. For attic installation, the passageway and servicing area adjacent to the appliance shall be in accordance with Section 304.4. {NFPA 54:9.2.1}

Unless otherwise specified, clearances of not less than 30 inches (762 mm) in depth, width, and height of working space shall be maintained.

**Exception:** A platform shall not be required for unit heaters or room heaters.

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<tr>
<th>Accept recommendation as submitted</th>
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**Substantiation:**

The language in UPC Item # 110, Section 507.26 (Accessibility for Service) is being revised to correlate with the action taken by the UMC TC for Item # 059, Section 304.1 (General) by striking the term "sufficient," adding the reference to Section 508.4, and adding clearances for working space. Additionally, the TCC is not adding the UMC Exception as unit heaters and room heaters are not within the scope of the UPC.

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 110 of the UPC is as follows:** The Code requires access for the repair of appliances in Section 507.26, but does not require access for the removal of appliances without the need to remove building construction or other appliances.

**The substantiation provided for proposal Item # 059 of the UMC is as follows:** The change is a cleanup of the language to improve Section 304.1. The term "sufficient" is being removed as it is poor code language.

**The Committee Statement provided for amending proposal Item # 059 by the UMC TC is as follows:** The Code requires access for the repair of appliances in Section 304.1, but does not require access for the removal of appliances without the need to remove building construction or other appliances.
TCC ITEM # 011

RECOMMENDATION:

507.0 Appliance and Equipment Installation Requirements.

507.13 Installation in Residential Garages. Appliances in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit shall be installed so that all heating elements, switches, burners, and burner-ignition devices are located not less than 18 inches (457 mm) above the floor, unless

Exception: Listed as flammable vapor ignition resistant (FVIR) appliances. (NFPA 54:9.1.10.1)

305.0 Location.
305.1 Installation in Residential Garages. Appliances in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit shall be installed so that all heating elements, switches, burners, and burner-ignition devices are located not less than 18 inches (457 mm) above the floor. (NFPA 54:9.1.10.1)

Exception: Listed flammable vapor ignition resistant (FVIR) appliances. (NFPA 54:9.1.10.1)

X Accept recommendation as submitted.  No action needed.

Substantiation:
The language in UPC Item # 108, Section 507.13 (Installation in Residential Garages) is being revised to correlate with the action taken by the UMC TC for Item # 061, Section 305.1 (Installation in Residential Garages) to relocate the phrase “listed flammable vapor ignition resistant appliances” to an exception. Furthermore, UMC Item # 061 is being modified editorially to relocate the extract reference to the end of the section for consistency with the UPC.

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 108 of the UPC is as follows: Requirements for electric water heaters have been missing since the 2003 UPC. The reasons for this may no longer exist and are perhaps unimportant. The fact is that electric water heaters are still installed by plumbers and still need inspections. What document do plumbers and inspectors seek for these installation requirements?

Elements and switches (thermostats) are just as dangerous as burners and burner ignition devices, perhaps more so with the advent of FVIR for gas burning water heaters.

The substantiation provided for proposal Item # 061 of the UMC is as follows: Several years ago, this language was added at the end of the sentence. As more of these appliances are now equipped with Flammable Vapor Ignition Resistant (FVIR) technology it seems that moving it to an exception makes sense to make sure it is not overlooked.

The Committee Statement provided for amending proposal Item # 061 by the UMC TC is as follows: Requirements for electric water heaters have been missing since the 2003 UPC. The reasons for this may no longer exist and are perhaps unimportant. The fact is that electric water heaters are still installed by plumbers and still need inspections. What document do plumbers and inspectors seek for these installation requirements?

Elements and switches (thermostats) are just as dangerous as burners and burner ignition devices, perhaps more so with the advent of FVIR for gas burning water heaters.
**TCC ITEM # 012**

**RECOMMENDATION:**

507.0 Appliance and Equipment Installation Requirements.

507.5 Drainage Pan. Where a water heater is located in an attic, in or on an attic ceiling assembly, floor-ceiling assembly, floor-subfloor assembly or where damage results from a leaking water heater, a watertight pan of corrosion-resistant materials shall be installed beneath the water heater in accordance with the following:

1. The drainage pan shall be provided with not less than 3/4 of an inch (20 mm) diameter drain to an approved location. The terminating end of the drainpipe shall be readily visible.
2. The drainage pan shall be not less than 1½ inches (38 mm) in depth.
3. Where a drainage pan pipe is installed, the material of the piping shall be rated for the temperature rating of the water heater and shall be approved for use with the liquid being discharged.
4. Discharge from a relief valve into a drainage pan shall be prohibited.

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**Substantiation:**

The language in UMC Item # 064, Section 305.5 (Drainage Pan) is being revised to correlate with the action taken by the UPC TC for Item # 104, Section 507.5 (Drainage Pan) to separate drainage pan requirements into a numbered list format and add items (3) and (4) for temperature rating and discharge from a relief valve.

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 104 of the UPC is as follows:** The new text will add provisions which clarify that piping used on hot water applications shall be rated for such temperatures as there are drain line to be used for cold water applications only. Additionally, the provisions for the drainage pan are being placed in a list which makes the provisions easy to find.

**The Committee Statement provided for amending proposal Item # 104 by the UPC TC is as follows:** The modification adds parts of Item #105, Item #106, and Item #107.

The modification clarifies that Section 507.5 is applicable to all locations where a leaking water heater can cause damage and not only the locations indicated in the section. The intent of the section is to prevent damage from occurring in the surrounding vicinity of the water heater should a leak occur. Additionally, the terminating end of the drain pipe shall be visible to alert the owner or inspector that the water heater is leaking.

This modification also adds (4) as the same prohibition of not allowing discharging the relief valve into a water heater pan that is in Section 608.5(7). It is a common mistake and needs to be stated in both sections.

**The substantiation provided for proposal Item # 064 of the UMC is as follows:** The proposed change will clarify that Section 305.5 is applicable to all water heaters, regardless of the type of water heater. The intent of the section is to prevent damage from occurring in the surrounding vicinity of the water heater should a leak occur.
308.0 Prohibited Locations.
308.1 General. Piping, fixtures, appliances, or equipment shall not be so located as to interfere with the normal use thereof or with the normal operation and use of windows, doors, or other required facilities.

308.0 Improper Location.
308.1 General. Piping or equipment shall not be so located as to interfere with the normal use thereof or with the normal operation and use of windows, doors, or other required facilities.

Accept recommendation as submitted. | X | No action needed.

Substantiation:
No action is needed by the TCC for UPC Item # 033 or UMC Item # 067. The TCC agrees with the actions taken by the UPC TC to “accept as submitted” Item # 033 with regards to Section 308.1 (General) and the actions taken by the UMC TC to “reject” Item # 067 with regards to Section 305.6.1 (General).

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 033 of the UPC is as follows: This change adds “appliance” as an appliance can also interfere with the normal use of windows, doors, and facilities. Furthermore, the term “improper” is a subjective term and “prohibited” is clear, concise, and enforceable.

The substantiation provided for proposal Item # 067 of the UMC is as follows: The code change provides a list of spaces where fuel burning appliances shall not be installed for public health and safety. For example, Section 303.2 allows central heating furnaces and boilers installed in closets or alcoves shall be listed for such installation.

The Committee Statement provided for rejecting proposal Item # 067 by the UMC TC is as follows: The proposal needs additional revisions and is currently vague and poorly written.
RECOMMENDATION:

Item # 206

814.0 Condensate Waste and Control.

814.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section 814.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

1. A water level detecting device that will shut off the equipment or appliance in the event the primary drain is blocked. Such detecting device shall be in accordance with the manufacturer’s installation instructions.

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 than the primary drain line connection of the drain pan.

4. An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

Item # 207

814.0 Condensate Waste and Control.

814.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section 814.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

1. A water level detecting device that will shut off the equipment or appliance in the event the primary drain is blocked. Such detecting device shall be in accordance with the manufacturer’s installation instructions.

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 separate drain line at a level that is higher than the primary drain line connection of the drain pan.

4. An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.
ITEM # 070

(3) An additional separate drain line at a level that is higher than the primary drain line connection of the drain pan.

(4) An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drain pipe of not less than 3/4 of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

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<th>Accept recommendation as submitted.</th>
<th>No action needed.</th>
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<tr>
<td><strong>Substantiation:</strong></td>
<td>The language in UMC Item # 070, Section 310.2(1) (Condensate Control) and UPC Item # 207, Section 814.2(1) (Condensate Control) are being revised to correlate with the action taken by the UPC TC for Item # 206, Section 814.2(1) (Condensate Control) to add the sentence “Such detecting device shall be in accordance with the manufacturer’s installation instructions.”</td>
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The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 206 of the UPC is as follows:** As written, option (1) is not clear where a water detecting device shall be installed. The language gives clear direction to the location and will prevent installers from placing such devices in the drain line.

**The Committee Statement provided for amending proposal Item # 206 by the UPC TC is as follows:** The modification will clarify that the directions and guidance for such detecting devices are found in the manufacturer’s installation instructions. Additionally, there may be devices that are not installed directly inside the pan.

**The substantiation provided for proposal Item # 207 of the UPC is as follows:** The addition of “separate” ensures that the primary and secondary condensate drains are not tied together. They must be run separate in case the primary is clogged.

**The substantiation provided for proposal Item # 070 of the UMC is as follows:** The recommended change will assist in identifying whether the condensate waste is coming from the primary or secondary drain. If there is condensate coming from the secondary line, it must be investigated.

The addition of "separate" is to ensure that the primary and secondary are not tied together.

It used to have proposed language to make sure it was visible and marked, but it was removed.
TCC ITEM # 015

RECOMMENDATION:

814.0 Condensate Waste and Control.

814.5 Point of Discharge. Air-conditioning condensate waste pipes shall connect indirectly to the drainage system through an air gap or air break to trapped and vented receptors, dry wells, mop sinks, or leach pits. A condensate drain shall be trapped in accordance with the appliance manufacturer’s instructions or as approved.

Exception: Direct connections as permitted in accordance with Section 814.6.

310.0 Condensate Wastes and Control.

310.5 Point of Discharge. Air-conditioning condensate waste pipes shall connect indirectly to the drainage system through an air gap or air break to trapped and vented receptors, dry wells, mop sinks, or leach pits. A condensate drain shall be trapped in accordance with the appliance manufacturer’s instructions or as approved.

Exception: Direct connections in accordance with Section 310.6.

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<tr>
<th>X</th>
<th>Accept recommendation as submitted.</th>
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Substantiation:
The language in UPC Item # 212, Section 814.5 (Point of Discharge) is being revised to correlate with the action taken by the UMC TC for Item # 074, Section 310.5 (Point of Discharge) to change the phrase “as permitted in” to “in accordance with” for consistency throughout the code.

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 212 of the UPC is as follows: The first sentence of Section 814.5 starts with indirect connection and then gives the exception. The change relocates language in Section 814.5 to an exception for clarity and to ensure it is not overlooked. Such "direct" connection to the tailpiece is covered in Section 814.6. Additionally, the term “tailpiece of plumbing fixtures” is grouped with the list of locations allowed for “air gap” or “air breaks.” A connection to a tailpiece of a plumbing fixture is neither through an air break or air gap.

The Committee Statement provided for amending proposal Item # 212 by the UPC TC is as follows: The modification includes "mop sinks" which was accepted in Item # 211. The modification clarifies that mop sinks are an option for indirect connections for condensate waste pipes. Condensate drainage through mop sinks is common and will assist the end user in installing indirect waste piping.

The substantiation provided for proposal Item # 074 of the UMC is as follows: The first sentence of Section 310.5 starts with indirect connection and then gives the exception. The change relocates language in Section 310.5 to an exception for clarity and to ensure it is not overlooked. Such "direct" connection to the tailpiece is covered in Section 310.6. Additionally, the term “tailpiece of plumbing fixtures” is grouped with the list of locations allowed for “air gap” or “air breaks.” A connection to a tailpiece of a plumbing fixture is neither through an air break or air gap.

The Committee Statement provided for amending proposal Item # 074 by the UMC TC is as follows: The change clarifies that mop sinks are an option for indirect connections for condensate waste discharge. Condensate drainage through mop sinks is common and the modification will assist the end user in installing indirect condensate waste piping.
**313.0 Hangers, Supports, and Anchors.**

**313.1 General.** Piping, tubing, fixtures, appliances, and appurtenances shall be supported in accordance with this code, the manufacturer’s installation instructions, and in accordance with the Authority Having Jurisdiction. Seismic restraints shall be in accordance with the building code.

**313.2 Material.** Hangers, supports, and anchors shall be of sufficient strength to support the weight of the pipe or tubing and its contents. Piping or tubing shall be isolated from incompatible materials.

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<th>Item</th>
<th>Recommendation</th>
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<tr>
<td># 041</td>
<td>Accept recommendation as submitted.</td>
<td>No action needed.</td>
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**Substantiation:**
The language in UPC Item # 041, Section 313.1 (General) and Section 313.2 (Material) are being revised to correlate with the action taken by the UMC TC for Item # 080, Section 313.1 (General) and Section 313.2 (Material) to include the term “tubing.”

Additionally, UMC Item # 080, Section 313.1 (General) is being revised to correlate with the action taken by the UPC TC for Item # 041, Section 313.1 (General) to change the phrase “as required by” to “in accordance with” for consistency throughout the code.

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 041 of the UPC is as follows:** The proposed text is adding seismic restraints to ensure these provisions are not overlooked when designing or working in areas prone to seismic conditions. Additionally, “anchors” is being added to the title as the subsections also include anchors.

**The substantiation provided for proposal Item # 080 of the UMC is as follows:** The proposed text is adding seismic restraints to ensure these provisions are not overlooked when designing in areas prone to seismic conditions. Additionally, Section 313.0 and Section 313.2 are being modified as the sections address hangers, supports, and anchors.
TCC ITEM # 017

RECOMMENDATION:

312.0 Protection of Piping, Tubing, Materials, and Structures.

312.9 Steel Nail Plates. Plastic piping or tubing, and copper or copper alloy piping or tubing penetrating framing members to within 1 inch (25.4 mm) of the exposed framing shall be protected by steel nail plates not less than No. 18 gauge (0.0478 inches) (1.2 mm) in thickness. The steel nail plate shall extend along the framing member not less than 1 1/2 inches (38 mm) beyond the outside diameter of the pipe or tubing. Fuel gas piping shall be protected in accordance with Section 1210.4.3.

316.0 Protection of Piping, Tubing, Materials, and Structures.

316.6 Steel Nail Plates. Plastic piping or tubing, copper or copper alloy piping or tubing, and ducts penetrating framing members to within 1 inch (25.4 mm) of the exposed framing shall be protected by steel nail plates not less than No. 18 gauge (0.0478 inches) (1.2141 mm) in thickness. The steel nail plate shall extend along the framing member not less than 1 1/2 inches (38 mm) beyond the outside diameter of the pipe or tubing. Exception: See Fuel gas piping shall be protected in accordance with Section 1310.4.3.

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<tr>
<th>Accept recommendation as submitted.</th>
<th>No action needed.</th>
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Substantiation:
The language in UPC Item # 039, Section 312.9 (Steel Nail Plates) are being revised to correlate with the action taken by the UMC TC for Item # 086, Section 316.6 (Steel Nail Plates) to include the phrase “piping or tubing” and add “tubing” to the title.

Additionally, UMC Item # 086, Section 316.6 (Steel Nail Plates) is being revised to correlate with the action taken by the UPC TC for Item # 039, Section 312.9 (Steel Nail Plates) for referencing Section 1310.4.3 for fuel gas piping protection.

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 039 of the UPC is as follows: The section is being revised to add the existing standard for safety plates for the protection of concealed pipes running through the framing of a building. These plates are used in the industry on a daily basis and the standard will ensure such plates meet minimum safety requirements. Additionally, fuel gas tubing is required to be protected by specific requirements in Section 1210.4.3 which may include steel plates. Therefore, not an exception.

The Committee Statement provided for amending proposal Item # 039 by the UPC TC is as follows: The reference to IAPMO IGC 193 is overly restrictive since there are field fabricated nail plates that meet the thickness requirements in the code. The last sentence clarifies that fuel gas piping plates shall comply with Section 1210.4.3 and is a good update for clarity and direction.

The substantiation provided for proposal Item # 086 of the UMC is as follows: The section is being revised to add the existing standard for safety plates for the protection of concealed pipes running through the framing of a building. These plates are used in the industry on a daily basis and the standard will ensure such plates meet minimum safety requirements. Additionally, fuel gas tubing is required to be protected by specific requirements in Section 1310.4.3 which may include steel plates. Therefore, not an exception.

The Committee Statement provided for rejecting proposal Item # 086 by the UMC TC is as follows: The reference to IAPMO IGC 193 is overly restrictive since there are field-fabricated steel nail plates that can meet the thickness requirements in Section 316.6.
TCC ITEM # 018

2024 UNIFORM PLUMBING CODE

ITEM # 043

RECOMMENDATION:

314.0 Trenching, Excavation, and Backfill.

314.2 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.

X Accept recommendation as submitted. | No action needed.

Substantiation:
The language in UMC Item # 087, Section 317.2 (Tunneling and Driving) is being revised to correlate with the action taken by the UPC TC for Item # 043, Section 314.2 (Tunneling and Driving) by striking the sentence “The length of the tunneling shall be the distance required to clear the obstacle above.”

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 043 of the UPC is as follows: Where pipe is to be installed by jacketing or tunneling to clear a slab, driveway, or other paved area, such tunnels should not be longer than necessary, as it is difficult to refill with the appropriate backfill in longer tunnels. Furthermore, a new section is being added to address the earth loads that must be taken into account for any tunneling and to account for any earth settlement in order to protect the piping within.

The Committee Statement provided for rejecting proposal Item # 043 by the UPC TC is as follows: The proposal is being rejected as it is overly restrictive and unenforceable. Furthermore, it is outside of the scope of the UPC.

The substantiation provided for proposal Item # 087 of the UMC is as follows: Where pipe is to be installed by jacketing or tunneling to clear a slab, driveway, or other paved area, such tunnels should not be longer than necessary, as it is difficult to refill with the appropriate backfill in longer tunnels. Furthermore, a new section is being added to address the earth loads that must be taken into account for any tunneling and to account for any earth settlement in order to protect the piping within.

The Committee Statement provided for amending proposal Item # 087 by the UMC TC is as follows: Section 317.2.1 is being stricken as it is overly restrictive and unenforceable. Walls, structures, and ceilings are outside of the scope of the mechanical code and are better suited in a building code.
RECOMMENDATION:

509.0 Venting of Appliances.

509.10 Vent Connectors for Category I Appliances.

509.10.5 Joints. Joints between sections of connector piping and connections to flue collars or draft hood outlets shall be fastened in accordance with one of the following methods:
1. Mechanically fastened by means of not less than three sheet-metal screws equally spaced around the joint.
2. Vent connectors of listed vent material assembled and connected to flue collars or draft hood outlets in accordance with the manufacturer’s instructions.
3. Other approved means. [NFPA 54:12.11.6]

802.0 Venting of Appliances.

802.10 Vent Connectors for Category I Appliances.

802.10.5 Joints. Joints between sections of connector piping and connections to flue collars or draft hood outlets shall be fastened in accordance with one of the following methods:
1. Mechanically fastened by means of not less than three sheet-metal screws equally spaced around the joint.
2. Vent connectors of listed vent material assembled and connected to flue collars or draft hood outlets in accordance with the manufacturer’s instructions.
3. Other approved means. [NFPA 54:12.11.6]

x | Accept recommendation as submitted. | No action needed.

Substantiation:
The language in UMC Item # 174, Section 802.10.5(1) (Joints) is being revised to correlate with the action taken by the UPC TC for Item # 115, Section 509.10.5(1) (Joints) by rephrasing the sentence to “Mechanically fastened by means of not less than three sheet-metal screws equally spaced around the joint.”

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 115 of the UPC is as follows:
One: There is a potential conflict with the 2021 UMC Section 603.9: "UMC - 603.9 Joints and Seams of Ducts. Joints and seams for duct systems shall comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible. Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gasketing, or other means. Crimp joints for round ducts shall have a contact lap of not less than 1-1/2 inches (38 mm) and shall be mechanically fastened by means of not less than three sheet-metal screws equally spaced around the joint, or an equivalent fastening method."

Two: A common practice is to use one or two screws which can allow the vent to swivel and become dislodges and leak carbon monoxide and other exhaust gases.

Three: Some installers use an aluminum tape typically used for HVAC plenums. This product cannot take the heat and will fall off many times again exhausting gas into the space.

The substantiation provided for proposal Item # 174 of the UMC is as follows: In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Chapter 8 is being revised to the latest edition of NFPA 54-2021.
**RECOMMENDATION:**

509.2.6 Direct-Vent Appliances. Listed direct vent appliances shall be installed in accordance with the manufacturer’s installation instructions. [NFPA 54:12.3.5.1]

802.2.6 Direct Vent Appliances. Listed direct vent appliances shall be installed in accordance with the manufacturer’s installation instructions. [NFPA 54:12.3.5.1]

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**Substantiation:**

The language in UPC Item # 101, Section 509.2.6 (Direct-Vent Appliances) is being revised to correlate with the action taken by the UMC TC for Item # 174, Section 802.2.6 (Direct Vent Appliances) by adding the term “instructions” to the end of the section.

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 101 of the UPC is as follows: The above sections have been revised to correlate with NFPA 54-2021 (latest version) in accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines).

The substantiation provided for proposal Item # 174 of the UMC is as follows: In accordance with IAPMO’s Regulations Governing Committee Projects (Extract Guidelines), Chapter 8 is being revised to the latest edition of NFPA 54-2021.
TCC ITEM # 021

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**509.10.12 Passage Through Ceilings, Floors, or Walls.** A vent connector shall not pass through a ceiling, floor, or fire-resistance-rated wall. A single-wall metal pipe connector shall not pass through an interior wall.

**Exceptions:**

(1) Vent connectors made of listed Type B or Type L vent material and serving listed appliances with draft hoods and other appliances listed for use with Type B gas vents that pass through walls or partitions constructed of combustible material shall be installed with not less than the listed clearance to combustible material.

(2) Vent connectors shall be permitted to pass through ceilings, floors, or walls in accordance with Section 509.7.3.1 and Section 509.7.3.5.

**802.10.12 Passage Through Ceilings, Floors, or Walls.** A vent connector shall not pass through a ceiling, floor, or fire-resistance-rated wall. A single-wall metal pipe connector shall not pass through an interior wall.

**Exceptions:**

(1) Vent connectors made of listed Type B or Type L vent material and serving listed appliances with draft hoods and other appliances listed for use with Type B gas vents that pass through walls or partitions constructed of combustible material shall be installed with not less than the listed clearance to combustible material.

(2) Vent connectors shall be permitted to pass through ceilings, floors, or walls in accordance with Section 802.7.3.1 and Section 802.7.3.4.

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**Substantiation:**

The language in UPC Item # 116, Section 509.10.12 (Passage Through Ceilings, Floors, or Walls) is being revised to correlate with the action taken by the UMC TC for Item # 175, Section 802.10.12 (Passage Through Ceilings, Floors, or Walls) by changing the phrase “be installed” to “pass through ceilings, floors, or walls” in Exception (2). Furthermore, UMC Item # 175, Section 802.10.12 (Passage Through Ceilings, Floors, or Walls) is being revised to correlate with the action taken by the UPC TC for Item # 116, Section 509.10.12 (Passage Through Ceilings, Floors, or Walls) by adding the term “vent” to the beginning of Exception (2).

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 116 of the UPC is as follows:** The intent of the exception to Section 509.10.12 is further clarified by directing the end user to Section 509.7.3.1 and Section 509.7.3.5 which permit connectors to pass through ceilings, floors, or wall and are specified in the indicated sections. This change will clarify the intent of Section 509.10.12 and avoid any confusion between the sections.

**The substantiation provided for proposal Item # 175 of the UMC is as follows:** The intent of the exception to Section 802.10.12 is further clarified by directing the end user to Section 802.7.3.1 and Section 802.7.3.4 which permit connectors to pass through ceilings, floors, or wall and are specified in the indicated sections. This change will clarify the intent of Section 802.10.12 and avoid any confusion between the sections.
TCC ITEM # 022

RECOMMENDATION:

510.0 Sizing of Category I Venting Systems.

510.2 Multiple Appliance Vent Table 510.2(1) through Table 510.2(9). (remaining text unchanged)

510.2.11 Vent Connector Rise. The vent connector rise \((R)\) for each appliance shall be measured from the draft hood outlet or flue collar to the centerline where the vent gas streams come together. \(\text{NFPA 54:13.2.12}\)

Substantiation:

The language in UPC Item # 117, Section 510.2.11 (Vent Connector Rise) is being revised to correlate with the action taken by the UMC TC for Item # 178, Section 803.2.11 (Vent Connector Rise) to clarify the term "vent connector rise" and its application to "each appliance."

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 117 of the UPC is as follows:** This is about the vent connector, not the appliance it connects to so eliminates unnecessary wording and focuses on the vent connector.

**The substantiation provided for proposal Item # 178 of the UMC is as follows:** The language in Section 803.2.11 is being revised for clarity and ease of use.

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29
RECOMMENDATION:

705.10.3 Plastic Pipe to Other Materials. Where connecting plastic pipe to other types of plastic or other types of piping material; approved listed adapter or transition fittings and listed for the specific transition intended shall be used. Except as provided in Section 705.9.4, PVC and ABS pipe and fittings shall not be solvent welded to any other unlike material.

1211.14.2 Plastic Pipe to Other Materials. Where connecting plastic pipe to other types of plastic or other types of piping material; approved types of listed adapter or transition fittings designed for and listed for the specific transition intended shall be used. Except as provided in the plumbing code, PVC and ABS pipe and fittings shall not be solvent welded to any other unlike material.

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Substantiation:
The language in UMC Item # 264, Section 1211.14.2 (Plastic Pipe to Other Materials) is being revised to correlate with the action taken by the UPC TC for Item # 179, Section 705.10.3 (Plastic Pipe to Other Materials) with regards to adapters and transition fittings. Additionally, the TCC fixed an error by striking ABS as ABS is not listed as one of the approved materials in Table 1210.1 (Materials for Hydronic System Piping, Tubing, and Fittings).

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 179 of the UPC is as follows:** The current language under Section 705.9.4 allows for a single transition from ABS to PVC or PVC to ABS exterior of the structure. Transition glue is not being represented to be allowable to make transition joints between ABS and PVC anywhere in the building. This code change clarifies that this practice is not approved. I have seen residences where the below slab plumbing was PVC and then the above slab plumbing all PVC with the joints being made with transition glue. This is an improper use of the product. While there is a code change to place this change in Chapter 3 as a prohibited practice it is also important that this be in this section as a prohibited practice to aid the end user and AHJ.

**The substantiation provided for proposal Item # 264 of the UMC is as follows:** The current language allows for a single transition from ABS to PVC or PVC to ABS exterior of the structure. Transition glue is not being represented to be allowable to make transition joints between ABS and PVC anywhere in the building. This code change clarifies that this practice is not approved. I have seen residences where the below slab plumbing was PVC and then the above slab plumbing all PVC with the joints being made with transition glue. This is an improper use of the product. While there is a code change to place this change in Chapter 3 as a prohibited practice it is also important that this be in this section as a prohibited practice to aid the end user and AHJ.
RECOMMENDATION:

**1208.6.6 Regulator Vent Piping.** Plastic pipe and fittings used to connect regulator vents to remote vent terminations shall be PVC (Schedule 40 and 80). PVC vent piping shall not be installed indoors. ([NFPA 54:5.5.4.2])

**1208.6.9.3 Thread Joint Sealing.** Threaded joints shall be made using a thread joint sealing material. ([NFPA 54: 5.5.6.4.1]) Thread joint sealing materials shall be compatible with the pipe and fitting material on which the compounds are used. ([NFPA 54: 5.5.6.4.2]) Thread joint sealing materials shall be resistant to the chemical constituents of the gases to be conducted through the piping. ([NFPA 54:5.5.6.4.3])

**1210.3 Installation of Aboveground Piping.** Piping installed aboveground shall comply with all of the following:
1. Piping shall be securely supported and located where it will be protected from physical damage.
2. Where passing through an exterior wall, the piping shall also be protected from corrosion by coating or wrapping with an inert material approved for such applications.
3. The piping shall be sealed around its circumference at the point of the exterior penetration to prevent the entry of water, insects, and rodents.
4. Where piping is encased in a protective pipe sleeve, the annular spaces between the gas piping and sleeve and between the sleeve and the wall opening shall be sealed.
5. Piping installed outdoors shall be elevated not less than 3½ inches (89 mm) above the ground.
6. Sealing materials shall be compatible with the piping and sleeve. ([NFPA 54:7.2.1])

**1310.3.5.3 Piping on Roofs.** Gas piping installed on the roof surfaces shall be supported in accordance with Table 1210.3.5.1. Gas piping shall be elevated not less than 3½ inches (89 mm) above the roof surface. ([NFPA 54:7.2.6.4.1, 7.2.6.4.2])

**1308.5.4.1 Regulator Vent Piping.** Plastic pipe and fittings used to connect regulator vents to remote vent terminations shall be PVC ([Schedule 40 and 80]) conforming to UL 651. PVC vent piping shall not be installed indoors. ([NFPA 54:5.5.4.2])

**1308.5.6.3 Thread Joint Sealing.** Threaded joints shall be made using a thread joint sealing material. ([NFPA 54: 5.5.6.4.1]) Thread joint sealing materials shall be compatible with the pipe and fitting material on which the compounds are used. ([NFPA 54: 5.5.6.4.2]) Thread joint sealing materials shall be nonhardening and shall be resistant to the chemical constituents of the gases to be conducted through the piping. ([NFPA 54:5.5.6.4.3])

**1310.3 Installation of Aboveground Piping.** Piping installed aboveground shall comply with all of the following:
1. Piping shall be securely supported and located where it will be protected from physical damage.
2. Where passing through an exterior wall, the piping shall also be protected from corrosion by coating or wrapping with an inert material approved for such applications.
3. The piping shall be sealed around its circumference at the point of the exterior penetration to prevent the entry of water, insects, and rodents.
4. Where piping is encased in a protective pipe sleeve, the annular spaces between the gas piping and the sleeve and between the sleeve and the wall opening shall be sealed.
5. Piping installed outdoors shall be elevated not less than 3½ inches (89 mm) above the ground. ([NFPA 54:7.2.1])
6. Sealing materials shall be compatible with the piping and sleeve. ([NFPA 54:7.2.1])

**1310.3.5.3 Piping on Roofs.** Gas piping installed on the roof surfaces shall be elevated above the roof surface and shall be supported in accordance with Table 1310.3.5.1. Gas piping shall be elevated not less than 3½ inches (89 mm) above the roof surface. ([NFPA 54-2018:7.2.6.4.1, 7.2.6.4.2])
ITEM # 246

1212.1 Connecting Appliances and Equipment. Appliances and equipment shall be connected to the building piping in compliance with Section 1212.6 through Section 1212.8 by one of the following:

1) Rigid metallic pipe and fittings.
2) Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing shall not be used in exterior locations.
3) A connector for gas appliances listed in accordance with ANSI Z21.24/CSA 6.27. The connector shall be used in accordance with the manufacturer’s installation instructions and shall be in the same room as the appliance. Only one connector shall be used per appliance.
4) A connector for outdoor gas appliances and manufactured homes listed in accordance with ANSI Z21.75/CSA 6.27. Only one connector shall be used per appliance.
5) CSST where installed in accordance with the manufacturer’s installation instructions. CSST shall not be directly routed into a metallic appliance enclosure where the appliance is connected to a metallic vent that terminates above a roofline. CSST shall connect only to appliances that are fixed in place.
6) Listed nonmetallic gas hose connectors in accordance with Section 1212.3.
7) Unlisted gas hose connectors for use in laboratories and educational facilities in accordance with Section 1212.4. [NFPA 54:9.6.1]

1212.2 Suspended Low-Intensity Infrared Tube Heaters. Suspended low-intensity infrared tube heaters shall be connected to the building piping system with a connector listed for the application in accordance with ANSI Z21.24/CSA 6.27 CSA Z21.24 as follows:

1) The connector shall be installed in accordance with the tube heater installation instructions and shall be in the same room as the appliance.
2) Only one connector shall be used per appliance. [NFPA 54:9.6.1.5]

ITEM # 274

1312.1 Connecting Appliances and Equipment. Appliances and equipment shall be connected to the building piping in compliance with Section 1312.6 through Section 1312.8 by one of the following:

1) Rigid metallic pipe and fittings.
2) Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing shall not be used in exterior locations.
3) A connector for gas appliances listed in accordance with ANSI Z21.24/CSA 6.27 CSA Z21.24. The connector shall be used in accordance with the manufacturer’s installation instructions and shall be in the same room as the appliance. Only one connector shall be used per appliance.
4) A connector for outdoor gas appliances and manufactured homes listed in accordance with ANSI Z21.75/CSA 6.27 CSA Z21.75. Only one connector shall be used per appliance.
5) CSST where installed in accordance with the manufacturer’s installation instructions. CSST shall not be directly routed into a metallic appliance enclosure where the appliance is connected to a metallic vent that terminates above a roofline. CSST shall connect only to appliances that are fixed in place.
6) Listed nonmetallic gas hose connectors in accordance with Section 1312.3.
7) Unlisted gas hose connectors for use in laboratories and educational facilities in accordance with Section 1312.4. [NFPA 54:9.6.1]

1312.2 Suspended Low-Intensity Infrared Tube Heaters. Suspended low-intensity infrared tube heaters shall be connected to the building piping system with a connector listed for the application in accordance with ANSI Z21.24/CSA 6.27 CSA Z21.24 as follows:

1) The connector shall be installed in accordance with the tube heater installation instructions, and shall be in the same room as the appliance.
2) Only one connector shall be used per appliance. [NFPA 54:9.6.1.5]

Accept recommendation as submitted. No action needed.

Substantiation:
The language in UMC Item # 274, Section 1308.5.4.1 (Regulator Vent Piping) is being revised to correlate with the action taken by the UPC TC for Item # 246, Section 1208.6.6 (Regulator Vent Piping) with regards to the addition of “Schedule 40 and 80” and striking the UL 651 standard. Additionally, the UL 651 standard is being stricken from Table 1701.1 (Referenced Standards) for both the UPC and UMC.

The language in UMC Item # 274, Section 1308.5.6.3 (Thread Joint Sealing) is being revised to correlate with the action taken by the UPC TC for Item # 246, Section 1208.6.9.3 (Thread Joint Sealing) by striking the language pertaining to “nonhardening.”

The language in UMC Item # 274, Section 1310.3 (Installation of Aboveground Piping) is being revised to correlate with the action taken by the UPC TC for Item # 246, Section 1210.3 (Installation of Aboveground Piping) with regards to elevating piping installed outdoors to not less than 3 ½ inches above the ground.

The language in UMC Item # 274, Section 1310.3.5.3 (Piping on Roofs) is being revised to correlate with the action taken by the UPC TC for Item # 246, Section 1210.3.5.3 (Piping on Roofs) with regards to elevating gas piping installed on roofs to not less than 3 ½ inches above the roof surface.

Lastly, the language in UMC Item # 274, Section 1312.1 (Connecting Appliances and Equipment) and 1312.2...
(Suspended Low-Intensity Infrared Tube Heaters) and UPC Section 1212.2 (Suspended Low-Intensity Infrared Tube Heaters) are being revised to correlate with the action taken by the UPC TC for Item # 246, Section 1212.1 (Connecting Appliances and Equipment) regarding the designation of the CSA standards.

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 246 of the UPC is as follows:** The above sections have been revised to correlate with NFPA 54-2021 (latest version) in accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines).

**The Committee Statement provided for amending proposal Item # 246 by the UPC TC is as follows:** UL 651 is a standard for electric conduit and not vent piping. The reference to UL 651 is being removed to avoid confusion and to avoid the use of an incorrect fuel gas vent piping. Furthermore, the reference to the PVC "Schedule 40 and 80" is needed to prevent the use of thinner materials.

**The substantiation provided for proposal Item # 274 of the UMC is as follows:** In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Chapter 13 is being revised to the latest edition of NFPA 54-2021.

**The Committee Statement provided for amending proposal Item # 274 by the UMC TC is as follows:** There is no technical justification provided for changing the gas piping elevation to 3-1/2 inches above the roof surface. For example, 2x4 lumber has been used for years to elevate gas piping on roofs and is considered acceptable by the industry.


RecommendaTion:

L 201.0 Definitions.

Stormwater. Natural precipitation that has contacted a surface at grade or below grade and has not been put to beneficial use.

E 201.0 Definitions.

Storm Water. Stormwater. Natural precipitation that has contacted a surface at grade or below grade and has not been put to beneficial use or aboveground parking structures.

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Substantiation:

The definition of “Storm Water” in UMC Item # 291 is being revised to correlate with the action taken by the UPC TC for Item # 022 and to correlate with the existing definition in the 2021 UPC for “Stormwater.”

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 022 of the UPC is as follows: This term is being relocated to Chapter 2 as it is used throughout the UPC.

The Committee Statement provided for rejecting proposal Item # 022 by the UPC TC is as follows: The definition provided should remain in Appendix L. In addition, the definition should not be removed from Appendix L as the term is relevant to the language within the appendix. It should be noted that the term should be modified throughout the code for consistency.

The substantiation provided for proposal Item # 291 of the UMC is as follows: A definition of stormwater is needed to clarify that stormwater includes runoff water from concrete surfaces, some of which may include pollutants. This would require pretreatment of the stormwater prior to use as a non-potable water source.

The Committee Statement provided for amending proposal Item # 291 by the UMC TC is as follows: The term originated in the Green Plumbing Code and the modification clarifies that storm water is water that ends up in a street or parking lot or runs through a storm sewer.
RECOMMENDATION:

J 101.2 Example of Combination Indoor and Outdoor Combustion Air Opening Design. (remaining text unchanged)

Solution:
(1) Determine the total available room volume. Appliance room volume:
15 feet by 30 feet (4572 mm by 9144 mm) with an 8 foot (2438 mm) ceiling = 3600 cubic feet (101.94 m³)
(2) Determine the total required volume. The standard method to determine combustion air is used to calculate the required volume. The combined input for the appliances located in the basement is calculated as follows:

100 000 Btu/h (29 kW) + 40 000 Btu/h (11.7 kW) = 140 000 Btu/h (41 kW)

The standard method requires that the required volume be determined based on 50 cubic feet per 1000 Btu/h (4.83 m³/kW). Using Table J 101.2, the required volume for a 140 000 Btu/h (41 kW) water heater combined input is 7000 cubic feet (198.22 m³).

[NFPA 54:1.1]

G 103.0 Example of Combination Indoor and Outdoor Combustion Air Opening Design. (remaining text unchanged)

Solution:
(1) Determine the total available room volume. Appliance room volume:
15 feet by 30 feet (4572 mm by 9144 mm) with an 8 foot (2438 mm) ceiling = 3600 cubic feet (101.94 m³)
(2) Determine the total required volume. The Standard Method to determine combustion air is used to calculate the required volume.

The combined input for the appliances located in the basement is calculated as follows:

100 000 Btu/h (29 kW) + 40 000 Btu/h (11.7 kW) = 140 000 Btu/h (41 kW)

The Standard Method requires that the required volume be determined based on 50 cubic feet per 1000 Btu/h (4.83 m³/kW).

Using Table G 103.0 the required volume for a 140 000 Btu/h (41 kW) combined input is 7000 cubic feet (198.22 m³).

[NFPA 54:1.1]

X Accept recommendation as submitted. | No action needed.

Substantiation:
The language in UPC Item # 283, Section J 101.2 (Example of Combination Indoor and Outdoor Combustion Air Opening) is being revised to correlate with the action taken by the UMC TC for Item # 322, Section G 103.0 (Example of Combination Indoor and Outdoor Combustion Air Opening Design) with regards to replacing the term "water heater" with "combined input" and adding the term "Design" to the title to correlate with the latest edition of the NFPA 54 extract.

The following is provided for informational purpose only:

The substantiation provided for proposal Item # 283 of the UPC is as follows: The above sections have been revised to correlate with NFPA 54-2021 (latest version) in accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines).

The substantiation provided for proposal Item # 322 of the UMC is as follows: In accordance with IAPMO's Regulations Governing Committee Projects (Extract Guidelines), Appendix G is being revised to the latest edition of NFPA 54-2021.
# TCC ITEM # 027

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<th>2024 UNIFORM PLUMBING CODE</th>
<th>2024 UNIFORM MECHANICAL CODE</th>
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<tbody>
<tr>
<td>ITEM # 100</td>
<td>ITEM # 022</td>
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**RECOMMENDATION:**

**225.0 – W –**

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

**206.0 – D –**

**Dual Purpose Water Heater.** An appliance intended to be a heat source for both space heating and domestic hot water applications.

| X | Accept recommendation as submitted. | No action needed. |

**Substantiation:**

The definition of “Dual Purpose Water Heater” in UMC Item # 022 is being added to correlate with the action taken by the UPC TC for Item # 100. Additionally, UPC Item # 100 and UMC Item # 022 are being revised to correct an oversight by replacing the phrase “utilized as” to “intended to be.”

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 100 of the UPC is as follows:** The code is currently silent on dual purpose type water heaters. There are types water heaters specially designed to supply both potable water fixtures and space heating systems. The addition of this language will serve as a safety measure to ensure such designs are not overlooked. Also, the addition of a definition will clarify the intent of the code.

**The substantiation provided for proposal Item # 022 of the UMC is as follows:** UMC Sections 1002.5, 1202.3, 1203.2, 1207.3, and 1219.1 reference Dual Purpose Water Heaters. Therefore, a definition for the term is being added to clarify what a dual purpose water is and the intent of the code.
### RECOMMENDATION:

#### 301.0 General.

**301.3 Alternate Materials and Methods of Construction Equivalency.** Unless specifically prohibited, 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 prior to installation. 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.

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**Substantiation:**

No action is needed by the TCC for UPC Item # 030 or UMC Item # 057. The TCC believes this topic should be discussed during the next Technical Committee meeting with the entire Committee.

The following is provided for informational purpose only:

**The substantiation provided for proposal Item # 030 of the UPC is as follows:** Section 301.3 grants authority to AHJ’s to approve materials or products at their discretion. However, Section 301.3 places an obligation on the AHJ to approve only those alternate materials or products which comply "with the intent of this code," which are “at least the equivalent of that prescribed in this code,” and are not specifically prohibited elsewhere in the code.

**The substantiation provided for proposal Item # 057 of the UMC is as follows:** Section 302.2 grants authority to AHJ’s to approve materials or products at their discretion. However, Section 302.2 places an obligation on the AHJ to approve only those alternate materials or products which comply "with the intent of this code," which are “at least the equivalent of that prescribed in this code,” and are not specifically prohibited elsewhere in the code.
MEMORANDUM

TO:        UPC-UMC Technical Correlating Committee
FROM:      Zalmie Hussein, Staff Liaison
DATE:      August 5, 2021
SUBJECT:   UPC-UMC TCC Final Ballot Results - July 2021

Dear Technical Correlating Committee Members:

Attached are the final ballot results for the committee recommendations as a result of the actions taken during your recent meeting.

6 Members eligible to Vote
All ballots were received by the final closing date of August 3, 2021
(See attached voting results for details)

There are two criteria necessary to pass the letter ballot for each item as follows:
1. The number of affirmative votes needed for each item to pass is ¾ affirmative.
2. In all cases, an affirmative vote of at least a simple majority of the total members eligible to vote is required.

All of the committee actions for the Technical Correlating Committee Report achieved the necessary ¾ affirmative votes and simple majority on returned ballots.

Thank you for your willingness to participate in this Committee. If you have any questions, please contact Enrique Gonzalez at (909) 230-5535 or email at Enrique.Gonzalez@iapmo.org or Zalmie Hussein at (909) 218-8122 or email at Zalmie.Hussein@iapmo.org.

Best Regards,

Zalmie Hussein
- **Ballot Name:** TCC Item # 001 July 2021  
  **Total Votes:** 6

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- **Ballot Name:** TCC Item # 002 July 2021  
  **Total Votes:** 6

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- **Ballot Name:** TCC Item # 003 July 2021  
  **Total Votes:** 6

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# UPC-UMC TCC Final Ballot Results - July 2021

## Ballot Name: TCC Item # 004 July 2021

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## Ballot Name: TCC Item # 006 July 2021

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UPC-UMC TCC Final Ballot Results - July 2021

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### Ballot Name: TCC Item # 010 July 2021

**Total Votes:** 6

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### Ballot Name: TCC Item # 011 July 2021

**Total Votes:** 6

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### Ballot Name: TCC Item # 012 July 2021

**Total Votes:** 6

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### Ballot Name: TCC Item # 013 July 2021

Total Votes: 6

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### Ballot Name: TCC Item # 014 July 2021

Total Votes: 6

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### Ballot Name: TCC Item # 015 July 2021

Total Votes: 6

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## UPC-UMC TCC Final Ballot Results - July 2021

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CHAPTER 1
ADMINISTRATION

101.0 General.
101.1 Title. This document shall be known as the “Uniform Plumbing 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 plumbing systems within this jurisdiction.
101.3 Purpose. This code is an ordinance providing minimum requirements and standards for the protection of the public health, safety, and welfare.
101.4 Unconstitutional. Where a section, subsection, sentence, clause, or phrase of this code is, for a reason, held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this code. The legislative body hereby declares that it would have passed this code, and each section, subsection, sentence, clause, or phrase thereof, irrespective of the fact that one or more sections, subsections, sentences, clauses, and phrases are declared unconstitutional.
101.5 Validity. Where a provision of this code, or the application thereof to a person or circumstance, is held invalid, the remainder of the code, or the application of such provision to other persons or circumstances, shall not be affected thereby.

102.0 Applicability.
102.1 Conflicts Between Codes. Where the requirements within the jurisdiction of this plumbing code conflict with the requirements of the mechanical code, this code shall prevail. In instances where this code, applicable standards, or the manufacturer’s installation instructions conflict, the more stringent provisions shall prevail. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall prevail.
102.2 Existing Installations. Plumbing 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 plumbing system.
102.3 Maintenance. The plumbing and drainage system, both existing and new, of a premise under the Authority Having Jurisdiction shall be maintained in a sanitary and safe 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 plumbing systems. To determine compliance with this subsection, the Authority Having Jurisdiction shall be permitted to cause a plumbing system to be reinspected.

102.4 Additions, Alterations, Renovations, or Repairs. Additions, alterations, renovations or repairs shall conform to that required for a new system without requiring the existing plumbing 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 plumbing installations shall comply with the provisions for new construction unless such deviations are found to be necessary and are first approved by the Authority Having Jurisdiction.

102.4.1 Building Sewers and Drains. Existing building sewers and building drains shall be permitted to be used in connection with new buildings or new plumbing and drainage work where they are found on examination and test to be in accordance with the requirements governing new work, and the proper Authority Having Jurisdiction shall notify the owner to make changes necessary to be in accordance with this code. No building, or part thereof, shall be erected or placed over a part of a drainage system that is constructed of materials other than those approved elsewhere in this code for use under or within a building.

102.4.2 Openings. Openings into a drainage or vent system, excepting those openings to which plumbing fixtures are properly connected or which constitute vent terminals, shall be permanently plugged or capped in an approved manner, using the appropriate materials in accordance with this code.

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 plumbing and drainage facilities or shall make such repairs or alterations as ordered by the Authority Having Jurisdiction.

102.6 Changes in Building Occupancy. Plumbing 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 plumbing system of a building or part thereof that is moved from one foundation to another, or from one location to another, shall be in accordance with the provisions of this code for new installations and completely tested as prescribed elsewhere in this section for new work, except that walls or floors need not be removed during such test where 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 comply 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 Jurisdiction shall be permitted to appoint a 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.

The Authority Having Jurisdiction shall be permitted to request the assistance and cooperation of other officials of this jurisdiction so far as required in the discharge of the duties in accordance with this code or other pertinent law or ordinance.

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 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 provisions of this code shall be defended by legal counsel provided by this jurisdiction until final termination of such 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 in accordance with 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 construction documents shall not prevent the Authority Having Jurisdiction from thereafter requiring the correction of errors in said construction documents 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.

103.3.1 Licensing. Provision for licensing shall be determined by the Authority Having Jurisdiction.

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 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 by 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 plumbing system regulated by this code except as permitted in Section 104.2, or to cause the same to be done without first obtaining a separate plumbing permit for each separate building or structure.

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

1. The stopping of leaks in drains, soil, waste, or vent pipe, provided, however, that a trap, drainpipe, soil, waste, or vent pipe become defective, and it becomes necessary to remove and replace the same with new material, the same shall be considered as new work and a permit shall be procured and inspection made as provided in this code.

2. The clearing of stoppages, including the removal and reinstallation of water closets, or the repairing of leaks in pipes, valves, or fixtures, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes, or fixtures.

Exemption from the permit requirements of this code shall not be deemed 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 locate the proposed building or work.

3. Indicate the use or occupancy for which the proposed work is intended.
(4) Be accompanied by construction documents in accordance with 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 in accordance with the Authority Having Jurisdiction.

104.3.1 Construction Documents. Construction documents, engineering calculations, diagrams, and other data shall be submitted in two or more sets, or in a digital format where permitted by the Authority Having Jurisdiction, with each application for a permit. The construction documents, computations, and specifications shall be prepared by, and the plumbing designed by, a registered design professional. Construction documents shall be drawn to scale with clarity to identify that the intended work to be performed is in accordance with the code.

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

104.3.2 Plan Review Fees. Where a plan or other data is required to be submitted in accordance with Section 104.3.1, a plan review fee shall be paid at the time of submitting construction documents for review.

The plan review fees for plumbing 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 Section 104.5.

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 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 the 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, construction documents, 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 construction documents “APPROVED.” Such approved construction documents shall not be changed, modified, or altered without authorization from the Authority Having Jurisdiction, and the work shall be done in accordance with approved plans.

The Authority Having Jurisdiction shall be permitted to issue a permit for the construction of a part of a plumbing system before the entire construction documents 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 plumbing system will be granted.

104.4.2 Validity of Permit. The issuance of a permit or approval of construction documents 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 construction documents for such work, and provided further that such suspensions or abandonment has 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 per-
mittee showing that circumstances beyond the control of the permittee have prevented the 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 or Revocation. The Authority Having Jurisdiction shall be permitted, in writing, with written notification, to 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 construction documents and computations shall be retained by the Authority Having Jurisdiction until final approval of the work covered therein.

One set of approved construction documents, computations, and manufacturer’s installation instructions shall be returned to the applicant and said set 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 Investigation Fees. An investigation fee, in addition to the permit fee, shall be collected whether 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 a fee 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. Plumbing systems for which a permit is required by this code shall be inspected by the Authority Having Jurisdiction.

No plumbing system or portion thereof shall be covered, concealed, or put into use until 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. Plumbing 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 Inspections. New plumbing 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 plumbing system are 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. The underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and 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 drainage or plumbing system, building sewer, private sewage disposal 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 plumbing installed to replace existing equipment or fixtures serving an occupied portion of the building in the event a request for inspection of such equipment or fixture 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 plumbing system is concealed by a permanent portion of the building.

105.2.1.1 Water Supply System. No water supply system or portion thereof shall be covered or concealed until it first has been tested, inspected, and approved.

105.2.1.2 Covering or Using. No plumbing or drainage system, building sewer, private sewer disposal system, or part thereof, shall be covered, concealed, or put into use until it has been tested, inspected, and accepted as prescribed in this code.

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 a 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 in accordance with this code to provide access to and means for 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 reinspections where such portion of work for which inspection is called is not complete or where required corrections have not been made.

This provision shall not 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. Plumbing systems shall be tested and approved in accordance with 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 plumbing 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 plumbing system shall be gastight and watertight for the pressures required by the test.

105.3.1 Defective Systems. An air test shall be used in testing the sanitary condition of the drainage or plumbing system of 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 plumbing 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 plumbing 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 plumbing 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 plumbing or permit the same to be done in violation of this code.

106.2 Notices 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 their 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 plumbing 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 plumbing 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 plumbing 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 defective plumbing after receiving such notice.

Where such plumbing 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 plumbing design, construction, and maintenance and the public health aspects of plumbing 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>
<thead>
<tr>
<th>TABLE 104.5</th>
<th>PLUMBING PERMIT FEES</th>
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**Permit Issuance**

1. For issuing each permit  
2. For issuing each supplemental permit

**Unit Fee Schedule** (in addition to Item 1 and Item 2 above)

1. For each plumbing fixture on one trap or a set of fixtures on one trap (including water, drainage piping, and backflow protection therefore)
2. For each building sewer and each trailer park sewer
3. Rainwater systems – per drain (inside building)
4. For each cesspool (where permitted)
5. For each private sewage disposal system
6. For each water heater, vent, or both
7. For each gas piping system of one to five outlets
8. For each additional gas piping system outlet, per outlet
9. For each industrial waste pretreatment interceptor, including its trap and vent, except kitchen-type grease interceptors functioning as fixture traps
10. For each installation, alteration, or repair of water piping, water treating equipment, or both
11. For each repair or alteration of drainage or vent piping, each fixture
12. For each lawn sprinkler system on one meter including backflow protection devices therefore
13. For atmospheric-type vacuum breakers not referenced in Item 12:
   - One to 5
   - Over 5
14. For each backflow protective device other than atmospheric-type vacuum breakers:
   - Two inches (50 mm) in diameter and smaller
   - Over 2 inches (50 mm) in diameter
15. For each gray water system
16. For initial installation and testing of a reclaimed water system
17. For each annual cross-connection testing of a reclaimed water system (excluding initial test)
18. For each medical gas piping system serving one to five inlet(s)/outlet(s) for a specific gas
19. For each additional medical gas inlet(s)/outlet(s)

**Other Inspections and Fees**

1. Inspections outside of normal business hours
2. Reinspection fee
3. Inspections for which no fee is specifically indicated
4. Additional plan review required by changes, additions, or revisions to approved plans (minimum charge – ½ hour)

For SI units: 1 inch = 25 mm

* Jurisdiction will indicate their fees here
CHAPTER 2
DEFINITIONS

201.0 General.
201.1 Applicability. For the purpose of this code, the following terms have the meanings 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.

203.0 — A —
ABS. Acrylonitrile-butadiene-styrene.

Accepted Engineering Practice. That which conforms to technical or scientific-based principles, tests, or standards that are accepted by the engineering profession.

Accessible. Where applied to a fixture, connection, appliance, or equipment, “accessible” means having access thereto, 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 a panel, door, or similar obstruction.

Air Break. A physical separation which may be a low inlet into the indirect waste receptor from the fixture, appliance, or device indirectly connected.

Air Gap, Drainage. The unobstructed vertical distance through the free atmosphere between the lowest opening from a pipe, plumbing fixture, 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 fixture.

Alternate Water Source. Nonpotable source of water that includes but not limited to gray water, on-site treated nonpotable water, rainwater, and reclaimed (recycled) water.

Anchors. See Supports.

Anodeless Riser. An assembly of steel-cased plastic pipe used to make the transition between plastic piping installed underground and metallic piping installed aboveground. [NFPA 54:3.3.3]

Appliance. A device that utilizes fuel or electricity as an energy source to produce light, heat, power, refrigeration, or air conditioning, or compressed fuel gas. This definition also includes tanked decorative appliances and electric storage or tankless water heaters.

Appliance, Low-Heat. A fuel-burning appliance that produces a continuous flue gas temperature, at the point of entrance to the flue, of not more than 1000°F (538°C).

Appliance, Medium-Heat. A fuel-burning appliance that produces a continuous flue gas temperature, at the point of entrance to the flue, of more than 1000°F (538°C) and less than 2000°F (1093°C).

Appliance Categorized Vent Diameter/Area. The minimum vent diameter/area permissible for Category I appliances to maintain a nonpositive vent static pressure when tested in accordance with nationally recognized standards. [NFPA 54:3.3.5]

Appliance Fuel Connector. An assembly of listed semi-rigid or flexible tubing and fittings to carry fuel between a fuel-piping outlet and a fuel-burning appliance.

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.

Area Drain. A receptor designed to collect surface or storm water from an open area.

Aspirator. A fitting or device supplied with water or other fluid under positive pressure that passes through an integral orifice or constriction, causing a vacuum.

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 statutory authority, the Authority Having Jurisdiction may be some other responsible party. This definition shall include the Authority Having Jurisdiction’s duly authorized representative.

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 Back-pressure Backflow and Backspionage.

Backflow Connection. An arrangement whereby backflow can occur.

Backflow Preventer. A backflow prevention device, an assembly, or another 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.

Backwater Valve. A device installed in a drainage system to prevent reverse flow.

Bathroom. A room equipped with a shower, bathtub, or combination bath/shower.

Bathroom, Half. A room equipped with only a water closet and lavatory.

Bathroom Group. Any combination of fixtures, not to exceed one water closet, two lavatories, either one bathtub or one combination bath/shower, and one shower, and may include a bidet and an emergency floor drain.

Battery of Fixtures. A group of two or more similar, adjacent fixtures that discharge into a common horizontal waste or soil branch.

Bedpan Steamer. A fixture that is used to sterilize bedpans by way of steam.

Body Spray. A shower device for spraying water onto a bather from other than the overhead position.

Boiler Blowoff. An outlet on a boiler to permit emptying or discharge of sediment.

Bonding Conductor or Jumper. A reliable conductor to ensure the required electrical conductivity between metal parts required to be electrically connected. [NFPA 70:100 (Part I)]

Bottle Filling Station. A plumbing fixture connected to the potable water distribution system and sanitary drainage system that is designed and intended for filling personal use drinking water bottles or containers not less than 10 inches (254 mm) in height. Such fixtures can be separate from or integral to a drinking fountain and can incorporate a water filter and a cooling system for chilling the drinking water.

Branch. A part of the piping system other than a main, riser, or stack.

Branch, Fixture. See Fixture Branch.

Branch, Horizontal. See Horizontal Branch.

Branch Vent. A vent connecting one or more individual vents with a vent stack or stack vent.

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 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 Drain (Sanitary). A building drain that conveys sewage only.

Building Drain (Storm). A building drain that conveys storm water or another drainage, but no sewage.

Building Sewer. That part of the horizontal piping of a drainage system that extends from the end of the building drain and that receives the discharge of the building drain and conveys it to a public sewer, private sewer, private sewage disposal system, or another point of disposal.

Building Sewer (Combined). A building sewer that conveys both sewage and storm water or other drainage.

Building Sewer (Sanitary). A building sewer that conveys sewage only.

Building Sewer (Storm). A building sewer that conveys storm water or another drainage, but no sewage.

Building Subdrain. That portion of a drainage system that does not drain by gravity into the building sewer.

Building Supply. The pipe is carrying potable water from the water meter or another source of water supply to a building or other point of use or distribution on the lot.

205.0 – C –

Category 1. Activities, systems, or equipment whose failure is likely to cause major injury or death to patients, staff, or visitors. [NFPA 99:3.3.158.1–3.3.162.1]

Category 2. Activities, systems, or equipment whose failure is likely to cause minor injury to patients, staff, or visitors. [NFPA 99:3.3.158.2–3.3.162.2]

Category 3. Activities, systems, or equipment whose failure is not likely to cause injury to patients, staff, or visitors, but can cause discomfort. [NFPA 99:3.3.158.3–3.3.162.3]

Category 3 Vacuum System. A Category 3 vacuum distribution system that can be either a wet system designed to remove liquids, air-gas, or solids from the treated area; or a dry system designed to trap liquid and solids before the service inlet and to accommodate air-gas only through the service inlet. [NFPA 99:3.3.162.3]

Category 4. Activities, systems, or equipment whose failure would have no impact on patient care. [NFPA 99:3.3.158.4–3.3.162.4]

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

Cesspool. A lined excavation in the ground that receives the discharge of a drainage system or part thereof, so designed as to retain the organic matter and solids discharging therein but permitting the liquids to seep through the bottom and sides.

Chemical Waste. See Special Wastes.

Chimney. One or more passageways, vertical or nearly so, for conveying flue or vent gases to the outdoors. [NFPA 54:3.3.17]

Chimney, Factory-Built. A chimney composed of listed factory-built components assembled in accordance with the manufacturer’s installation instructions to form the completed chimney. [NFPA 54:3.3.17.2]
**Chimney, Masonry.** A field-constructed chimney of solid masonry units, bricks, stones, listed masonry chimney units, or reinforced Portland cement concrete, lined with suitable chimney flue liners. [NFPA 54:3.3.18.3.3.17.3]

**Chimney, Metal.** A chimney—field-constructed chimney of metal with a minimum thickness not less than 0.127 inches (3.23 mm) (No. 10 manufacturer’s standard gauge) steel sheet. [NFPA 54:3.3.18.4]

**Chimney Classifications:**

**Chimney, High-Heat Appliance-Type.** A factory-built, masonry, or metal chimney suitable for removing the products of combustion from fuel-burning high-heat appliances producing combustion gases in excess of 2000°F (1093°C), measured at the appliance flue outlet.

**Chimney, Low-Heat Appliance-Type.** A factory-built, masonry, or metal chimney suitable for removing the products of combustion from fuel-burning low-heat appliances producing combustion gases not in excess of 1000°F (538°C) under normal operating conditions, but capable of producing combustion gases of 1400°F (760°C) during intermittent forced firing for periods up to one hour. Temperatures are measured at the appliance flue outlet.

**Chimney, Medium-Heat Appliance-Type.** A factory-built, masonry, or metal chimney suitable for removing the products of combustion from fuel-burning medium-heat appliances producing combustion gases, not in excess of 2000°F (1093°C), measured at the appliance flue outlet.

**Chimney, Residential Appliance-Type.** A factory-built or masonry chimney suitable for removing products of combustion from residential-type appliances producing combustion gases, not in excess of 1000°F (538°C), measured at the appliance flue outlet. Factory-built Type HT chimneys have high-temperature thermal shock resistance.

**Circuit Vent.** The vent that connects to a horizontal drainage branch and vents two traps to a maximum of eight traps connected into a battery of fixtures.

**Clarifier.** See Interceptor (Clarifier).

**Clear Water Waste.** Cooling water and condensate drainage from refrigeration and air-conditioning equipment; cooled condensate from steam heating systems, and cooled boiler blowdown water.

**Clinical Sink.** A fixture that has the same flushing and cleansing characteristics of a water closet that is used to receive the wastes from a bedpan. Also, known as a bedpan washer.

**Coastal High Hazard Areas.** An area within the flood hazard area that 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.

**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.

**Combination Temperature and Pressure-Relief Valve.** A relief valve that actuates when a set temperature, pressure, or both is reached. Also, known as a T&P Valve.

**Combination Thermostatic/Pressure Balancing Valve.** A mixing valve that senses outlet temperature and incoming hot and cold water pressure and compensates for fluctuations in incoming hot and cold water temperatures, pressures, or both to stabilize outlet temperatures.

**Combination Waste and Vent System.** A specially designed system of waste piping embodying the horizontal wet venting of one or more sinks or floor drains using a common waste and vent pipe adequately sized to provide free movement of air above the flow line of the drain.

**Combined Building Sewer.** See Building Sewer (Combined).

**Combustible Material.** A material that, in the form in which it is used and under the conditions anticipated, will ignite and burn; a material that does not meet the definition of noncombustible. [NFPA 54:3.3.64.1]

**Commercial Modular System.** A drinking water treatment unit system consisting of multiple components attached to a manifold, produced specifically for food service applications, and not intended for use in residential applications.

**Common.** That part of a plumbing system that is so designed and installed as to serve more than one appliance, fixture, building, or system.

**Condensate.** The liquid phase produced by condensation of a gas or vapor.

**Conductor.** A pipe inside the building that conveys storm water from the roof to a storm drain, combined building sewer, or other approved point of disposal.

**Confined Space.** A room or space having a volume less than 50 cubic feet per 1000 British thermal units per hour (Btu/h) (4.83 m$^3$/kW) of the aggregate input rating of all fuel-burning appliances installed in that space with limited entrance and egress that is not suitable for inhabitants and not intended for continuous human occupancy.

**Construction Documents.** Plans, specifications, written, graphic, and pictorial documents prepared or assembled for describing the design, location, and physical characteristics of the elements of a project necessary for obtaining a permit.

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

**Continuous Vent.** A vertical vent that is a continuation of the drain to which it connects.

**Continuous Waste.** A drain is connecting the compartments of a set of fixtures to a trap or connecting other permitted fixtures to a common trap.

**Copper Alloy.** A homogeneous mixture of two or more metals in which copper is the primary component, such as brass and bronze.

**CPVC.** Chlorinated Polyvinyl Chloride.

**Critical Care Area.** See Patient Care Space, Category 1.
DEFINITIONS

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 plumbing fixture or 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 –

Dead Leg. A section of potable water pipe which contains water that has no flow or does not circulate.

Debris Excluder. A device installed on the rainwater catchment conveyance system to prevent the accumulation of leaves, needles, or other debris in the system.

Department Having Jurisdiction. The Authority Having Jurisdiction, including any other law enforcement agency 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 is the elevation of the highest existing grade of the building’s perimeter plus the depth number (in feet) 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 is taken as being equal to 2 feet (610 mm).

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

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

Direct-Vent Appliances. Appliances that are constructed and installed so that all air for combustion is derived directly from the outdoors and all flue gases are discharged to the outdoors. [NFPA 54:3.3.3.3-3.3.4.2]

Diverter Valve. A valve that directs gray water to the sanitary drainage system or a subsurface irrigation system.

Diverter Valve, Gray Water. A component in the collection system to control inflow and overflow in collection tanks intended for on-site treatment and direct beneficial use.

Diverter Valve, On-Site Treated Nonpotable Water. A component in the collection system to control inflow and overflow in collection tanks intended for on-site treatment and direct beneficial use.

Diverter Valve, Rainwater. A component in commercial rainwater catchment systems to control high inflow and overflow volumes in rainwater storage tanks.

Domestic Sewage. The liquid and water-borne wastes derived from the ordinary living processes, free from industrial wastes, and of such character as to permit satisfactory disposal, without special treatment, into the public sewer or by means of a private sewage disposal system.

Downspout. The rain leader from the roof to the building storm drain, combined building sewer, or other means of disposal located outside of the building. See Conductor and Leader.

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

Drainage System. Includes all the piping within public or private premises that conveys sewage, storm water, or other liquid wastes to a legal point of disposal, but does not include the mains of a public sewer system or a public sewage treatment or disposal plant.

Drinking Fountain. A plumbing fixture connected to the potable water distribution system and sanitary drainage system that provides drinking water in a flowing stream so that the user can consume water directly from the fixture without the use of accessories. Drinking fountains should also incorporate a bottle filling station and can incorporate a water filter and a cooling system for chilling the drinking water.

Dry Vent. A vent that does not receive the discharge of any sewage or waste.

Durham System. Soil or waste system in which all piping is threaded pipe, tubing, or other such rigid construction, using recessed drainage fittings to correspond to the types of piping.

207.0 – E –

Effective Ground-Fault Current Path. An intentionally constructed, low impedance electrically conductive path designed and intended to carry current under ground-fault conditions from the point of a ground fault on a wiring system to the electrical supply source and that facilitates the operation of the overcurrent protective device or ground-fault detectors. [NFPA 54:3.3.34.70:100]

Effective Opening. The minimum cross-sectional area at the point of water supply discharge measured or expressed in terms of (1) diameter of a circle or (2) where the opening is not circular, the diameter of a circle of equivalent cross-sectional area. (This applies to an air gap).

Emergency Floor Drain. A floor drain that does not receive discharge from any fixture drain or indirect waste pipe, and serves to protect from damage where accidental spills, leaks or fixture backups occur.

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

Exam Room Sink. A sink used in the patient exam room of a medical or dental office with a primary purpose of the washing of hands.
**Excess Flow Valve (EFV).** A valve designed to activate when the fuel gas passing through it exceeds a prescribed flow rate. [NFPA 54:3.3.98.3]

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

**Expansion Joint.** A fitting or arrangement of pipe and fittings that permit the contraction and expansion of a piping system.

**Expansion Tank.** A vessel used to protect potable water systems from excessive pressure.

**208.0 – F –**

**F Rating.** The time period that the penetration firestop system limits the spread of fire through the penetration, where tested in accordance with ASTM E814 or UL 1479.

**Fixture Branch.** A water supply pipe between the fixture supply pipe and the water distribution pipe.

**Fixture Drain.** The drain from the trap of a fixture to the junction of that drain with any other drainpipe.

**Fixture Fitting.** A device that controls and guides the flow of water.

**Fixture Supply.** A water supply pipe is connecting the fixture with the fixture branch.

**Fixture Unit.** A quantity in terms of which the load-producing effects on the plumbing system of different kinds of plumbing fixtures are expressed on some arbitrarily chosen scale.

**Flammable Vapor or Fumes.** The concentration of flammable constituents in the air that exceeds 25 percent of its lower flammability limit (LFL).

**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 Level.** See Flooded.

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

**Flooded.** A fixture is flooded where the liquid therein rises to the flood-level rim.

**Flue Collar.** That portion of an appliance designed for the attachment of a draft hood, vent connector, or venting system. [NFPA 54:3.3.44]

**Flush Tank.** A tank located above or integral with water closets, urinals, or similar fixtures for the purpose of flushing the usable portion of the fixture.

**Flush Valve.** A valve located at the bottom of a tank for flushing water closets and similar fixtures.

**Flushometer Tank.** A tank integrated within an air accumulator vessel that is designed to discharge a predetermined quantity of water to fixtures for flushing purposes.

**Flushometer Valve.** A valve that discharges a predetermined quantity of water to fixtures for flushing purposes and is actuated by direct water pressure.

**FOG Disposal System.** A grease interceptor that reduces nonpetroleum fats, oils, and grease (FOG) in the effluent by separation, mass, and volume reduction.

**Fuel Gas.** Natural, manufactured liquefied petroleum, or a mixture of these.

**209.0 – G –**

**Gang or Group Shower.** Two or more showers in a common area.

**Gas Piping.** An installation of pipe, valves, or fittings that are used to convey fuel gas, installed on a premise or in a building, but shall not include:

1. A portion of the service piping.
2. An approved piping connection 6 feet (1829 mm) or less in length between an existing gas outlet and a gas appliance in the same room with the outlet.

**Gas Piping System.** An arrangement of gas piping or regulators after the point of delivery and each arrangement of gas piping serving a building, structure, or premises, whether individually metered or not.

**General Anesthesia and Levels of Sedation/Analgesia.**

**Deep Sedation/Analgesia.** A drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained. [NFPA 99:3.3.68.2]

**General Anesthesia.** A drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired. [NFPA 99:3.3.66.4]

**Minimal Sedation (Anxiolysis).** A drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected. [NFPA 99:3.3.66.43.3.68.4]

**Moderate Sedation/Analgesia (Conscious Sedation).** A drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained. [NFPA 99:3.3.66.33.3.68.3]
DEFINITIONS

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 (meter) length of pipe.

Gravity Grease Interceptor. A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept nonpetroleum fats, oils, and greases (FOG) from a wastewater discharge and is identified by volume, 30 minute retention time, baffle(s), not less than two compartments, a total volume of not less than 300 gallons (1135 L), and gravity separation. [These interceptors comply with the requirements of Chapter 10 or are designed by a registered design professional.] Gravity grease interceptors are generally installed outside.

Gray Water. Untreated wastewater that has not come into contact with toilet waste, kitchen sink waste, dishwasher waste or similarly contaminated sources. Gray water includes wastewater from bathtubs, showers, lavatories, clothes washers, and laundry tubs. Also, known as grey water, graywater, and greywater.

Grease Interceptor. A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept nonpetroleum fats, oil, and greases (FOG) from a wastewater discharge.

Grease Removal Device (GRD). A hydromechanical grease interceptor that automatically, mechanically removes nonpetroleum fats, oils and grease (FOG) from the interceptor, the control of which are either automatic or manually initiated.

Grounding Electrode. A conducting object through which a direct connection to earth is established. [NFPA 70:100 (Part I)]

Groundwater. Water that exists beneath the earth's surface.

Group Wash Fixture. A lavatory that allows more than one person to utilize the fixture at the same time. The fixture has one or more drains and one or more faucets.

210.0 – H –

Hangers. See Supports.

Health Care Facility’s Governing Body. The person or persons who have the overall legal responsibility for the operation of a health care facility. [NFPA 99:2013.3.74]

Heat-Fusion Weld Joints. A joint used in some thermoplastic systems to connect the pipe to fittings or pipe lengths directly to one another (butt-fusion). This method of joining pipe to fittings includes socket-fusion, electro-fusion, and saddle-fusion. This method of welding involves the application of heat and pressure to the components, allowing them to fuse together forming a bond between the pipe and fitting.

High Hazard. See Contamination.

Horizontal Branch. A drainpipe extending laterally from soil or waste stack or building drain with or without vertical sections or branches, which receives the discharge from one or more fixture drains and conducts it to the soil or waste stack or the building drain.

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.

Hot Water. Water at a temperature exceeding or equal to 120°F (49°C).

House Drain. See Building Drain.

House Sewer. See Building Sewer.

Hydromechanical Grease Interceptor. A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept nonpetroleum fats, oil, and grease (FOG) from a wastewater discharge and is identified by flow rate, and separation and retention efficiency. The design incorporates air entrainment, hydromechanical separation, interior baffling, or barriers in combination or separately, and one of the following:

(1) External flow control, with an air intake (vent), directly connected.
(2) External flow control, without air intake (vent), directly connected.
(3) Without external flow control, directly connected.
(4) Without external flow control, indirectly connected.

These interceptors comply with the requirements of Table 1014.2.1. Hydromechanical grease interceptors are generally installed inside.

211.0 – I –

Indirect-Fired Water Heater. A water heater consisting of a storage tank equipped with an internal or external heat exchanger used to transfer heat from an external source to heat potable water. The storage tank either contains heated potable water or water supplied from an external source, such as a boiler.

Indirect Waste Pipe. A pipe that does not connect directly to the drainage system but conveys liquid wastes by discharging into a plumbing fixture, interceptor, or receptacle that is directly connected to the drainage system.

Individual Vent. A pipe installed to vent a fixture trap, and that connects with the vent system above the fixture served or terminates in the open air.

Industrial Waste. Liquid or water-borne waste from industrial or commercial processes, except domestic sewage.

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.
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, Compression. A multipiece joint with cup-shaped threaded nuts that, when tightened, compress tapered sleeves so that they form a tight joint on the periphery of the tubing they connect.

Joint, Flanged. One made by bolting together a pair of flanged ends.

Joint, Flared. A metal-to-metal compression joint in which a conical spread is made on the end of a tube that is compressed by a flare nut against a mating flare.

Joint, Mechanical. The general form for gas-tight or liquid-tight joints obtained by the joining of parts through a positive holding mechanical construction.

Joint, Press-Connect. A permanent mechanical joint incorporating an elastomeric seal or an elastomeric seal and corrosion resistant grip ring. The joint is made with a pressing tool and jaw or ring that complies with the manufacturer’s installation instructions.

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.

Lavatories in Sets. Two or three lavatories that are served by one trap.

Leader. An exterior vertical drainage pipe for conveying storm water from roof or gutter drains. See Downspout.

Liquefied Petroleum Gas (LP-Gas) Facilities. Liquefied petroleum gas (LP-Gas) facilities include tanks, containers, container valves, regulating equipment, meters, appurtenances, or any combination thereof for the storage and supply of liquefied petroleum gas for a building, structure, or premises.

Liquid Waste. The discharge from a fixture, appliance, or appurtenance in connection with a plumbing system that does not receive fecal matter.

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 materials 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 specific 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 are 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 that 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.

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 any 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.

Low-Pressure Water Dispenser. A terminal fitting located downstream of a pressure reducing valve that dispenses drinking hot water above 71°C (160°F) or cold water or both at a pressure of 105 kPa (15 psi) or less.

Macerating Toilet System. A system comprised of a sump with macerating pump and with connections for a water closet and other plumbing fixtures, which is designed to accept, grind and pump wastes to an approved point of discharge.

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

Main Sewer. See Public Sewer.

Main Vent. The principal artery of the venting system to which vent branches may be connected.
DEFINITIONS

May. A permissive term.

Medical Air. For the purposes of this code, medical air is air supplied from cylinders, bulk containers, or medical air compressors, or reconstituted from oxygen USP and oil-free, dry nitrogen NF. [NFPA 99:3.3.96 - 3.3.106]

Medical Gas. A patient medical gas or medical support gas. (See also Patient Medical Gas and Medical Support Gas) [NFPA 99:3.3.104 - 3.3.108]

Manifold. A device for connecting the outlets of one or more gas cylinders to the central piping system for that specific gas. [NFPA 99:3.3.108 - 3.3.109]

Medical Gas System. An assembly of equipment and piping for the distribution of nonflammable medical gases such as oxygen, nitrous oxide, compressed air, carbon dioxide, and helium. [NFPA 99:3.3.108 - 3.3.109]

Medical Support Gas. Nitrogen or instrument air used for any medical support purpose (e.g., to remove excess moisture from instruments before further processing, or to operate medical-surgical tools, air-driven booms, pendants, or similar applications) and, if appropriate to the procedures, used in laboratories and are not respired as part of any treatment. Medical support gas falls under the general requirements for medical gases. [NFPA 99:3.3.107 - 3.3.111]

Medical-Surgical Vacuum. A method used to provide a source of drainage, aspiration, and suction in order to remove body fluids from patients. [NFPA 99:3.3.108 - 3.3.112]

Medical-Surgical Vacuum System. An assembly of central vacuum-producing equipment and a network of piping for patient suction in medical, medical-surgical, and waste anesthetic gas disposal (WAGD) applications. [NFPA 99:3.3.109 - 3.3.113]

Mid-Story Guide. A support designed to keep piping in alignment, located mid-way between floors or a floor and ceiling.

Mobile Home Park Sewer. That part of the horizontal piping of a drainage system that begins 2 feet (610 mm) downstream from the last mobile home site and conveys it to a public sewer, private sewer, private sewage disposal system, or other point of disposal.

Mulch. Organic materials, such as wood chips and fines, tree bark chips, and pine needles that are used in a mulch basin to conceal gray water outlets and permit the infiltration of gray water.

Mulch Basin. A subsurface catchment area for gray water that is filled with mulch and of sufficient depth and volume to prevent ponding, surging, or runoff.

216.0 – N –

Nitrogen, NF. Nitrogen complying as a minimum, with nitrogen NF. [NFPA 99:3.3.109 - 3.3.119.1]

Nonwater Urinal with Drain Cleansing Action. A nonwater urinal that conveys waste into the drainage system without the use of water for flushing and automatically performs a drain-cleansing action after a predetermined amount of time.

Nuisance. Includes, but is not limited to:
(1) A public nuisance known at common law or in equity jurisprudence.
(2) Where work regulated by this code is dangerous to human life or is 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.

Oil Interceptor. See Interceptor (Clarifier).

On-Site Treated Nonpotable Water. Nonpotable water, including gray water that has been collected, treated, and intended to be used on-site and is suitable for direct beneficial use.

218.0 – P –

Patient Care Space. Any space of a health care facility wherein patients are intended to be examined or treated. [NFPA 99:3.3.126 - 3.3.140]

Category 1 Space. Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [NFPA 99:3.3.126 - 3.3.140.1]

Category 2 Space. Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [NFPA 99:3.3.126 - 3.3.140.2]

Category 3 Space. Space in which the failure of equipment or a system is not likely to cause injury to patients, staff, or visitors but can cause discomfort. [NFPA 99:3.3.126 - 3.3.140.3]

Category 4 Space. Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [NFPA 99:3.3.126 - 3.3.140.4]

Patient Medical Gas. Piped gases such as oxygen, nitrous oxide, helium, carbon dioxide, and medical air that are used in the application of human respiration and the calibration of medical devices used for human respiration. [NFPA 99:3.3.142 - 3.3.144]

PB. Polybutylene.

PE. Polyethylene.

PE-AL-PE. Polyethylene-aluminum-polyethylene.

PE-RT. Polyethylene of raised temperature.

Penetration Firestop System. A specific assembly of field-assembled materials, or a factory-made device, which has been tested to a standard test method and, where installed properly on penetrating piping materials, is capable of maintaining the fire-resistance rating of assemblies penetrated.

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. The singular includes the plural, male includes female.
PEX. Cross-linked polyethylene.
PEX-AL-PEX. Cross-linked polyethylene–aluminum-cross-linked polyethylene.
Pipe. A cylindrical conduit or conductor is conforming to the dimensions commonly known as “pipe size.”
Plumbing. The business, trade, or work having to do with the installation, removal, alteration, or repair of plumbing systems or parts thereof.

Plumbing Appliance. A special class of device or equipment that is intended to perform a special plumbing function. Its operation, control, or both may be dependent upon one or more energized components, such as motors, controls, heating elements, or pressure- or temperature-sensing elements. Such device or equipment may operate automatically through one or more of the following actions: a time cycle, a temperature range, a pressure range, a measured volume or weight; or the device or equipment may be manually adjusted or controlled by the user or operator.

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

Plumbing Fixture. An approved type installed receptacle, device or appliance that is supplied with water or that receives liquid or liquid-borne wastes and discharges such wastes into the drainage system to which it may be directly or indirectly connected. Industrial or commercial tanks, vats, and similar processing equipment are not plumbing fixtures, but may be connected to or discharged into approved traps or plumbing fixtures where and as otherwise provided for elsewhere in this code.

Plumbing Official. See Authority Having Jurisdiction.
Plumbing System. Includes all potable water, alternate water sources, building supply, and distribution pipes; all plumbing fixtures and traps; all drainage and vent pipes; and all building drains and building sewers, including their respective joints and connections, devices, receptors, and appurtenances within the property lines of the premises and shall include potable water piping, potable water treating or using equipment, medical gas and medical vacuum systems, liquid and fuel gas piping, and water heaters and vents for same.

Plumbing Vent. A pipe provided to ventilate a plumbing system, to prevent trap siphonage and backpressure, or to equalize the air pressure within the drainage system.

Plumbing Vent System. A pipe or pipes installed to provide a flow of air to or from a drainage system or to provide a circulation of air within such system to protect trap seals from siphonage and backpressure.

Point-of-Entry, Water Treatment Unit. A device serving the water distribution system of a building for the purposes of altering, modifying, adding, or removing any minerals, chemicals, contaminants, and suspended solids in the water.

Point-of-Use, Water Treatment Unit. A device serving a single atmospheric outlet such as a faucet for the purposes of altering, modifying, adding, or removing any minerals, chemicals, contaminants, and suspended solids in water.

Pollution. An impairment of the quality of the potable water to the 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.
PP. Polypropylene.
Pre-fabricated Shower Enclosure. A factory-assembled watertight structure with enclosing walls, a drain, and door or open access way.
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 is existing without any flow.

Pressure-Balancing Valve. A mixing valve that senses incoming hot and cold water pressures and compensates for fluctuations in either to stabilize outlet temperature.

Pressure-Lock-Type Connection. A mechanical connection that depends on an internal retention device to prevent pipe or tubing separation. The connection is made by inserting the pipe or tubing into the fitting to a prescribed depth.

Private or Private Use. Applies to plumbing fixtures in residences and apartments, to private bathrooms in hotels, hospitals, and health care facilities, and to restrooms in commercial establishments where the fixtures are intended for the use of a family or an individual.

Private Sewage Disposal System. A septic tank with the effluent discharging into a subsurface disposal field, into one or more seepage pits, or into a combination of subsurface disposal field and seepage pit or of such other facilities as may be permitted under the procedures set forth elsewhere in this code.

Private Sewer. A building sewer that receives the discharge from more than one building drain and conveys it to a public sewer, private sewage disposal system, or another point of disposal.

Proportioning System for Medical Air USP. A central supply that produces medical air (USP) reconstituted from oxygen USP and nitrogen NF by means of a mixer or blender. [NFPA 99-3.3.102.1-3.3.106.1]

Public or Public Use. Applies to plumbing fixtures that are not defined as private or private use.
DEFINITIONS

Public Sewer. A common sewer directly controlled by public authority.

Public Water System. A system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of twenty-five individuals daily for at least 60 days per year.

Push Fit Fitting. A mechanical fitting where the connection is assembled by pushing the tube or pipe into the fitting and is sealed with an o-ring.

PVC. Polyvinyl Chloride.

PVDF. Polyvinylidene Fluoride.

Quick-Disconnect Device. A hand-operated device that provides a means for connecting and disconnecting a hose to a water supply, and that is equipped with a means to shut off the water supply when the device is disconnected.

Quick-Disconnect Device, (Fuel Gas). A hand-operated device that provides a means for connecting and disconnecting an appliance or an appliance connector to a gas supply, and that is equipped with an automatic means to shut off the gas supply when the device is disconnected. [NFPA 54:3.2.28, 3.3.27]

Rainwater. Natural precipitation that has not been contaminated by use.

Rainwater Catchment System. A system that utilizes the principal of collecting, storing, and using rainwater from a rooftop or other manmade, aboveground collection surface. Also, known as a rainwater harvesting system.

Rainwater Storage Tank. The central component of the rainwater catchment system. Also, known as a cistern or rain barrel.

Receptor. An approved plumbing fixture or device of such material, shape, and capacity as to adequately receive the discharge from indirect waste pipes, so constructed and located as to be readily cleaned.

Reclaimed Water. Nonpotable water provided by a water/wastewater utility that, as a result of tertiary treatment of domestic wastewater, meets requirements of the public health Authority Having Jurisdiction for its intended uses.

Registered Design Professional. An individual who is registered or licensed by the laws of the state to perform such design work in the jurisdiction.

Regulating Equipment. Includes valves and controls used in a plumbing system that is required to be accessible or readily accessible.

Relief Vent. A vent, the primary function of which is to provide circulation of air between drainage and vent systems or to act as an auxiliary vent on a specially designed system.

Remote Outlet. Where used for sizing water piping, it is the furthest outlet dimension, measuring from the meter, either the developed length of the cold-water piping or through the water heater to the furthest outlet on the hot-water piping.

Rim. See Flood-Level Rim.

Riser. A water supply pipe that extends vertically one full story or more to convey water to branches or fixtures.

Roof Drain. A drain installed to receive water collecting on the surface of a roof and to discharge it into a leader, downspout, or conductor.

Roof Washer. A device or method for removal of sediment and debris from a collection surface by diverting initial rainfall from entry into the cistern(s). Also, known as a first flush device.

Roughing-In. The installation of all parts of the plumbing system that can be completed prior to the installation of fixtures. This includes drainage, water supply, gas piping, vent piping, and the necessary fixture supports.

Sand Interceptor. See Interceptor (Clarifier).

Scavenging. Evacuation of exhaled mixtures of oxygen and nitrous oxide. [NFPA 99, 3.3.163]

SDR. An abbreviation for “standard dimensional ratio,” which is the specific ratio of the average specified outside diameter to the minimum wall thickness for outside controlled diameter plastic pipe.

Seam, Welded. See Joint, Welded.

Seepage Pit. A lined excavation in the ground which receives the discharge of a septic tank so designed as to permit the effluent from the septic tank to seep through its bottom and sides.

Septic Tank. A watertight receptacle that receives the discharge of a drainage system or part thereof, designed and constructed so as to retain solids, digest organic matter through a period of detention, and allow the liquids to discharge into the soil outside of the tank through a system of open joint piping or a seepage pit meeting the requirements of this code.

Service Piping. The piping and equipment between the street gas main and the gas piping system inlet that is installed by, and is under the control and maintenance of, the serving gas supplier.

Sewage. Liquid waste containing animal or vegetable matter in suspension or solution and that may include liquids containing chemicals in solution.

Sewage Ejector. A device for lifting sewage by entraining it on a high-velocity jet stream, air, or water.

Sewage Pump. A permanently installed mechanical device, other than an ejector, for removing sewage or liquid waste from a sump.

Shall. Indicates a mandatory requirement.

Shielded Coupling. An approved elastomeric sealing gasket with an approved outer shield and a tightening mechanism.

Shock Arrester. See Water Hammer Arrester.
Should. Indicates a recommendation or that which is advised but not required.

Single-Family Dwelling. A building designed to be used as a home by the owner of such building, which shall be the only dwelling located on a parcel of ground with the usual accessory buildings.

Size and Type of Tubing. See Diameter.

Slip Joint. An adjustable tubing connection, consisting of a compression nut, a friction ring, and a compression washer, designed to fit a threaded adapter fitting or a standard taper pipe thread.

Slope. See Grade.

Soil Pipe. A pipe that conveys the discharge of water closets, urinals, clinical sinks, or fixtures having similar functions of collection and removal of domestic sewage, with or without the discharge from other fixtures to the building drain or building sewer.

Special Wastes. Wastes that require some special method of handling, such as the use of indirect waste piping and receptors, corrosion-resistant piping, sand, oil or grease interceptors, condensers, or other pretreatment facilities.

Stack. The vertical main of a system of soil, waste, or vent piping extending through one or more stories.

Stack Vent. The extension of soil or waste stacks above the highest horizontal drain connected to the stack.

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 Cubic Feet per Minute (SCFM). Volumetric flow rate of gas in units of standard cubic feet per minute. [NFPA 99:3.3.168-3.3.172]

Station Inlet. An inlet point in a piped medical/surgical vacuum distribution system at which the user makes connections and disconnections. [NFPA 99:3.3.169-3.3.173]

Station Outlet. An outlet point in a piped medical gas distribution system at which the user makes connections and disconnections. [NFPA 99:3.3.170-3.3.174]

Sterilizer. A piece of equipment that disinfects instruments and equipment by way of heat.

Storm Drain. See Building Drain (Storm).

Storm Sewer. A sewer used for conveying rainwater, surface water, condensate, cooling water, or similar liquid wastes.

Subsoil Drain. A drain that collects subsurface or seepage water and conveys it to a place of disposal.

Subsoil Irrigation Field. Gray water irrigation field installed in a trench within the layer of soil below the topsoil. This system is typically used for irrigation of deep rooted plants.

Subsurface Irrigation Field. Gray water irrigation field installed below finished grade within the topsoil.

Sump. An approved tank or pit that receives sewage or liquid waste and which is located below the normal grade of the gravity system and which must be emptied by mechanical means.

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

Surge Tank. A reservoir to modify the fluctuation in flow rates to allow for uniform distribution of gray water to the points of irrigation.

222.0 – T –

T Rating. The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise of 325°F (181°C) above its initial temperature through the penetration on the nonfire side, where tested in accordance with ASTM E814 or UL 1479.

Tailpiece. The pipe or tubing that connects the outlet of a plumbing fixture to a trap.

Thermostatic (Temperature Control) Valve. A mixing valve that senses outlet temperature and compensates for fluctuations in incoming hot or cold water temperatures.

Toilet Facility. A room or space containing not less than one lavatory and one water closet.

Transition Gas Riser. A listed or approved section or sections of pipe and fittings used to convey fuel gas and installed in a gas piping system to provide a transition from belowground to aboveground.

Trap. A fitting or device so designed and constructed as to provide, where properly vented, a liquid seal that will prevent the back passage of air without materially affecting the flow of sewage or wastewater through it.

Trap Arm. Those portions of a fixture drain between a trap and the vent.

Trap Primer. A device and system of piping that maintains a water seal in a remote trap.

Trap Seal. The vertical distance between the crown weir and the top dip of the trap.

Crown Weir (Trap Weir). The lowest point in the cross-section of the horizontal waterway at the exit of the trap.

Top Dip (of the trap). The highest point in the internal cross-section of the trap at the lowest part of the bend (inverted siphon). By contrast, the bottom dip is the lowest point in the internal cross-section.

223.0 – U –

Unsanitary. See Insanitary.

User Outlet. See Station Outlet.

224.0 – V –

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

**Vacuum Breaker.** See Backflow Preventer.

**Vacuum Relief Valve.** A device that prevents excessive vacuum in a pressure vessel.

**Vacuum System-Level 1.** A system consisting of central vacuum-producing equipment with pressure and operating controls, shutoff valves, alarm warning systems, gauges, and a network of piping extending to and terminating with suitable station inlets at locations where patient suction could be required.

**Valve, Balancing.** A valve that regulates and controls the return of water to the water heater in a recirculating hot water piping system.

**Valve, Isolation.** A valve that isolates one piece of equipment from another.

**Valve, Pressure-Relief.** A pressure-actuated valve held closed by a spring or other means and designed automatically to relieve pressure in excess of its setting.

**Valve, Riser.** A valve at the base of a vertical riser that isolates that riser.

**Valve, Service.** A valve serving horizontal piping extending from a riser to a station outlet or inlet.

**Valve, Source.** A single valve at the source that controls a number of units that makes up the source.

**Valve, Zone.** A valve that controls the gas or vacuum to a particular area.

**Vent.** See Plumbing Vent; Dry Vent; Wet Vent.

**Vent Connector, Gas.** That portion of a gas venting system that connects a listed gas appliance beginning at the draft hood or flue collar to a gas vent and is installed entirely within the space or area in which the appliance is located.

**Vent Offset.** An arrangement of two or more fittings and pipe installed for the purpose of locating a vertical section of vent pipe in a different but parallel plane with respect to an adjacent section of vertical vent pipe. [NFPA 54:3.3.102]

**Vent Pipe.** See Plumbing Vent.

**Vent Stack.** The vertical vent pipe installed primarily for the purpose of providing circulation of air to and from any part of the drainage system.

**Vent System.** See Plumbing Vent System.

**Vented Flow Control Device.** A device installed upstream from the hydromechanical grease interceptor having an orifice that controls the rate of flow through the interceptor, and an air intake (vent) downstream from the orifice, which allows air to be drawn into the flow stream.

**Venting System.** A continuous open passageway from the flue collar or draft hood of an appliance to the outdoors for the purpose of removing flue or vent gases. [NFPA 54:3.3.95.7]

**Vent, Gas.** A listed factory-made vent pipe and vent fittings for conveying flue gases to the outdoors.

**Type B Gas Vent.** A factory-made gas vent listed by a nationally recognized testing agency for venting listed or approved appliances equipped to burn only gas.

**Type BW Gas Vent.** A factory-made gas vent listed by a nationally recognized testing agency for venting listed or approved gas-fired vented wall furnaces.

**Type L Gas Vent.** A venting system consisting of listed vent piping and fittings for use with oil-burning appliances listed for use with Type L or with listed gas appliances.

**Vertical Pipe.** A pipe or fitting that is installed in a vertical position or that makes an angle of not more than 45 degrees (0.79 rad) with the vertical.

**225.0 – W –**

**Wall-Hung Water Closet.** A water closet installed in such a way that no part of the water closet touches the floor.

**Waste.** See Liquid Waste and Industrial Waste.

**Waste Pipe.** A pipe that conveys only liquid waste, free of fecal matter.

**Water-Conditioning or Treating Device.** A device that conditions or treats a water supply to change its chemical content or remove suspended solids by filtration.

**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 Hammer Arrester.** A device designed to provide protection against hydraulic shock in the building water supply system.

**Water Heater, Dual Purpose.** An appliance intended to be a heat source for both space heating and domestic hot water applications.

**Water Heater or Hot Water Heating Boiler.** An appliance designed primarily to supply hot water for domestic or commercial purposes and equipped with automatic controls limiting water temperature to a maximum of 210°F (99°C).

**Water Main (Street Main).** A water supply pipe for public or community use.

**Water Station.** A designated location intended to provide access to drinking water through a device or appliance.

**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.

**Water/Wastewater Utility.** A public or private entity which may treat, deliver or do both functions to reclaimed (recycled) water, potable water, or both to wholesale or retail customers.

**Welder, Pipe.** A person who specializes in the welding of pipes and holds a valid certificate of competency from a recognized testing laboratory, based on the requirements of the ASME Boiler and Pressure Vessels code, Section IX.

**Wet Procedure Locations.** The area in a patient care space where a procedure is performed that is normally subject to wet conditions while patients are present, including standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. [NFPA 99:3.3.183-3.3.187]
**Wet Vent.** A vent that also serves as a drain.

**Whirlpool Bathtub.** A bathtub fixture equipped and fitted with a circulating piping system designed to accept, circulate, and discharge bathtub water upon each use.

226.0  – X –  
No definitions.

227.0  – Y –  
**Yoke Vent.** A pipe connecting upward from soil or waste stack to a vent stack to prevent pressure changes in the stacks.

228.0  – Z –  
No definitions.
CHAPTER 3
GENERAL REGULATIONS

301.0 General.
301.1 Applicability. This chapter shall govern the general requirements, not specific to other chapters, for the installation of plumbing systems.

301.2 Minimum Standards. Pipe, pipe fittings, traps, fixtures, material, and devices used in a plumbing system shall be listed (third-party certified) by a listing agency (accredited conformity assessment body) as complying with the approved applicable recognized standards referenced in this code, and shall be free from defects. Unless otherwise provided for in this code, materials, fixtures, or devices used or entering into the construction of plumbing systems, or parts thereof shall be submitted to the Authority Having Jurisdiction for approval prior to being installed.

301.2.1 Marking. Each length of pipe and each pipe fitting, trap, fixture, material, and device used in a plumbing system shall have cast, stamped, or indelibly marked on it any markings required by the applicable referenced standards and listing agency, and 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 plumbing and drainage 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 acceptable.

Exception: Markings shall not be required on nipples created from cutting and threading of approved pipe.

301.2.2 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 plumbing standards that appear in specific sections of this code is referenced in Table 1701.1. Standards referenced in Table 1701.1 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 1701.2. An IAPMO Installation Standard is referenced in Appendix I for the convenience of the users of this code. It is not considered as a part of this code unless formally adopted as such by the Authority Having Jurisdiction.

301.2.3 Plastic Pipe, Plastic Pipe Fittings, and Components. Plastic pipe, plastic pipe fittings, and components other than those for gas shall comply with NSF/ANSI 14.

301.2.4 Cast-Iron Soil Pipe, Fittings, and Hubless Couplings. Cast-iron soil pipe, fittings, and hubless couplings shall be third party certified in accordance with ASTM C1277 and CISPI 310 for couplings and ASTM A888, ASTM A74, and CISPI 301 for pipes and fittings.

301.2.5 Existing Buildings. In existing buildings or premises in which plumbing 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 plumbing, shall be observed.

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.

301.3 Alternate Materials and Methods of Construction Equivalency. Unless specifically prohibited, 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 prior to installation. The Authority Having Jurisdiction shall have the authority to approve or disapprove the system, method, or device for the intended purpose.

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

301.3.1.1 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.

301.3.1.2 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.

301.4 Flood Hazard Areas. Plumbing systems shall be located above the elevation in accordance with the building...
code for utilities and attendant equipment or the elevation of the lowest floor, whichever is higher.

**Exception:** Plumbing systems shall be permitted to be located below the elevation in accordance with the building code for utilities and attendant equipment or the elevation of the lowest floor, whichever is higher, provided that the systems are designed and installed to prevent water from entering or accumulating within their components, and the systems are constructed to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to such elevation.

**301.4.1 Coastal High Hazard Areas.** Plumbing systems in buildings located in coastal high hazard areas shall be in accordance with the requirements of Section 301.4, and plumbing systems, pipes, and fixtures shall not be mounted on or penetrate through walls that are intended to breakaway under flood loads in accordance with the building code.

**301.5 Alternative Engineered Design.** An alternative engineered design shall comply with the intent of the provisions of this code and shall provide an equivalent level of quality, strength, effectiveness, fire resistance, durability, and safety. Material, equipment, or components shall be designed and installed in accordance with the manufacturer’s installation instructions.

**301.5.1 Permit Application.** The registered design professional shall indicate on the design documents that the plumbing system, or parts thereof, is an alternative engineered design so that it is noted on the construction permit application. The permit and permanent permit records shall indicate that an alternative engineered design was part of the approved installation.

**301.5.2 Technical Data.** The registered design professional shall submit sufficient technical data to substantiate the proposed alternative engineered design and to prove that the performance meets the intent of this code.

**301.5.3 Design Documents.** The registered design professional shall provide two complete sets of signed and sealed design documents for the alternative engineered design for submittal to the Authority Having Jurisdiction. The design documents shall include floor plans and a riser diagram of the work. Where appropriate, the design documents shall indicate the direction of flow, pipe sizes, grade of horizontal piping, loading, and location of fixtures and appliances.

**301.5.4 Design Approval.** An approval of an alternative engineered design shall be at the discretion of the Authority Having Jurisdiction. 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 alternative engineered design 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.

**301.5.5 Design Review.** The Authority Having Jurisdiction shall have the authority to require testing of the alternative engineered design in accordance with Section 301.3.1, including the authority to require an independent review of the design documents by a registered design professional selected by the Authority Having Jurisdiction and at the expense of the applicant.

**301.5.6 Inspection and Testing.** The alternative engineered design shall be tested and inspected in accordance with the submitted testing and inspection plan and the requirements of this code.

**301.6 Tall Wood (Mass Timber) Buildings.** Plumbing systems installed in tall wood (mass timber) buildings, shall comply with the following:

1. Be designed by a licensed plumbing contractor or a registered design professional in accordance with this code and the building code.
2. Have a flame-spread index of not more than 25 and a smoke developed index of not more than 50, where tested in accordance with ASTM E84 or UL 723.
3. Be designed to accommodate expansion, contraction, and differential movement between parts of a mass timber building.

**302.0 Iron Pipe Size (IPS) Pipe.**

**302.1 General.** Iron, steel, copper, and copper alloy pipe shall be standard-weight iron pipe size (IPS) pipe.

**303.0 Disposal of Liquid Waste.**

**303.1 General.** It shall be unlawful for a person to cause, suffer, or permit the disposal of sewage, human excrement, or other liquid wastes, 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.

**304.0 Connections to Plumbing System Required.**

**304.1 General.** Plumbing fixtures, drains, appurtenances, and appliances, used to receive or discharge liquid wastes or sewage, shall be connected properly to the drainage system of the building or premises, in accordance with the requirements of this code.

**305.0 Damage to Drainage System or Public Sewer.**

**305.1 Unlawful Practices.** It shall be unlawful for a person to deposit, by any means whatsoever, into a plumbing fixture, floor drain, interceptor, sump, receptor, or device, which is connected to a drainage system, public sewer, private sewer, septic tank, or cesspool, any ashes; cinders; solids; rags; inflammable, poisonous, or explosive liquids or gases; oils; grease; or any other thing whatsoever that is capable of causing damage to the drainage system or public sewer.

**306.0 Industrial Wastes.**

**306.1 Detrimental Wastes.** Wastes detrimental to the public sewer system or detrimental to the functioning of the sewage treatment plant shall be treated and disposed of as found necessary and directed by the Authority Having Jurisdiction.
306.2 Safe Discharge. Sewage or other waste from a plumbing system that is capable of being deleterious to surface or subsurface waters shall not be discharged into the ground or a waterway unless it has first been rendered safe by some acceptable form of treatment in accordance with the Authority Having Jurisdiction.

307.0 Location.
307.1 System. Except as otherwise provided in this code, no plumbing system, drainage system, building sewer, private sewage disposal 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.
307.2 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.

308.0 Improper-Prohibited Locations.
308.1 General. Piping, fixtures, appliances, or equipment shall not be so located as to interfere with the normal use thereof or with the normal operation and use of windows, doors, or other required facilities.

309.0 Workmanship.
309.1 Engineering Practices. Design, construction, and workmanship shall be in accordance with accepted engineering practices and shall be of such character as to secure the results sought to be obtained by this code.
309.2 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 paint, wax, tar, solvent cement, or other leak-sealing or repair agent.
309.3 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.
309.4 Installation Practices. Plumbing systems shall be installed in a workmanlike manner which is in accordance with this code, applicable standards, and the manufacturer’s installation instructions. All materials shall be installed so as not to adversely affect the systems and equipment or the structure of the building, and in compliance with all laws and other provisions of this code. All plumbing systems shall be in accordance with construction documents approved by the Authority Having Jurisdiction.
309.5 Sound Transmission. Plumbing piping systems shall be designed and installed in conformance with sound limitations as required in the building code.
309.6 Dead Legs. Dead legs shall have a method of flushing.

310.0 Prohibited Fittings and Practices.
310.1 Fittings. No double hub fitting, single or double tee branch, single or double tapped tee branch, side inlet quarter bend, running thread, band, or saddle shall be used as a drainage fitting, except that a double hub sanitary tapped tee shall be permitted to be used on a vertical line as a fixture connection.
310.2 Drainage and Vent Piping. No drainage or vent piping shall be drilled and tapped for the purpose of making connections thereto, and no cast-iron soil pipe shall be threaded.
310.3 Waste Connection. No waste connection shall be made to a closet bend or stub of a water closet or similar fixture.
310.4 Use of Vent and Waste Pipes. Except as hereinafter provided in Section 908.0 through Section 911.0, no vent pipe shall be used as a soil or waste pipe, nor shall a soil or waste pipe be used as a vent. Also, single-stack drainage and venting systems with unvented branch lines are prohibited.
310.5 Obstruction of Flow. No fitting, fixture and piping connection, appliance, device, or method of installation that obstructs or retards the flow of water, wastes, sewage, or air in the drainage or venting systems, in an amount exceeding the normal frictional resistance to flow, shall be used unless it is indicated as acceptable in this code or is approved in accordance with Section 301.2 of this code. The enlargement of a 3 inch (80 mm) closet bend or stub to 4 inches (100 mm) shall not be considered an obstruction.
310.6 Dissimilar Metals. Except for necessary valves, where intermembering or mixing of dissimilar metals occurs, the point of connection shall be confined to exposed or accessible locations.
310.7 Direction of Flow. Valves, pipes, and fittings shall be installed in correct relationship to the direction of flow.
310.8 Screwed Fittings. Screwed fittings shall be ABS, cast-iron, copper, copper alloy, malleable iron, PVC, steel, or other approved materials. Threads shall be tapped out of solid metal or molded in solid ABS or PVC.
310.9 Female Plastic Connections. Female plastic threaded connections shall not be allowed to be used when threaded onto a male metallic connection.
310.10 ABS and PVC Transition Joints. Except as provided in Section 705.9.4, PVC and ABS pipe and fittings shall not be solvent welded to any other unlike material.

311.0 Independent Systems.
311.1 General. The drainage system of each new building and new work installed in an existing building shall be separate and independent from that of any other building, and, where available, every building shall have an independent connection with a public or private sewer.
Exception: Where one building stands in the rear of another building on an interior lot, and no public or private sewer is available or can be constructed to the rear building through an adjoining court, yard, or driveway, the building drain from the front building shall be permitted to be extended to the rear building.
312.0 Protection of Piping, Tubing, Materials, and Structures.

312.1 General. Piping passing under or through walls shall be protected from breakage. Piping passing through or under cinders or other corrosive materials shall be protected from external corrosion in an approved manner. Approved provisions shall be made for expansion of hot water piping. Voids around piping passing through concrete floors on the ground shall be sealed.

312.2 Installation. Piping in connection with a plumbing system shall be so installed that piping or connections will not be subject to undue strains or stresses, and provisions shall be made for expansion, contraction, and structural settlement. No plumbing piping shall be directly embedded in concrete or masonry. No structural member shall be seriously weakened or impaired by cutting, notching, or otherwise, as defined in the building code.

312.3 Building Sewer and Drainage Piping. No building sewer or other drainage piping or part thereof, constructed of materials other than those approved for use under or within a building, shall be installed under or within 2 feet (610 mm) of a building or structure, or less than 1 foot (305 mm) below the surface of the ground.

312.4 Corrosion, Erosion, and Mechanical Damage. Piping subject to corrosion, erosion, or mechanical damage shall be protected in an approved manner.

312.5 Protectively Coated Pipe. Protectively coated pipe or tubing shall be inspected and tested, and a visible void, damage, or imperfection to the pipe coating shall be repaired in an approved manner.

312.6 Freezing Protection. No water, soil, or waste pipe shall be installed or permitted outside of a building, in attics or crawl spaces, or in an exterior wall unless, where necessary, adequate provision is made to protect such pipe from freezing.

312.7 Fire-Resistant Construction. Piping penetrations of fire-resistance-rated walls, partitions, floors, floor/ceiling assemblies, roof/ceiling assemblies, or shaft enclosures shall be protected in accordance with the requirements of the building code and Chapter 14, “Firestop Protection.”

312.8 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. Counterflashings shall not restrict the required internal cross-sectional area of the vent.

312.9 Steel Nail Plates. Plastic piping or tubing, and copper or copper alloy piping or tubing penetrating framing members to within 1 inch (25.4 mm) of the exposed framing shall be protected by steel nail plates not less than No. 18 gauge (0.0478 inches) (1.2 mm) in thickness. The steel nail plate shall extend along the framing member not less than 1½ inches (38 mm) beyond the outside diameter of the pipe or tubing. Exception: See Fuel gas piping shall be protected in accordance with Section 1210.4.3.

312.10 Sleeves. Sleeves shall be provided to protect piping through concrete and masonry walls, and concrete floors. Exception: Sleeves shall not be required where openings are drilled or bored.

312.10.1 Building Loads. Piping through concrete or masonry walls shall not be subject to a load from building construction.

312.10.2 Exterior Walls. In exterior walls, annular space between sleeves and pipes shall be sealed and made watertight, as approved by the Authority Having Jurisdiction. A penetration through fire-resistive construction shall be in accordance with Section 312.7.

312.10.3 Firewalls. A pipe sleeve through a firewall shall have space around the pipe completely sealed with an approved fire-resistive material in accordance with other codes.

312.11 Structural Members. 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.

312.12 Rodentproofing. Strainer plates on drain inlets shall be designed and installed so that no opening exceeds ½ inch (12.7 mm) in the least dimension.

312.12.1 Meter Boxes. Meter boxes shall be constructed in such a manner as to restrict rodents or vermin from entering a building by following the service pipes from the box into the building.

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

312.12.3 Tub Waste Openings. Tub waste openings in framed construction to crawl spaces at or below the first floor shall be protected by the installation of approved metal collars or metal screen securely fastened to the adjoining structure with no opening exceeding ½ inch (12.7 mm) in the least dimension.

313.0 Hangers, and Supports, and Anchors.

313.1 General. Piping, tubing, fixtures, appliances, and appurtenances shall be supported in accordance with this code, the manufacturer’s installation instructions, and in accordance with the Authority Having Jurisdiction. Seismic restraints shall be in accordance with the building code.

313.2 Material. Hangers, supports, and anchors shall be of sufficient strength to support the weight of the pipe or tubing and its contents. Piping or tubing shall be isolated from incompatible materials.

313.3 Suspended Piping. Suspended piping shall be supported at intervals not to exceed those shown in Table 313.3.

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

313.5 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 301.2.

313.6 Hanger Rod Sizes. Hanger rod sizes shall be not smaller than those shown in Table 313.6.
314.0 Trenching, Excavation, and Backfill.

314.1 Trenches. Trenches deeper than the footing of a building or structure, and paralleling the same, shall be located not less than 45 degrees (0.79 rad) from the bottom exterior edge of the footing, or as approved in accordance with Section 301.0.

314.2 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.

314.3 Open Trenches. Excavations required to be made for the installation of a building drainage system or 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.

314.4 Excavations. Excavations shall be completely backfilled 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, cinder fill, 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 be then 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.

Underground thermoplastic pipe and fittings for sewers and other gravity flow applications shall be installed in accordance with this code and Section 314.4.1.

314.4.1 Installation of Thermoplastic Pipe and Fittings. Trench width for thermoplastic sewer pipe shall be not less than 1.25 times the outside diameter of the piping plus 12 inches (305 mm) or the outside diameter of the piping plus not less than 16 inches (406 mm). Thermoplastic piping shall be bedded in not less than 4 inches (102 mm) of granular fill supporting the piping. The backfill for thermoplastic piping shall be compacted along the sides of the piping in 6 inch (152 mm) layers and continue to not less than 12 inches (305 mm) above the piping. Compaction shall be not less than an 85 percent standard proctor density.

317.0 Food-Handling Establishments.

317.1 General. Food or drink shall not be stored, prepared, or displayed beneath soil or drainpipes unless those areas are protected against leakage or condensation from such pipes reaching the food or drink as described below. Where building design requires that soil or drainpipes be located over such areas, the installation shall be made with the least possible number of joints and shall be installed to connect to the nearest adequately sized vertical stack with the provisions as follows:

1. Openings through floors over such areas shall be sealed watertight to the floor construction.
2. Floor and shower drains installed above such areas shall be equipped with integral seepage pans.
3. Soil or drainpipes shall be of an approved material as listed in Chapter 17 and Section 701.2. Materials shall comply with established standards. Cleanouts shall be extended through the floor construction above.
4. Piping subject to operation at temperatures that will form condensation on the exterior of the pipe shall be thermally insulated.
5. Where pipes are installed in ceilings above such areas, the ceiling shall be of the removable type or shall be provided with access panels to form a ready access for inspection of piping.
318.0 Test Gauges.

318.1 General. Tests in accordance with this code, which are performed utilizing dial gauges, shall be limited to gauges having the following pressure graduations or incrementations.

318.2 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.

318.3 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.

318.4 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.

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

319.0 Medical Gas and Vacuum Systems.

319.1 General. Such piping shall be in accordance with the requirements of Chapter 13. The Authority Having Jurisdiction shall require evidence of the competency of the installers and verifiers.

320.0 Rehabilitation of Piping Systems.

320.1 General. Where pressure piping systems are rehabilitated using an epoxy lining system, it shall be in accordance with ASTM F2831.
### TABLE 313.3

**HANGERS AND SUPPORTS**

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>TYPES OF JOINTS</th>
<th>HORIZONTAL</th>
<th>VERTICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast</td>
<td>Lead and Oakum</td>
<td>5 feet, except 10 feet where 10 foot lengths are installed&lt;sup&gt;1, 2, 3&lt;/sup&gt;</td>
<td>Base and each floor, not to exceed 15 feet</td>
</tr>
<tr>
<td></td>
<td>Compression Gasket</td>
<td>Every other joint, unless over 4 feet then support each joint&lt;sup&gt;1, 2, 3&lt;/sup&gt;</td>
<td>Base and each floor, not to exceed 15 feet</td>
</tr>
<tr>
<td>Cast-Iron Hubless</td>
<td>Shielded Coupling</td>
<td>Every other joint, unless over 4 feet then support each joint&lt;sup&gt;1, 2, 3, 4&lt;/sup&gt;</td>
<td>Base and each floor, not to exceed 15 feet</td>
</tr>
<tr>
<td>Copper &amp; Copper Alloys</td>
<td>Soldered, Brazed, Threaded, or Mechanical</td>
<td>1½ inches and smaller, 6 feet; 2 inches and larger, 10 feet</td>
<td>Each floor, not to exceed 10 feet&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Steel Pipe for Water or DWV</td>
<td>Threaded or Welded</td>
<td>½ inch and smaller, 10 feet; 1 inch and larger, 12 feet</td>
<td>Every other floor, not to exceed 25 feet&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Steel Pipe for Gas</td>
<td>Threaded or Welded</td>
<td>½ inch, 6 feet; ¾ inch and 1 inch, 8 feet; 1½ inches and larger, 10 feet</td>
<td>½ inch, 6 feet; ¼ inch and 1 inch, 8 feet; ¼ inches every floor level</td>
</tr>
<tr>
<td>Schedule 40 PVC and ABS DWV</td>
<td>Solvent Cemented</td>
<td>All sizes, 4 feet; allow for expansion every 30 feet&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Base and each floor; provide mid-story guides; provide for expansion every 30 feet</td>
</tr>
<tr>
<td>CPVC</td>
<td>Solvent Cemented</td>
<td>1 inch and smaller, 3 feet; 1½ inches and larger, 4 feet</td>
<td>Base and each floor; provide mid-story guides</td>
</tr>
<tr>
<td>CPVC-AL-CPVC</td>
<td>Solvent Cemented</td>
<td>½ inch, 5 feet; ¾ inch, 6 inches; 1 inch, 6 feet</td>
<td>Base and each floor; provide mid-story guides</td>
</tr>
<tr>
<td>Lead</td>
<td>Wiped or Burned</td>
<td>Continuous Support</td>
<td>Not to exceed 4 feet</td>
</tr>
<tr>
<td>Steel</td>
<td>Mechanical</td>
<td>In accordance with standards acceptable to the Authority Having Jurisdiction</td>
<td></td>
</tr>
<tr>
<td>PEX</td>
<td>Cold Expansion, Insert and Compression</td>
<td>1 inch and smaller, 32 inches; 1½ inches and larger, 4 feet</td>
<td>Base and each floor; provide mid-story guides</td>
</tr>
<tr>
<td>PEX-AL-PE</td>
<td>Metal Insert and Metal Compression</td>
<td>½ inch, 3/4 inch, 1 inch</td>
<td>All sizes 98 inches</td>
</tr>
<tr>
<td>PE-AL-PE</td>
<td>Metal Insert and Metal Compression</td>
<td>½ inch, 3/4 inch, 1 inch</td>
<td>All sizes 98 inches</td>
</tr>
<tr>
<td>PE-RT</td>
<td>Insert and Compression</td>
<td>1 inch and smaller, 32 inches; 1½ inches and larger, 4 feet</td>
<td>Base and each floor; provide mid-story guides</td>
</tr>
<tr>
<td>Polypropylene (PP)</td>
<td>Fusion weld (socket, butt, saddle, electrofusion), threaded (metal threads only), or mechanical</td>
<td>1 inch and smaller, 32 inches; 1½ inches and larger, 4 feet</td>
<td>Base and each floor; provide mid-story guides</td>
</tr>
</tbody>
</table>

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.
CHAPTER 4
PLUMBING FIXTURES AND FIXTURE FITTINGS

401.0 General.
401.1 Applicability. This chapter shall govern the materials and installation of plumbing fixtures, including faucets and fixture fittings, and the minimum number of plumbing fixtures required based on occupancy.

401.2 Quality of Fixtures. Plumbing fixtures shall be constructed of dense, durable, non-absorbent materials and shall have smooth, impervious surfaces, free from unnecessary concealed fouling surfaces.

402.0 Installation.
402.1 Cleaning. Plumbing fixtures shall be installed in a manner to afford easy access for repairs and cleaning. Pipes from fixtures shall be run to the nearest wall.

402.2 Joints. Where a fixture comes in contact with the wall or floor, the joint between the fixture and the wall or floor shall be made watertight.

402.3 Securing Fixtures. Floor-outlet or floor-mounted fixtures shall be rigidly secured to the drainage connection and to the floor, where so designed, by screws or bolts of copper, copper alloy, or other equally corrosion-resistant material.

402.4 Wall-Hung Fixtures. Wall-hung fixtures shall be rigidly supported by metal supporting members so that no strain is transmitted to the connections. Floor-affixed supports for off-the-floor plumbing fixtures for public use shall comply with ASME A112.6.1M. Framing-affixed supports for off-the-floor water closets with concealed tanks shall comply with ASME A112.6.2. Flush tanks and similar appurtenances shall be secured by approved non-corrosive screws or bolts.

402.5 Setting. Fixtures shall be set level and in proper alignment with reference to adjacent walls. No water closet or bidet shall be set closer than 15 inches (381 mm) from its center to a side wall or obstruction or closer than 30 inches (762 mm) center to center to a similar fixture. The clear space in front of a water closet, lavatory, or bidet shall be not less than 24 inches (610 mm). No urinal shall be set closer than 12 inches (305 mm) from its center to a side wall or partition or closer than 24 inches (610 mm) center to center.

Exception: The installation of paper dispensers or accessibility grab bars shall not be considered obstructions.

402.6 Flanged Fixture Connections. Fixture connections between drainage pipes and water closets, floor outlet service sinks and urinals shall be made using an approved copper alloy, hard lead, ABS, PVC, or iron flanges caulked, soldered, solvent cemented; rubber compression gaskets; or screwed to the drainage pipe. The connection shall be bolted with an approved gasket, washer, or setting compound between the fixture and the connection. The bottom of the flange shall be set on an approved firm base-the top of the finished floor.

Wall-mounted water closet fixtures shall be securely bolted to an approved carrier fitting. The approved carrier fitting shall be securely attached to the structure. The connecting pipe between the carrier fitting and the fixture shall be an approved material and designed to accommodate an adequately sized gasket. Gasket material shall be neoprene, felt, or similar approved types.

402.6.1 Closet Rings (Closet Flanges). Closet rings (closet flanges) for water closets or similar fixtures shall be of an approved type and shall be copper alloy, copper, hard lead, cast-iron, galvanized malleable iron, ABS, PVC, or other approved materials. Each such closet ring (closet flange) shall be approximately 7 inches (178 mm) in diameter and, where installed, shall, together with the soil pipe, present a 1 1/2 inch (38 mm) wide flange or face to receive the fixture gasket or closet seal.

Caulked-on closet rings (closet flanges) shall be not less than 3/4 of an inch (6.4 mm) thick and not less than 2 inches (51 mm) in overall depth.

Closet rings (closet flanges) shall be burned or soldered to lead bends or stubs, shall be caulked to cast-iron soil pipe, shall be solvent cemented to ABS and PVC, and shall be screwed or fastened in an approved manner to other materials.

Closet bends or stubs shall be cut-off to present a smooth surface even with the top of the closet ring before the rough inspection is called.

Closet rings (closet flanges) shall be adequately designed and secured to support fixtures connected thereto.

402.6.2 Securing Closet Flanges. Closet screws, bolts, washers, and similar fasteners shall be of copper alloy, copper, or other listed equally corrosion-resistant materials. Screws and bolts shall be of a size and number to properly support the fixture installed.

402.6.3 Securing Floor-Mounted, Back-Outlet Water Closet Bowls. Floor-mounted, back-outlet water closet bowls shall be set level with an angle of 90 degrees (1.57 rad) between the floor and wall at the centerline of the fixture outlet. The floor and wall shall have a flat mounting surface not less than 5 inches (127 mm) to the right and left of the fixture outlet centerline. The fixture shall be secured to the wall outlet flange or drainage connection and the floor by corrosion-resistant screws or bolts. The closet flange shall be secured to a firm base. Offset, eccentric, or reducing closet flanges shall not be permitted with these fixtures.

Where floor mounted, back-outlet water closets are used, the soil pipe shall be not less than 3 inches (80 mm) in diameter. Offset, eccentric, or reducing closet flanges shall not be used.

402.7 Supply Fittings. The supply lines and fittings for every plumbing fixture shall be so installed as to prevent backflow in accordance with Chapter 6.
402.8 Installation. Fixtures shall be installed in accordance with the manufacturer’s installation instructions.

402.9 Design and Installation of Plumbing Fixtures. Plumbing fixtures shall be installed in accordance with the manufacturer’s installation instructions. The means of backflow prevention shall not be compromised by the designated fixture mounting surface.

402.10 Slip Joint Connections. Fixtures having concealed slip joint connections shall be provided with an access panel or utility space not less than 12 inches (305 mm) in its least dimension and so arranged without obstructions as to make such connections accessible for inspection and repair.

402.11 Future Fixtures. Where provisions are made for the future installation of fixtures, those provided for shall be considered in determining the required sizes of the drain and water supply piping. Construction for future installations shall be terminated with a plugged fitting or fittings. Where the plugged fitting is at the point where the trap of a fixture is installed, the plumbing system for such fixture shall be complete and be in accordance with the plumbing requirements of this code.

403.0 Accessible Plumbing Facilities.

403.1 General. Where accessible facilities are required in applicable building regulations, the facilities shall be installed in accordance with those regulations.

403.2 Fixtures and Fixture Fittings for Persons with Disabilities. Plumbing fixtures and fixture fittings for persons with disabilities shall be in accordance with ICC A117.1 and the applicable standards referenced in Chapter 4.

403.3 Exposed Pipes and Surfaces. Water supply and drainpipes under accessible lavatories and sinks shall be insulated or otherwise be configured to protect against contact. Protectors, insulators, or both shall comply with ASME A112.18.9 or ASTM C1822.

404.0 Waste Fittings and Overflows.

404.1 Waste Fittings. Waste fittings shall comply with ASME A112.18.2/CSA B125.2, ASTM F409 or Table 701.2 for aboveground drainage piping and fittings.

404.2 Overflows. Where a fixture is provided with an overflow, the overflow shall comply with Section 404.2.1 and Section 404.2.2.

404.2.1 Sinks, Lavatories, and Bathtubs. The waste shall be so arranged that the standing water in the fixture shall not rise in the overflow where the stopper is closed or remain in the overflow where the fixture is empty. The overflow pipe from a fixture shall be connected to the house or inlet side of the fixture trap, except that overflow on flush tanks shall be permitted to discharge into the water closets or urinals served by them, but it shall be unlawful to connect such overflows with any other part of the drainage system.

404.2.2 Water Closets and Urinals. Overflows on flush tanks shall be permitted to discharge into the water closets or urinals served by them.

405.0 Prohibited Fixtures.

405.1 Prohibited Water Closets. Water closets having an invisible seal or an unventilated space or having walls which are not thoroughly washed at each discharge shall be prohibited. A water closet that might permit siphonage of the contents of the bowl back into the tank shall be prohibited.

405.2 Prohibited Urinals. Trough urinals and urinals with an invisible seal shall be prohibited.

405.3 Miscellaneous Fixtures. Fixed wooden, or tile wash trays or sinks for domestic use shall not be installed in a building designed or used for human habitation. No sheet metal-lined wooden bathtub shall be installed or reconnected. No dry or chemical closet (toilet) shall be installed in a building used for human habitation unless first approved by the Health Officer.

406.0 Special Fixtures and Specialties.

406.1 Water and Waste Connections. Baptisteries, ornamental and lily ponds, aquaria, ornamental fountain basins, and similar fixtures and specialties requiring water, waste connections, or both shall be submitted for approval to the Authority Having Jurisdiction prior to installation.

406.2 Special Use Sinks. Restaurant kitchen and other special use sinks shall be permitted to be made of approved-type bonderized and galvanized sheet steel of not less than No. 16 U.S. gauge (0.0635 inches) (1.6 mm). Sheet-metal plumbing fixtures shall be adequately designed, constructed, and braced in an approved manner to accomplish their intended purpose.

406.3 Special Use Fixtures. Special use fixtures shall be made of one of the following:

1. Soapstone
2. Chemical stoneware
3. Copper-based alloy
4. Nickel-based alloy
5. Corrosion-resistant steel
6. Other materials suited for the intended use of the fixture

406.4 Zinc Alloy Components. Zinc alloy components shall comply with applicable nationally recognized standards and shall be used in accordance with their listing.

407.0 Lavatories.

407.1 Application. Lavatories shall comply with ASME A112.19.1/CSA B45.2, ASME A112.19.2/CSA B45.1, ASME A112.19.3/CSA B45.4, ASME A112.19.12, CSA B45.5/IAPMO Z124, CSA B45.8/IAPMO Z403, CSA B45.11/IAPMO Z401 or CSA B45.12/IAPMO Z402. Group wash fixtures shall comply with the requirements of Section 401.2. Every 20 inches (508 mm) of rim space of a group wash fixture shall be considered as one lavatory for determining the number of lavatories required in accordance with Table 422.1. Lavatory assemblies with automatic soap dispensers, faucets, or hand dryers shall comply with IAPMO IGC 127.
A temperature actuated flow reduction device con-
forming to ASSE 1084.

407.2.1 Maximum Flow Rate. The maximum flow rate for public lavatory faucets shall not exceed 0.5 gpm
at 60 psi (1.9 L/m at 414 kPa) and 2.2 gpm at 60 psi (8.3
L/m at 414 kPa) for private lavatory faucets.

407.2.2 Metering Faucets. Metered faucets shall
deliver a maximum of 0.25 gallons (0.95 L) per metering
cycle.

407.3 Limitation of Hot Water Temperature for Public
Lavatories. Hot water delivered from public-use lavatories
shall be limited to a maximum temperature of 120°F (49°C).
The maximum temperature shall be regulated by one of the
following means:

(1) A limiting device conforming to either ASSE
1070/ASME A112.1070/CSA B125.70, or

(2) A water heater conforming to ASSE 1084.

407.4 Transient Public Lavatories. Self-closing or meter-
ing faucets shall be installed on lavatories intended to serve
the transient public, such as those in, but not limited to service sta-
tions, train stations, airports, restaurants, and convention halls.

407.5 Waste Outlet. Lavatories shall have a waste outlet
and fixture tailpiece not less than 1 1/4 inches (32 mm) in diam-
er. Continuous wastes and fixture tailpieces shall be con-
structed from the materials specified in Section 701.4. Waste
outlets shall be provided with an approved stopper or strainer.

407.6 Overflow. Where overflows are provided, they shall
be installed in accordance with Section 404.2.

408.0 Showers.

408.1 Application. Manufactured shower receptors and
shower bases shall comply with ASME A112.19.1/CSA B45.2,
ASME A112.19.2/CSA B45.1, ASME A112.19.3/CSA B45.4,
CSA B45.12/IAPMO Z402, or CSA B45.5/IAPMO Z124. Prefab-
fabricated shower enclosures shall comply with IAPMO IGC
154.

408.2 Tileable Shower Receptors. Tileable shower recep-
tors and shower kits shall comply with IAPMO PS 106.

408.2.408.3 Water Consumption. Showerheads shall
have a maximum flow rate of not more than 2.5 gpm at 80
psi (9.5 L/m at 552 kPa). Body sprays shall have a flow rate
of not more than 2.5 gpm at 80 psi (9.5 L/m at 552 kPa).

408.3.408.4 Individual Shower and Tub-Shower Com-
bination Control Valves. Showers and tub-shower combi-
nations shall be provided with individual control valves of
the pressure balance, thermostatic, or combination pressure bal-
ance/thermostatic mixing valve type that provide scald and
thermal shock protection for the rated flow rate of the installed
showerhead. These valves shall be installed at the point of use
and comply with ASSE 1016/ASME A112.1016/CSA
B125.16 or ASME A112.18.1/CSA B125.1.

408.3.408.4.1 Gang Showers. Where gang show-
ers are supplied with a single temperature-controlled
water supply pipe, it shall be controlled by a mixing
valve that complies with ASSE 1069.

408.3.2 408.4.2 Temperature Limiting. The maxi-
imum water temperature discharging from an individual
showerhead shall be limited to 120°F (49°C) by one of
the following methods:

(1) A shower or tub/shower combination valve con-
forming to ASSE 1016/ASME A112.1016/CSA
B125.16 where either:

(a) The valve is field-adjusted to the required max-
imum temperature, or

(b) The handle position, stop, or temperature limit-
ing control is set in accordance with the manu-
ufacturer’s instructions to the required maximum

(2) For gang showers supplied by a single water supply
pipe, a mixing valve that conforms to ASSE 1069
that is field-adjusted to the required maximum

(3) A limiting device conforming to either ASSE
1070/ASME A112.1070/CSA B125.70 or CSA
B125.3.

(4) A water heater conforming to ASSE 1084.

(5) A temperature actuated flow reduction device con-
forming to ASSE 1062.

408.4.3 Temperature-Actuated, Flow-Reduction
Devices for Individual Fixture Fittings. Tempera-
ture-actuated, flow-reduction devices, where installed for
individual fixture fittings, shall comply with ASSE 1062.
Such devices shall not be used alone as a substitute for the
balanced pressure, thermostatic or combination
shower valves requirements or as a substitute for bathtub
or whirlpool tub water temperature-limiting valves
requirements.

408.4.408.5 Waste Outlet. Showers shall have a waste out-
let and fixture tailpiece not less than 2 inches (50 mm) in diam-
er. Fixture tailpieces shall be constructed from the materials specified in Section 701.4. Waste
outlets shall be provided with an approved stopper or strainer.

408.5.408.6 Finished Curb or Threshold. Where a
shower receptor has a finished dam, curb, or threshold, it shall
be not less than 1 inch (25.4 mm) lower than the sides and
back of such receptor. In no case, shall a dam or threshold be
less than 2 inches (51 mm) or exceeding 9 inches (229 mm)
in depth where measured from the top of the dam or thresh-
old to the top of the drain. Each such receptor shall be pro-
vided with an integral nailing flange to be located where the
receiver meets the vertical surface of the finished interior of
the shower compartment—either integral or field installed in
accordance with the manufacturer’s installation instructions.
The flange shall be watertight and extend vertically not less
than 1 inch (25.4 mm) above the top of the sides of the recep-
tor. The finished floor of the receptor shall slope uniformly from the sides towards the drain not less than 1/8 inch per foot
(10.4 mm/m), nor more than 1/2 inch per foot (41.6 mm/m).

Thresholds shall be of sufficient width to accommodate
a minimum 22 inch (559 mm) door. Shower doors shall open
so as to maintain not less than a 22 inch (559 mm) unob-
structured opening for egress. Where there is a shower without a threshold, the floor space within the same room shall be considered a wet location and shall comply with the requirements of the building, residential, and electrical codes.

Exceptions:
(1) Showers in accordance with Section 403.2.
(2) A cast-iron shower receptor flange shall be not less than 0.3 of an inch (7.62 mm) in height.
(3) For flanges not used as a means of securing, the sealing flange shall be not less than 0.3 of an inch (7.62 mm) in height.

408.7 Shower Compartments. Shower compartments, regardless of shape, shall have a minimum finished interior of in accordance with the following:
(1) Not less than 1024 square inches (0.6606 m²), and shall also be capable of encompassing
(2) Be capable of encompassing a 30 inch (762 mm) circle.

The minimum required area and dimensions shall be measured at a height equal to the top of the threshold and a point tangent to its centerline. The area and dimensions shall be maintained to a point of not less than 70 inches (1778 mm) above the shower drain outlet with no protrusions other than the fixture valve or valves, showerheads, soap dishes, shelves, and safety grab bars, or rails. Fold-down seats in accessible shower stalls shall be permitted to protrude into the 30 inch (762 mm) circle.

Exceptions:
(1) Showers that are designed to be in accordance with ICC A117.1.
(2) The minimum required area and dimension shall not apply for a shower receptor having overall dimensions of not less than 30 inches (762 mm) in width and 60 inches (1524 mm) in length.

408.7–408.8 Lining for Showers and Receptors. Shower receptors built on-site shall be watertight and shall be constructed from approved-type dense, nonabsorbent, and noncorrosive materials. Each such receptor shall be adequately reinforced, shall be provided with an approved flanged floor drain designed to make a watertight joint on the floor, and shall have smooth, impervious, and durable surfaces.

Shower receptors shall have the subfloor and rough side of walls to a height of not less than 3 inches (76 mm) above the top of the finished dam or threshold shall be first lined with sheet plastic, lead, or copper, or shall be lined with other durable and watertight materials. Showers that are provided with a built in place, permanent seat or seating area that is located within the shower enclosure, shall be first lined with sheet plastic, lead, copper, or shall be lined with other durable and watertight materials that extend not less than 3 inches (76 mm) above horizontal surfaces of the seat or the seating area.

Lining materials shall be pitched ¼ inch per foot (20.8 mm/m) to weep holes in the subdrain of a smooth and solidly formed subbase. Such lining materials shall extend upward on the rough jambs of the shower opening to a point not less than 3 inches (76 mm) above the horizontal surfaces of the seat or the seating area, the top of the finished dam or threshold and shall extend outward over the top of the permanent seat, permanent seating area, or rough threshold and be turned over and fastened on the outside face of both the permanent seat, permanent seating area, or rough threshold and the jambs.

Nonmetallic shower subpans or linings shall be permitted to be built up on the job site of not less than three layers of standard grade 15 pound (6.8 kg) asphalt impregnated roofing felt. The bottom layer shall be fitted to the formed subbase and each succeeding layer thoroughly hot-mopped to that below. Corners shall be carefully fitted and shall be made strong and watertight by folding or lapping, and each corner shall be reinforced with suitable webbing hot-mopped in place.

Folds, laps, and reinforcing webbing shall extend not less than 4 inches (102 mm) in all directions from the corner, and webbing shall be of approved type and mesh, producing a tensile strength of not less than 50 pounds per square foot (lb/ft²) (244 kg/m²) in either direction. Nonmetallic shower subpans or linings shall be permitted to consist of multilayers of other approved equivalent materials suitably reinforced and carefully fitted in place on the job site as elsewhere required in this section.

Linings shall be properly recessed and fastened to the approved backing so as not to occupy the space required for the wall covering, and shall not be nailed or perforated at a point that is less than 1 inch (25.4 mm) above the finished dam or threshold. An approved type subdrain shall be installed with a shower subpan or lining. Each such subdrain shall be of the type that sets flush with the subbase and shall be equipped with a clamping ring or other device to make a tight connection between the lining and the drain. The subdrain shall have weep holes into the waste line. The weep holes located in the subdrain clamping ring shall be protected from clogging.

408.7–408.8.1 PVC Sheets. Plasticized polyvinyl chloride (PVC) sheets shall conform to ASTM D4551. Sheets shall be joined by solvent cementing in accordance with the manufacturer’s installation instructions.

408.7–408.8.2 Chlorinated Polyethylene (CPE) Sheets. Nonplasticized chlorinated polyethylene sheets shall conform to ASTM D4068. The liner shall be joined in accordance with the manufacturer’s installation instructions.

408.7–408.8.3 Sheet Lead. Sheet lead shall weigh not less than 4 lb/ft² (19.5 kg/m²) and shall be coated with an asphalt paint or other approved coating. The lead sheet shall be insulated from conducting substances, other than the connecting drain, by 15 pound (6.8 kg) asphalt felt or an equivalent. Sheet lead shall be joined by burning.

408.7–408.8.4 Sheet Copper. Sheet copper shall comply with ASTM B152 and shall weigh not less than 12 ounces per square foot (oz/ft²) (3.7 kg/m²) or No. 24 B & S Gauge (0.02 inches) (0.51 mm). The copper sheet shall be insulated from conducting substances, other than the connecting drain, by 15 pound (6.8 kg) asphalt felt or an equivalent. Sheet copper shall be joined by brazing or soldering.
408.75–408.8.5 Tests for Shower Receptors. Shower receptors shall be tested for watertightness by filling with water to the level of the rough threshold—a depth of not less than 2 inches (51 mm) for not less than 15 minutes. Where no threshold is present, a 2 inch (51 mm) barrier shall be temporarily constructed for testing. The test plug shall be so placed that both upper and under sides of the subpan shall be subjected to the test at the point where it is clamped to the drain.

408.8–408.9 Public Shower Floors. Floors of public shower rooms shall have a nonskid surface and shall be drained in such a manner that wastewater from one bather shall not pass over areas occupied by other bathers. Gutters in public or gang shower rooms shall have rounded corners for easy cleaning and shall be sloped not less than 2 percent toward drains. Drains in gutters shall be spaced at a maximum of 8 feet (2438 mm) from sidewalls or more than 16 feet (4877 mm) apart.

408.10 Location of Valves and Heads. Control valves and showerheads shall be located on the sidewall of shower compartments or otherwise arranged so that the showerhead does not discharge directly at the entrance to the compartment so that the bather can adjust the valves before stepping into the shower spray.

408.11 Water Supply Riser. A water supply riser from the shower valve to the showerhead outlet, whether exposed or not, shall be securely attached to the structure.

409.0 Bathtubs and Whirlpool Bathtubs.


409.2 Waste Outlet. Bathtubs and whirlpool bathtubs shall have a waste outlet and fixture tailpiece not less than 1 1/2 inches (40 mm) in diameter. Fixture tailpieces shall be constructed from the materials specified in Section 701.2 for drainage piping. Waste outlets shall be provided with an approved stopper or strainer.

409.3 Overflow. Where overflows are provided, they shall be installed in accordance with Section 404.2.

409.4 Limitation of Hot Water Temperature in Bathtubs and Whirlpool Bathtubs. The maximum hot water temperature discharging from the bathtub and whirlpool bathtub filler shall be limited to 120°F (49°C). The maximum temperature shall be regulated by one of the following means:

(1) A limiting device conforming to either ASSE 1070/ASME A112.1070/CSA B125.70 or CSA B125.3.

(2) A water heater conforming to ASSE 1084.

409.5 Backflow Protection. The water supply to a bathtub and whirlpool bathtub filler valve shall be protected by an air gap or in accordance with Section 417.0.

409.6 Installation and Access. Bathtubs and whirlpool bathtubs shall be installed in accordance with the manufacturer’s installation instructions. Access openings shall be of a size and opening to permit the removal and replacement of the circulation pump.

Whirlpool pump access located in the crawl space shall be located not more than 20 feet (6096 mm) from an access door, trap door, or crawl hole.

The circulation pump shall be located above the crown weir of the trap.

The pump and the circulation piping shall be self-draining to minimize water retention.

409.6.1 Suction Fittings. Suction fittings on whirlpool bathtubs shall comply with ASME A112.19.7/CSA B45.10.

409.6.2 Flexible PVC Hoses and Tubing. Flexible PVC hoses and tubing intended to be used on whirlpool bathtub water circulation systems or pneumatic systems shall comply with IAPMO Z1033.

410.0 Bidets.

410.1 Application. Bidets shall comply with ASME A112.19.2/CSA B45.1 or ASME A112.19.3/CSA B45.4.

410.2 Backflow Protection. The water supply to the bidet shall be protected by an air gap or in accordance with Section 603.3.2, Section 603.3.5, or Section 603.3.6.

410.3 Limitation of Water Temperature in Bidets. The maximum hot water temperature discharging from a bidet shall be limited to 110°F (43°C). The maximum temperature shall be regulated by one of the following means:

(1) A limiting device conforming to either ASSE 1070/ASME A112.1070/CSA B125.70 or CSA B125.3.

(2) A water heater conforming to ASSE 1084.

411.0 Water Closets.

411.1 Application. Water closets shall comply with ASME A112.19.2/CSA B45.1, ASME A112.19.3/CSA B45.4, or CSA B45.5/IAPMO Z124. Water closet bowls for public use shall be of the elongated type. In nurseries, schools, and other similar places where plumbing fixtures are provided for the use of children less than 6 years of age, water closets shall be of a size and height suitable for children’s use.

411.2 Water Consumption. Water closets shall have a maximum consumption not to exceed 1.6 gallons (6.0 Lpf) of water per flush.

411.2.1 Dual Flush Water Closets. Dual flush water closets shall comply with ASME A112.19.14. The effective flush volume for dual flush water closets shall be defined as the composite, average flush volume of two reduced flushes and one full flush.

411.2.2 Flushometer Valve Activated Water Closets. Flushometer valve activated water closets shall have a maximum flush volume of 1.6 gallons (6.0 Lpf) of water per flush.
411.3 Water Closet Seats. Water closet seats shall be properly sized for the water closet bowl type, and shall be of smooth, non-absorbent material. Seats, for public use, shall be of the elongated type and either of the open front type or have an automatic seat cover dispenser. Plastic seats shall comply with IAPMO Z124.5.

411.4 Personal Hygiene Devices. Water closets with integral personal hygiene devices shall comply with ASME A112.4.2/CSA B45.16.

412.0 Urinals.

412.1 Application. Urinals shall comply with ASME A112.19.2/CSA B45.1, ASME A112.19.19, or CSA B44.5/IAPMO Z124. Urinals shall have an average water consumption not to exceed 1 gallon (3.8 Lpf) of water per flush.

412.1.1 Nonwater Urinals. Nonwater urinals shall have a liquid barrier sealant to maintain a trap seal. Non-water urinals shall permit the uninhibited flow of waste through the urinal to the sanitary drainage system. Non-water urinals shall be cleaned and maintained in accordance with the manufacturer’s instructions after installation. Where nonwater urinals are installed, not less than one water supplied fixture rated at not less than 1 water supply fixture unit (WSFU) shall be installed upstream on the same drain line to facilitate drain line flow and rinsing. Where nonwater urinals are installed, they shall have a water distribution line rough-in to each individual urinal location to allow for the installation of an approved backflow prevention device in the event of a retrofit.

412.1.2 Nonwater Urinals with Drain Cleansing Action. Nonwater urinals with drain cleansing action shall comply with ASME A112.19.19 and shall be cleaned, maintained and installed in accordance with the manufacturer’s installation instructions.

412.2 Backflow Protection. A water supply to a urinal shall be protected by an approved-type vacuum breaker or other approved backflow prevention device in accordance with Section 603.5.

413.0 Flushing Devices.

413.1 Where Required. Each water closet, urinal, clinical sink, or other plumbing fixture that depends on trap siphonage to discharge its waste contents shall be provided with a flushometer valve, flushometer tank, or flush tank designed and installed so as to supply water in sufficient quantity and rate of flow to flush the contents of the fixture to which it is connected, to cleanse the fixture, and to refill the fixture trap, without excessive water use. Flushing devices shall comply with the antisiphon requirements in accordance with Section 603.5.

413.2 Flushometer Valves. Flushometer valves and flushometer tanks shall comply with ASSE 1037/ASME A112.1037/CSA B125.37, and shall be installed in accordance with Section 603.5.1. No manually controlled flushometer valve shall be used to flush more than one urinal, and each such urinal flushometer valve shall be an approved, self-closing type discharging a predetermined quantity of water. Flushometers shall be installed so that they will be accessible for repair. Flushometer valves shall not be used where the water pressure is insufficient to operate them properly. Where the valve is operated, it shall complete the cycle of operation automatically, opening fully, and closing positively under the line water pressure. Each flushometer shall be provided with a means for regulating the flow through it.

413.3 Flush Tanks. Flush tanks for manual flushing shall be equipped with a flush valve that complies with ASME A112.19.5/CSA B45.15 and an antisiphon fill valve (ballcock) that complies with ASSE 1002/ASME A112.1002/CSA B125.12 and installed in accordance with Section 603.5.2.

413.4 Water Supply for Flush Tanks. An adequate quantity of water shall be provided to flush and clean the fixture served. The water supply for flushing tanks and flushometer tanks equipped for manual flushing shall be controlled by a float valve or other automatic device designed to refill the tank after each discharge and to shut completely off the water flow to the tank where the tank is filled to operational capacity. Provision shall be made to automatically supply water to the fixture to refill the trap seal after each flushing.

413.5 Overflows in Flush Tanks. Flush tanks shall be provided with overflows discharging into the water closet or urinal connected thereto. Overflows supplied as original parts with the fixture shall be of sufficient size to prevent tank flooding at the maximum rate at which the tank is supplied with water under normal operating conditions and where installed in accordance with the manufacturer’s installation instructions.

414.0 Dishwashing Machines.

414.1 Application. Domestic dishwashing machines shall comply with UL 749. Commercial dishwashing machines shall comply with NSF/ANSI 3 and UL 921.

414.2 Backflow Protection. The water supply connection to a commercial dishwashing machine shall be protected by an air gap or a backflow prevention device in accordance with Section 603.3.2, Section 603.3.5, Section 603.3.6, or that complies with ASSE 1004.

414.3 Drainage Connection. Domestic dishwashing machines shall discharge indirectly through an air gap fitting in accordance with Section 807.3 into a waste receptor, a wye branch fitting on the tailpiece of a kitchen sink, or a dishwasher connection of a food waste disposer. Commercial dishwashing machines shall discharge indirectly through an air break or direct connection. The indirect discharge for commercial dishwashing machines shall be in accordance with Section 807.1, and the or by a direct connection discharge shall be in accordance with Section 704.3.

414.4 Lead Content. Dishwashing machines shall comply with the lead content requirements of Section 604.2.

415.0 Drinking Fountains.

415.0 Drinking Fountain Alternatives. Where food is consumed indoors, water stations shall be permitted to be substituted for drinking fountains. Bottle filling stations shall be permitted to be substituted for drinking fountains up to 50 percent of the requirements for drinking fountains. Drinking fountains shall not be required for an occupant load of 30 or less.

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415.3 Drainage Connection. Drinking fountains shall be permitted to discharge directly into the drainage system or indirectly through an air break in accordance with Section 809.1.

415.4 Location. Drinking fountains shall not be installed in toilet rooms.

416.0 Emergency Eyewash and Shower Equipment.

416.1 Application. Emergency eyewash and shower equipment shall comply with ISEA Z358.1.

416.2 Water Supply. Emergency eyewash and shower equipment shall not be limited in the water supply flow rates. Where hot and cold water is supplied to an emergency shower or eyewash station, the temperature of the water supply shall be controlled by a temperature actuated mixing valve complying with ASSE 1071. Where water is supplied directly to an emergency shower or eyewash station from a water heater, the water heater shall comply with ASSE 1085. The flow rate, discharge pattern, and temperature of flushing fluids shall be provided in accordance with ISEA Z358.1.

416.3 Installation. Emergency eyewash and shower equipment shall be installed in accordance with the manufacturer’s installation instructions.

416.4 Location. Emergency eyewash and shower equipment shall be located on the same level as the hazard and accessible for immediate use. The path of travel shall be free of obstructions and shall be clearly identified with signage.

416.5 Drain. A drain shall not be required for emergency eyewash or shower equipment. Where a drain is provided, the discharge shall be in accordance with Section 811.0.

417.0 Faucets and Fixture Fittings.

417.1 Application. Faucets and fixture fittings shall comply with ASME A112.18.1/CSA B125.1. Fixture fittings covered under the scope of NSF/ANSI/CAN 61 shall comply with the requirements of NSF/ANSI/CAN 61.

417.2 Deck Mounted Bath/Shower Valves. Deck mounted bath/shower transfer valves with integral backflow protection shall comply with ASME A112.18.1/CSA B125.1. This shall include hand held showers, and other bathing appliances mounted on the deck of bathtubs or other bathing appliances that incorporate a hose or pull out feature.

417.3 Handheld Showers. Handheld showers shall comply with ASME A112.18.1/CSA B125.1. Handheld showers with integral backflow protection shall comply with ASME A112.18.1/CSA B125.1 or shall have a backflow prevention device that complies with ASME A112.18.3 or ASSE 1014.

417.4 Faucets and Fixture Fittings with Hose Connected Outlets. Faucets and fixture fittings with pull out spouts shall comply with ASME A112.18.1/CSA B125.1. Faucets and fixture fittings with pull out spouts with integral backflow protection shall comply with ASME A112.18.1/CSA B125.1 or shall have a backflow preventer device that complies with ASME A112.18.3.

417.5 Separate Controls for Hot and Cold Water. Where two separate handles control the hot and cold water, the left-hand control of the faucet where facing the fixture fitting outlet shall control the hot water. Faucets and diverters shall be connected to the water distribution system so that hot water corresponds to the left side of the fixture fitting.

Single-handle mixing valves installed in showers and tub-shower combinations shall have the flow of hot water corresponding to the markings on the fixture fitting.

417.6 Low-Pressure Water Dispenser. Beverage faucets shall comply with ASME A112.18.1/CSA B125.1. Low-pressure water dispensers that dispense electrically heated water and have a reservoir vented to the atmosphere shall comply with ASSE 1023. Electric devices that heat water shall comply with UL 499.

418.0 Floor Drains.

418.1 Application. Floor drains shall comply with ASME A112.3.1, ASME A112.6.3, or CSA B79.

418.2 Strainer. Floor drains shall be considered plumbing fixtures and each such drain shall be provided with an approved-type strainer having a waterway equivalent to the area of the tailpiece. Floor drains shall be of an approved type and shall provide a watertight joint on the floor.

418.3 Location of Floor Drains. Floor drains shall be installed in the following areas:

1. Toilet rooms containing two or more water closets or a combination of one water closet and one urinal, except in a dwelling unit.

2. Commercial kitchens and in accordance with Section 704.3.

3. Laundry rooms in commercial buildings and common laundry facilities in multi-family dwelling buildings.

4. Boiler rooms.

418.4 Food Storage Areas. Where drains are provided in storerooms, walk-in freezers, walk-in coolers, refrigerated equipment, or other locations where food is stored, such drains shall have indirect waste piping. Separate waste pipes shall be run from each food storage area, each with an indirect connection to the building sanitary drainage system. Traps shall be provided in accordance with Section 801.3.2 of this code and shall be vented.

Indirect drains shall be permitted to be located in freezers or other spaces where freezing temperatures are maintained, provided that traps, where supplied, shall be located where the seal will not freeze. Otherwise, the floor of the freezer shall be sloped to a floor drain located outside of the storage compartment.

418.5 Floor Slope. Floors shall be sloped to floor drains.
419.0 Food Waste Disposers.

419.1 Application. Food waste disposal units shall comply with UL 430. Residential food waste disposers shall also comply with ASSE 1008.

419.2 Drainage Connection. Approved wye or other directional-type branch fittings shall be installed in continuous wastes connecting or receiving the discharge from a food waste disposer. No dishwasher drain shall be connected to a sink tailpiece, continuous waste, or trap on the discharge side of a food waste disposer.

419.3 Water Supply. A cold water supply shall be provided for food waste disposers. Such connection to the water supply shall be protected by an air gap or backflow prevention device in accordance with Section 603.2.

420.0 Sinks.


420.2 Water Consumption. Sink faucets shall have a maximum flow rate of not more than 2.2 gpm at 60 psi (8.3 L/m at 414 kPa).

Exceptions:
(1) Clinical sinks
(2) Laundry trays
(3) Service sinks

420.3 Pre-Rinse Spray Valve. Commercial food service pre-rinse spray valves shall have a maximum flow rate of 1.6 gallons per minute (gpm) at 60 pounds-force per square inch (psi) (6.0 L/min at 414 kPa) in accordance with Table 420.3 and shall be equipped with an integral automatic shutoff.

<table>
<thead>
<tr>
<th>PRODUCT CLASS BY SPRAY FORCE</th>
<th>MAXIMUM FLOW RATE, GPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Class 1 (&lt; 5.0 ounces-force)</td>
<td>1.00</td>
</tr>
<tr>
<td>Product Class 2 (&gt; 5.0 ounces-force and &lt; 8.0 ounces-force)</td>
<td>1.20</td>
</tr>
<tr>
<td>Product Class 3 (&gt; 8.0 ounces-force)</td>
<td>1.28</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 3.785 L/min, 1 ounce-force = 0.0625 pound-force

420.4 Waste Outlet. Kitchen and laundry sinks shall have a waste outlet and fixture tailpiece not less than 1½ inches (40 mm) in diameter. Service sinks shall have a waste outlet and fixture tailpiece not less than 2 inches (50 mm) in diameter. Fixture tailpieces shall be constructed from the materials specified in Section 701.2 for drainage piping. Waste outlets shall be provided with an approved strainer.

421.0 Floor Sinks.

421.1 Application. Floor sinks shall comply with ASME A112.6.7.

421.2 Strainers. The waste outlet of a floor sink shall be provided with an approved strainer or grate that is removable and accessible.

422.0 Minimum Number of Required Fixtures.

422.1 Fixture Count. Plumbing fixtures shall be provided for the type of building occupancy and in the minimum number shown in Table 422.1. The total occupant load and occupancy classification shall be determined in accordance with the building code. Occupancy classification not shown in Table 422.1 shall be considered separately by the Authority Having Jurisdiction.

The minimum number of fixtures shall be calculated at 50 percent male and 50 percent female based on the total occupant load. Where information submitted indicates a difference in the distribution of the sexes such information shall be used to determine the number of fixtures for each sex. Once the occupancy load and occupancy are determined, Table 422.1 shall be applied to determine the minimum number of plumbing fixtures required. Where applying the fixture ratios in Table 422.1 results in fractional numbers, such numbers shall be rounded to the next whole number. For multiple occupancies, fractional numbers shall be first summed and then rounded to the next whole number.

422.2 Separate Facilities. Separate toilet facilities shall be provided for each sex.

Exceptions:
(1) Residential installations.
(2) In occupancies with a total occupant load of 10 or less, including customers and employees, one toilet facility, designed for use by no more than one person at a time, shall be permitted for use by both sexes.
(3) In business and mercantile occupancies with a total occupant load of 50 or less including customers and employees, one toilet facility, designed for use by no more than one person at a time, shall be permitted for use by both sexes.

422.2.1 Single Use Toilet Facilities. Single use toilet facilities and family or assisted use toilet facilities shall be identified with signage indicating use by either sex.

422.2.2 Family or Assisted-Use Toilet Facilities. Where a separate toilet facility is required for each sex, and each toilet facility is required to have only one water closet, two family or assisted-use toilet facilities shall be permitted in place of the required separate toilet facilities.

422.3 Fixture Requirements for Special Occupancies. Additional fixtures shall be permitted to be required...
where unusual environmental conditions or referenced activities are encountered. In food preparation areas, fixture requirements shall be permitted to be dictated by health codes.

422.4 Toilet Facilities Serving Employees and Customers. Each building or structure shall be provided with toilet facilities for employees and customers. Requirements for customers and employees shall be permitted to be met with a single set of restrooms accessible to both groups.

Required toilet facilities for employees and customers located in shopping malls or centers shall be permitted to be met by providing a centrally located toilet facility accessible to several stores. The maximum travel distance from entry to any store to the toilet facility shall not exceed 300 feet (91440 mm).

Required toilet facilities for employees and customers in other than shopping malls or centers shall have a maximum travel distance not to exceed 500 feet (152 m).

422.4.1 Access to Toilet Facilities. In multi-story buildings, accessibility to the required toilet facilities shall not exceed one vertical story. Access to the required toilet facilities for customers shall not pass through areas designated as for employee use only such as kitchens, food preparation areas, storage rooms, closets, or similar spaces. Toilet facilities accessible only to private offices shall not be counted to determine compliance with this section.

422.5 Toilet Facilities for Workers. Toilet facilities shall be provided and maintained in a sanitary condition for the use of workers during construction.
Each building shall be provided with sanitary facilities, including provisions for persons with disabilities as prescribed by the Department Having Jurisdiction. Table 422.1 applies to new buildings, additions to a building, and changes of occupancy or type in an existing building resulting in increased occupant load.

<table>
<thead>
<tr>
<th>TYPE OF OCCUPANCY</th>
<th>WATER CLOSETS (FIXTURES PER PERSON)</th>
<th>URINALS (FIXTURES PER PERSON)</th>
<th>LAVATORIES (FIXTURES PER PERSON)</th>
<th>BATHTUBS OR SHOWERS (FIXTURES PER PERSON)</th>
<th>DRINKING FOUNTAINS/ FACILITIES (FIXTURES PER PERSON)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over 400, add 1 fixture for each additional 500 males and 1 fixture for each additional 125 females.</td>
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<tr>
<td></td>
<td>Over 400, add 1 fixture for each additional 250 males and 1 fixture for each additional 125 females.</td>
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<tr>
<td></td>
<td>Over 400, add 1 fixture for each additional 500 males and 1 fixture for each additional 125 females.</td>
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<tr>
<td></td>
<td>Over 400, add 1 fixture for each additional 500 males and 1 fixture for each additional 125 females.</td>
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</tr>
<tr>
<td>TYPE OF OCCUPANCY</td>
<td>WATER CLOSETS (FIXTURES PER PERSON)</td>
<td>URINALS (FIXTURES PER PERSON)</td>
<td>LAVATORIES (FIXTURES PER PERSON)</td>
<td>BATHTUBS OR SHOWERS (FIXTURES PER PERSON)</td>
<td>DRINKING FOUNTAINS/FACILITIES (FIXTURES PER PERSON)</td>
<td>OTHERS</td>
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<tr>
<td></td>
<td>Female 1: 1-25 2: 26-50 3: 51-100 4: 101-200 6: 201-300 8: 301-400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 service sink or laundry tray</td>
</tr>
<tr>
<td></td>
<td>Over 400, add 1 fixture for each additional 500 males and 1 fixture for each additional 125 females.</td>
<td>Over 600, add 1 fixture for each additional 300 males.</td>
<td>Over 750, add 1 fixture for each additional 250 males and 1 fixture for each additional 200 females.</td>
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<tr>
<td></td>
<td>Female 1: 1-15 2: 16-30 3: 31-50 4: 51-100 8: 101-200</td>
<td></td>
<td></td>
<td>1 per 150</td>
<td></td>
<td>1 service sink or laundry tray</td>
</tr>
<tr>
<td></td>
<td>Over 400, add 1 fixture for each additional 500 males and 1 fixture for each additional 150 females.</td>
<td>Over 600, add 1 fixture for each additional 300 males.</td>
<td>Over 750, add 1 fixture for each additional 250 males and 1 fixture for each additional 200 females.</td>
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</tr>
<tr>
<td>E Educational occupancy-private or public schools</td>
<td>Male 1 per 50</td>
<td>Male 1 per 100</td>
<td>Male 1 per 40</td>
<td>Female 1 per 40</td>
<td></td>
<td>1 per 150</td>
</tr>
<tr>
<td>F1, F2 Factory or Industrial occupancy-fabricating or assembly work</td>
<td>Male 1: 1-50 2: 51-75 3: 76-100</td>
<td>Female 1: 1-50 2: 51-75 3: 76-100</td>
<td></td>
<td></td>
<td></td>
<td>1 shower for each 15 persons exposed to excessive heat or to skin contamination with poisonous, infectious, irritating material</td>
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<td></td>
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<td></td>
<td>Over 100, add 1 fixture for each additional 40 persons.</td>
<td>Over 100, add 1 fixture for each additional 40 persons.</td>
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</tr>
<tr>
<td>I-1 Institutional occupancy (houses more than 16 persons on a 24-hour basis)- substance abuse centers, assisted living, group homes, or residential facilities</td>
<td>Male 1 per 15</td>
<td>Female 1 per 15</td>
<td></td>
<td></td>
<td></td>
<td>1 per 8</td>
</tr>
</tbody>
</table>
### Table 422.1
**Minimum Plumbing Facilities**

<table>
<thead>
<tr>
<th>TYPE OF OCCUPANCY</th>
<th>WATER CLOSETS (FIXTURES PER PERSON)</th>
<th>URINALS (FIXTURES PER PERSON)</th>
<th>LAVATORIES (FIXTURES PER PERSON)</th>
<th>BATHTUBS OR SHOWERS (FIXTURES PER PERSON)</th>
<th>DRINKING FOUNTAINS/FACILITIES (FIXTURES PER PERSON)</th>
<th>OTHERS[^7]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I-2 Institutional occupancy—medical, psychiatric, surgical or nursing homes</strong></td>
<td>Hospitals and nursing homes-individual rooms and ward room 1 per room — 1 per room 1 per room</td>
<td></td>
<td></td>
<td></td>
<td>1 per 150</td>
<td>1 service sink or laundry tray</td>
</tr>
<tr>
<td></td>
<td>Hospital Waiting or Visitor Rooms 1 per room — 1 per room —</td>
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<tr>
<td></td>
<td></td>
<td>Over 55, add 1 fixture for each additional 40 persons.</td>
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<tr>
<td><strong>I-3 Institutional occupancy (houses more than 5 people)</strong></td>
<td>Prisons 1 per cell — 1 per cell 1 per 20</td>
<td></td>
<td></td>
<td></td>
<td>1 per cell block/floor</td>
<td>—</td>
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<tr>
<td></td>
<td>Correctional facilities or juvenile center 1 per 8 — 1 per 10 1 per 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employee Use</td>
<td>Male 1: 1-15 2: 16-35 3: 36-55 Female 1: 1-15 3: 16-35 4: 36-55</td>
<td>—</td>
<td>Male 1 per 40 Female 1 per 40</td>
<td></td>
<td>1 per 150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 55, add 1 fixture for each additional 40 persons.</td>
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<tr>
<td><strong>I-4 Institutional occupancy (any age that receives care for less than 24 hours)</strong></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Male 1: 1-15 2: 16-35 3: 36-55 Female 1: 1-15 3: 16-35 4: 36-55</td>
<td>—</td>
<td>Male 1 per 40 Female 1 per 40</td>
<td></td>
<td>1 per 150</td>
<td>1 service sink or laundry tray</td>
</tr>
<tr>
<td></td>
<td>Over 55, add 1 fixture for each additional 40 persons.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Over 400, add 1 fixture for each additional 500 males and 1 fixture for each 200 females.</td>
<td>Over 400, add 1 fixture for each additional 500 males.</td>
<td>Over 400, add 1 fixture for each additional 500 males and 1 fixture for each 400 females.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R-1 Residential occupancy (minimal stay)—hotels, motels, bed and breakfast homes</strong></td>
<td>1 per sleeping room — 1 per sleeping room 1 per sleeping room</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[^7]: Additional Notes and Specifications
<table>
<thead>
<tr>
<th>TYPE OF OCCUPANCY^2</th>
<th>WATER CLOSETS (FIXTURES PER PERSON)^3</th>
<th>URINALS (FIXTURES PER PERSON)^4</th>
<th>LAVATORIES (FIXTURES PER PERSON)^5</th>
<th>BATHTUBS OR SHOWERS (FIXTURES PER PERSON)</th>
<th>DRINKING FOUNTAINS/FACILITIES (FIXTURES PER PERSON)</th>
<th>OTHER^6,7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dormitories</td>
<td>Male 1 per 10</td>
<td>Female 1 per 8</td>
<td>Male 1 per 25</td>
<td>Add 1 fixture for each additional 25 males and 1 fixture for each additional 20 females.</td>
<td>Add 1 fixture for each additional 20 males and 1 fixture for each additional 15 females.</td>
<td>1 per 8</td>
</tr>
<tr>
<td></td>
<td>Over 150, add 1 fixture for each additional 50 males.</td>
<td></td>
<td>Over 150, add 1 fixture for each additional 20 males and 1 fixture for each additional 15 females.</td>
<td>1 per 8</td>
<td>1 per 150</td>
<td>1 service sink or laundry tray</td>
</tr>
<tr>
<td>Employee Use</td>
<td>Male 1: 1-15</td>
<td>Female 1: 1-15</td>
<td>Male 1 per 40</td>
<td>Add 1 fixture for each additional 20 males and 1 fixture for each additional 15 females.</td>
<td>Add 1 fixture for each additional 20 males and 1 fixture for each additional 15 females.</td>
<td>1 per 40</td>
</tr>
<tr>
<td></td>
<td>2: 16-35</td>
<td>3: 16-35</td>
<td>Female 1 per 40</td>
<td>1 per 40</td>
<td>1 per 40</td>
<td>1 per 40</td>
</tr>
<tr>
<td></td>
<td>3: 36-55</td>
<td>4: 36-55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Over 55, add 1 fixture for each additional 40 persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apartment house/unit</td>
<td>1 per apartment</td>
<td></td>
<td>1 per apartment</td>
<td>1 per apartment</td>
<td>1 per apartment</td>
<td>1 per apartment</td>
</tr>
<tr>
<td>R-3 Residential occupancy (long-term or permanent in nature) for more than 5 but does not exceed 16 occupants)</td>
<td>Male 1 per 10</td>
<td>Female 1 per 8</td>
<td>Male 1 per 12</td>
<td>Female 1 per 12</td>
<td>Add 1 fixture for each additional 25 males and 1 fixture for each additional 20 females.</td>
<td>1 per 8</td>
</tr>
<tr>
<td>R-3 Residential occupancy (one and two family dwellings)</td>
<td>1 per one and two family dwelling</td>
<td></td>
<td>1 per one and two family dwelling</td>
<td>1 per one and two family dwelling</td>
<td>1 per one and two family dwelling</td>
<td>1 per one and two family dwelling</td>
</tr>
<tr>
<td>R-4 Residential occupancy (residential care or assisted living)</td>
<td>Male 1 per 10</td>
<td>Female 1 per 8</td>
<td>Male 1 per 12</td>
<td>Female 1 per 12</td>
<td>Add 1 fixture for each additional 25 males and 1 fixture for each additional 20 females.</td>
<td>1 per 8</td>
</tr>
</tbody>
</table>
Table 422.1
Minimum Plumbing Facilities (continued)

<table>
<thead>
<tr>
<th>TYPE OF OCCUPANCY²</th>
<th>WATER CLOSETS (FIXTURES PER PERSON)³</th>
<th>URINALS (FIXTURES PER PERSON)⁴</th>
<th>LAVATORIES (FIXTURES PER PERSON)⁵</th>
<th>BATHTUBS OR SHOWERS (FIXTURES PER PERSON)</th>
<th>DRINKING FOUNTAINS/FACILITIES (FIXTURES PER PERSON)</th>
<th>OTHER⁶,⁷</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over 400, add 1 fixture for each additional 500 males and 1 fixture for each additional 150 females.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 service sink or laundry tray</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:

1 The figures shown are based upon one fixture being the minimum required for the number of persons indicated or any fraction thereof.
2 A restaurant is defined as a business that sells food to be consumed on the premises.
   a. The number of occupants for a drive-in restaurant shall be considered as equal to the number of parking stalls.
   b. Hand-washing facilities shall be available in the kitchen for employees.
3 The total number of required water closets for females shall be not less than the total number of required water closets and urinals for males.
4 For each urinal added in excess of the minimum required, one water closet shall be permitted to be deducted. The number of water closets shall not be reduced to less than two-thirds of the minimum requirement.
5 Metering or self-closing faucets shall be installed on lavatories intended to serve the transient public.
6 Service sinks shall not be required for non-residential occupancies with an occupant load of 15 or less.
7 For business and mercantile occupancies, one common service sink shall be permitted when accessible to all businesses and mercantile within 300 feet (91,400 mm) and within the same story.
CHAPTER 5
WATER HEATERS

501.0 General.
501.1 Applicability. The regulations of this chapter shall govern the construction, location, and installation of fuel-burning and other types of water heaters heating potable water, together with chimneys, vents, and their connectors. The minimum capacity for storage water heaters shall be in accordance with the first-hour rating listed in Table 501.1(2). No water heater shall be hereinafter installed that does not comply with the manufacturer’s installation instructions and the type and model of each size thereof approved by the Authority Having Jurisdiction. A list of accepted water heater appliance standards is referenced in Table 501.1(1). Listed appliances shall be installed in accordance with the manufacturer’s installation instructions. Unlisted water heaters shall be permitted in accordance with Section 504.3.2.

Water heaters shall be installed in accordance with the manufacturer’s installation instructions. The final installation shall be approved by the Authority Having Jurisdiction.

502.0 Permits.
502.1 General. It shall be unlawful for a person to install, remove, or replace or cause to be installed, removed, or replaced a water heater without first obtaining a permit from the Authority Having Jurisdiction to do so.

503.0 Inspection.
503.1 Inspection of Chimneys or Vents. This inspection shall be made after chimneys, vents, or parts thereof, authorized by the permit, have been installed and before such vent or part thereof has been covered or concealed.
503.2 Final Water Heater Inspection. This inspection shall be made after work authorized by the permit has been installed. The Authority Having Jurisdiction will make such inspection as deemed necessary to be assured that the work has been installed in accordance with the intent of this code. No appliance or part thereof shall be covered or concealed until the same has been inspected and approved by the Authority Having Jurisdiction.

504.0 Water Heater Requirements.
504.1 Location. Water heater installations in bedrooms and bathrooms shall comply with one of the following [NFPA 54:10.27.1]:

(1) Water heater shall be of the direct-vent type. [NFPA 54:10.27.1(2)]
(2) Fuel-burning water heaters shall be permitted to be installed in a closet located in the bedroom or bathroom provided the closet is equipped with a listed, gasketed door assembly and a listed self-closing device. The self-closing door assembly shall meet the requirements of Section 504.1.1. The door assembly shall be installed with a threshold and bottom door seal and shall meet the requirements of Section 504.1.2. Combustion air for such installations shall be obtained from the outdoors in accordance with Section 506.4. The closet shall be for the exclusive use of the water heater.

504.1.1 Self-Closing Doors. Self-closing doors shall swing easily and freely, and shall be equipped with a self-closing device to cause the door to close and latch each time it is opened. The closing mechanism shall not have a hold-open feature.
504.1.2 Gasketing. Gasketing on gasketed doors or frames shall be furnished in accordance with the published listings of the door, frame, or gasketing material manufacturer.

Exception: Where acceptable to the Authority Having Jurisdiction, gasketing of non-combustible or limited-
combustible material shall be permitted to be applied to the frame, provided closing and latching of the door are not inhibited.

504.2 Vent. Water heaters of other than the direct-vent type shall be located as close as practical to the chimney or gas vent.

504.3 Clearance. The clearance requirements for water heaters shall comply with Section 504.3.1 or Section 504.3.2.

504.3.1 Listed Water Heaters. The clearances shall not be such as to interfere with combustion air, draft hood clearance and relief, and accessibility for servicing. Listed water heaters shall be installed in accordance with their listings and the manufacturer’s installation instructions.

504.3.2 Unlisted Water Heaters. Except as otherwise permitted in this code, unlisted water heaters shall be approved by the Authority Having Jurisdiction prior to being installed, with a clearance of 12 inches (305 mm) on all sides and rear. Combustible floors under unlisted water heaters shall be protected in an approved manner. [NFPA 54:2018:10.27.2.24]

504.4 Pressure-Limiting Devices. A water heater installation shall be provided with overpressure protection using an approved, listed device installed in accordance with the terms of its listing and the manufacturer’s installation instructions. Pressure relief devices shall have a pressure setting greater than the water service pressure and not exceed 150 psi (1034 kPa) as required in Section 608.4.

504.5 Temperature-Limiting Devices. A water heater installation or a hot water storage vessel installation shall be provided with overtemperature protection by means of an approved, listed device installed in accordance with the terms of its listing and the manufacturer’s installation instructions. [NFPA 54:10.26.5]

504.6 Temperature, Pressure, and Vacuum Relief Devices. Temperature, pressure, and vacuum relief devices or combinations thereof, and automatic gas shut-off devices shall be installed in accordance with the terms of their listings and the manufacturer’s installation instructions. A shut-off valve shall not be placed between the relief valve and the water heater or on discharge pipes between such valves and the atmosphere. The hourly British thermal units (Btu) (kW*h) discharge capacity or the rated steam relief capacity of the device shall be not less than the input rating of the water heater. [NFPA 54:10.26.6] Discharge piping shall be installed in accordance with Section 608.5.

504.7 Lead Content. Water heaters shall comply with the lead content requirements of Section 604.2.

505.0 Oil-Burning and Other Water Heaters.

505.1 Water Heaters. Water heaters deriving heat from fuels or types of energy other than gas shall comply with the standards referenced in Table 501.1(1), Section 505.3, or Section 505.4. Vents or chimneys for such appliances shall be of approved types. An adequate supply of air for combustion and for adequate ventilation of heater rooms or compartments shall be provided. Each such appliance shall be installed in a location approved by the Authority Having Jurisdiction and local and state fire-prevention agencies.

505.2 Safety Devices. Storage-type water heaters and hot water boilers deriving heat from fuels or types of energy other than gas, shall be provided with, in addition to the primary temperature controls, an over-temperature safety protection device that complies with and is installed in accordance with nationally recognized applicable standards for such devices and a combination temperature and pressure-relief valve.

505.3 Oil-Fired Water Heaters. Oil-fired water heaters shall be installed in accordance with NFPA 31.

505.4 Indirect-Fired Water Heaters. Indirect-fired water heaters shall be in accordance with the applicable sections of the ASME Boiler and Pressure Vessel Code or shall comply with one of the other applicable standards shown in Table 501.1(1). Each water heater shall bear a label in accordance with ASME requirements, or an approved testing agency, certifying and attesting that such an appliance has been tested, inspected and meets the requirements of the applicable standards or code.

505.4.1 Single-Wall Heat Exchanger. An indirect-fired water heater that incorporates a single-wall heat exchanger shall be in accordance with the following requirements:

1. The heat-transfer medium shall be either potable water or contain fluids recognized as safe by the Food and Drug Administration (FDA) as food grade.

2. Bear a label with the word “Caution,” followed by the following statements:

   a. The heat-transfer medium shall be potable water or other nontoxic fluid recognized as safe by the FDA.

   b. The maximum operating pressure of the heat exchanger shall not exceed the maximum operating pressure of the potable water supply.

3. The word “Caution” and the statements in letters shall have an uppercase height of not less than 0.120 of an inch (3.048 mm). The vertical spacing between lines of type shall be not less than 0.046 of an inch (1.168 mm). Lowercase letters shall be compatible with the uppercase letter size specification.

506.0 Air for Combustion and Ventilation.

506.1 General. Air for combustion, ventilation, and dilution of flue gases for appliances installed in buildings shall be obtained by application of one of the methods covered in Section 506.2 through Section 506.7.3. Where the requirements of Section 506.2 are not met, outdoor air shall be introduced in accordance with methods covered in Section 506.4 through Section 506.7.3.

Exception: This provision shall not apply to direct vent appliances. [NFPA 54:9.3.1.1]

506.1.1 Other Types of Appliances. Appliances of other than natural draft design, appliances not designated as Category I vented appliances, and appliances equipped with power burners shall be provided with combustion,
ventilation, and dilution air in accordance with the appliance manufacturer’s instructions. [NFPA 54:9.3.1.2]

506.1.2 Draft Hood and Regulators. Where used, a draft hood or a barometric draft regulator shall be installed in the same room or enclosure as the appliance served so as to prevent any difference in pressure between the hood or regulator and the combustion air supply. [NFPA 54:9.3.1.4]

506.1.3 Makeup Air. Where exhaust fans, clothes dryers, and kitchen ventilation systems interfere with the operation of appliances, makeup air shall be provided. [NFPA 54:9.3.1.5]

506.2 Indoor Combustion Air. The required volume of indoor air shall be determined in accordance with the method in Section 506.2.1 or Section 506.2.2 except that where the air infiltration rate is known to be less than 0.40 ACH (air change per hour), the method in Section 506.2.2 shall be used. The total required volume shall be the sum of the required volume calculated for all appliances located within the space. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors, and through combustion air openings sized and located in accordance with Section 506.3, are considered a part of the required volume. [NFPA 54:9.3.2]

506.2.1 Standard Method. The minimum required volume shall be 50 cubic feet per 1000 British thermal units per hour (Btu/h) (4.83 m³/kW). [NFPA 54:9.3.2.1]

506.2.2 Known Air Infiltration Rate Method. Where the air infiltration rate of a structure is known, the minimum required volume shall be determined as follows [NFPA 54:9.3.2.2]:

(1) For appliances other than fan-assisted, calculate using the following Equation 506.2.2(1). [NFPA 54:9.3.2.2(1)]

\[
\text{Required Volume}_{\text{other}} \geq \frac{21 \text{ ft}^3}{\text{ACH}} \left( \frac{I_{\text{other}}}{1000 \text{ Btu/h}} \right)
\]

(2) For fan-assisted appliances, calculate using the following Equation 506.2.2(2). [NFPA 54:9.3.2.2(2)]

\[
\text{Required Volume}_{\text{fan}} \geq \frac{15 \text{ ft}^3}{\text{ACH}} \left( \frac{I_{\text{fan}}}{1000 \text{ Btu/h}} \right)
\]

Where:
- \(I_{\text{other}}\) = All appliances other than fan-assisted input in (Btu/h)
- \(I_{\text{fan}}\) = Fan-assisted appliance input in (Btu/h)
- \(\text{ACH}\) = Air change per hour (percent of volume of space exchanged per hour, expressed as a decimal)

For SI units: 1 cubic foot = 0.0283 m³, 1000 British thermal units per hour = 0.293 kW

(3) For purposes of these calculations, an infiltration rate greater than 0.60 ACH shall not be used in the equations in Section 506.2.2(1) and Section 506.2.2(2). [NFPA 54:9.3.2.2(3)]

506.3 Indoor Opening Size and Location. Openings used to connect indoor spaces shall be sized and located in accordance with the following:

(1) Combining spaces on the same story. Each opening shall have a minimum free area of 1 square inch per 1000 Btu/h (0.002 m²/kW) of the total input rating of all appliances in the space but not less than 100 square inches (0.665 m²). One permanent opening shall commence within 12 inches (305 mm) of the top of the enclosure and one permanent opening shall commence within 12 inches (305 mm) of the bottom of the enclosure (see Figure 506.3). The minimum dimension of air openings shall not be less than 3 inches (76 mm).

(2) Combining spaces in different stories. The volumes of spaces in different stories shall be considered as communicating spaces where such spaces are connected by one or more permanent openings in doors or floors having a total minimum free area of 2 square inches per 1000 Btu/h (0.004 m²/kW) of total input rating of all appliances. [NFPA 54:9.3.2.3]

506.4 Outdoor Combustion Air. Outdoor combustion air shall be provided through opening(s) to the outdoors in accordance with the methods in Section 506.4.1 or Section 506.4.2. The minimum dimension of air openings shall not be less than 3 inches (76 mm). [NFPA 54:9.3.3]

506.4.1 Two Permanent Openings Method. Two permanent openings, one commencing within 12 inches
FIGURE 506.4.1(1)
ALL COMBUSTION AIR FROM OUTDOORS –
INLET AIR FROM VENTILATED CRAWL SPACE AND
OUTLET AIR TO VENTILATED ATTIC
[NFPA 54: FIGURE A.9.3.3.1(1)(a)]

FIGURE 506.4.1(2)
ALL COMBUSTION AIR FROM OUTDOORS
THROUGH VENTILATED ATTIC
[NFPA 54: FIGURE A.9.3.3.1(1)(b)]

For SI units: 1 foot = 304.8 mm

FIGURE 506.4.1(3)
ALL COMBUSTION AIR FROM OUTDOORS THROUGH HORIZONTAL DUCTS
[NFPA 54: FIGURE A.9.3.3.1(2)]

FIGURE 506.4.2
ALL COMBUSTION AIR FROM OUTDOORS THROUGH
SINGLE COMBUSTION AIR OPENING
[NFPA 54: FIGURE A.9.3.3.2]
506.4.1(3)

506.4.1(2)

506.4.1(1)

506.5 Combination Indoor and Outdoor Combustion Air. The use of a combination of indoor and outdoor combustion air shall be in accordance with Section 506.5.1 through Section 506.5.3. [NFPA 54:9.3.4(1)]

506.5.1 Indoor Openings. Where used, openings connecting the interior spaces shall comply with Section 506.3. [NFPA 54:9.3.4(1)]

506.5.2 Outdoor Opening(s) Location. Outdoor opening(s) shall be located in accordance with Section 506.4. [NFPA 54:9.3.4(2)]

506.5.3 Outdoor Opening(s) Size. The outdoor opening(s) size shall be calculated in accordance with the following:

(1) The ratio of the interior spaces shall be the available volume of all communicating spaces divided by the required volume.

(2) The outdoor size reduction factor shall be 1 minus the ratio of interior spaces.

(3) The minimum size of outdoor opening(s) shall be the full size of outdoor opening(s) calculated in accordance with Section 506.4, multiplied by the reduction factor. The minimum dimension of air openings shall not be less than 3 inches (76 mm). [NFPA 54:9.3.4(3)]

506.6 Engineered Installations. Engineered combustion air installations shall provide an adequate supply of combustion, ventilation, and dilution air and shall be approved by the Authority Having Jurisdiction determined using engineering methods. [NFPA 54:9.3.5]

506.7 Mechanical Combustion Air Supply. Where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from outdoors at the minimum rate of 0.35 cubic feet per minute per 1000 Btu/h [0.034 (m³/min)/kW] for all appliances located within the space. [NFPA 54:9.3.6]

506.7.1 Exhaust Fans. Where exhaust fans are installed, additional air shall be provided to replace the exhausted air. [NFPA 54:9.3.6.1]

506.7.2 Interlock. Each of the appliances served shall be interlocked to the mechanical air supply system to prevent main burner operation where the mechanical air supply system is not in operation. [NFPA 54:9.3.6.2]

506.7.3 Specified Combustion Air. Where combustion air is provided by the building’s mechanical ventilation system, the system shall provide the specified combustion air rate in addition to the required ventilation air. [NFPA 54:9.3.6.3]

506.8 Louvers, Grilles, and Screens. The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening. Where the free area through a design of louver, grille, or screen is known, it shall be used in calculating the size opening required to provide the free area specified. Where the louvers grille design and free area are not known, it shall be assumed that wood louvers have 25 percent free area, and metal louvers and grilles have 75 percent free area. Nonmotorized louvers and grilles shall be fixed in the open position. [NFPA 54:9.3.7.1]

506.8.1 Minimum Screen Mesh Size. Screens shall not be smaller than ⅛ of an inch (6.4 mm) mesh. [NFPA 54:9.3.7.2]

506.8.2 Motorized Louvers. Motorized louvers shall be interlocked with the appliance so they are proven in the full open position prior to main burner ignition and during main burner operation. Means shall be provided to prevent the main burner from igniting should the louver fail to open during burner startup and to shut down the main burner if the louvers close during burner operation. [NFPA 54:9.3.7.3]

506.9 Combustion Air Ducts. Combustion air ducts shall comply with the following [NFPA 54:9.3.8):

(1) Ducts shall be constructed of galvanized steel or a material having equivalent corrosion resistance, strength, and rigidity.

Exception: Within dwellings units, unobstructed stud and joist spaces shall not be prohibited from conveying combustion air, provided that not more than one fire-block is removed. [NFPA 54:9.3.8.1]

(2) Ducts shall terminate in an unobstructed space, allowing free movement of combustion air to the appliances. [NFPA 54:9.3.8.2]
507.0 Appliance and Equipment Installation Requirements.

507.1 Dielectric Insulator. The Authority Having Jurisdiction shall have the authority to require the use of an approved dielectric insulator on the water piping connections of water heaters and related water heating appliances.

507.2 Seismic Provisions. Water heaters shall be anchored or strapped to resist horizontal displacement due to earthquake motion. Strapping shall be at points within the upper one-third and lower one-third of its vertical dimensions. At the lower point, a distance of not less than 4 inches (102 mm) shall be maintained from the controls with the strapping.

507.3 Appliance Support. Appliances and equipment shall be furnished either with load distributing bases or with a sufficient number of supports to prevent damage to either the building structure or the appliance and the equipment. [NFPA 54:9.1.8.1]

507.3.1 Structural Capacity. At the locations selected for installation of appliances and equipment, the dynamic and static load carrying capacities of the building structure shall be checked to determine whether they are adequate to carry the additional loads. The appliances and equipment shall be supported and shall be connected to the piping so as not to exert undue stress on the connections. [NFPA 54:9.1.8.2]

507.4 Ground Support. A water heater supported from the earth shall rest on level concrete or other approved base extending not less than 3 inches (76 mm) above the adjoining ground level.

507.5 Drainage Pan. Where a water heater is located in an attic, in or on an attic ceiling assembly, floor-ceiling assembly, or floor-subfloor assembly or where damage results from a leaking water heater, a watertight pan of corrosion-resistant materials shall be installed beneath the water heater in accordance with the following:

1. The drainage pan shall be provided with not less than \( \frac{3}{4} \) of an inch (20 mm) diameter drain to an approved location. The terminating end of the drainpipe shall be readily visible.

2. Such the drainage pan shall be not less than 1½ inches (38 mm) in depth.

3. Where a drainage pan pipe is installed, the material of the piping shall be rated for the temperature rating of the water heater and shall be approved for use with the liquid being discharged.

4. Discharge from a relief valve into a drainage pan shall be prohibited.

507.6 Added or Converted Equipment or Appliances. When additional or replacement appliances or equipment is installed or an appliance is converted to gas from another fuel, the location in which the appliances or equipment is to be operated shall be checked to verify the following:

1. Air for combustion and ventilation is provided where required, in accordance with the provisions of Section 506.0. Where existing facilities are not adequate, they shall be upgraded to meet Section 506.0 specifications.

2. The installation components and appliances meet the clearances to combustible material provisions of Section 507.27. It shall be determined that the installation and operation of the additional or replacement appliances do not render the remaining appliances unsafe for continued operation.

3. The venting system is constructed and sized in accordance with the provisions of Section 509.0. Where the existing venting system is not adequate, it shall be upgraded to comply with Section 509.0. [NFPA 54:9.1.2]

507.7 Types of Gas(ES). The appliance shall be connected to the fuel gas for which it was designed. No attempt shall be made to convert the appliance from the gas specified on the rating plate for use with a different gas without consulting the installation instructions, the serving gas supplier, or the appliance manufacturer for complete instructions. Listed appliances shall not be converted unless permitted by and in accordance with the manufacturer’s installation instructions. [NFPA 54:9.1.3]

507.8 Safety Shutoff Devices for Unlisted LP-Gas Appliance Used Indoors. Unlisted appliances for use with undiluted liquefied petroleum gas LP-Gases and installed indoors, except attended laboratory equipment, shall be equipped with safety shutoff devices of the complete shutoff type. [NFPA 54:9.1.4]

507.9 Use of Air or Oxygen Under Pressure. Where air or oxygen under pressure is used in connection with the gas supply, effective means such as a backpressure regulator and
relief valve shall be provided to prevent air or oxygen from passing back into the gas piping. Where oxygen is used, installation shall be in accordance with NFPA 51. [NFPA 54:9.1.5]

507.10 Protection of Gas Appliances from Fumes or Gases other Than Products of Combustion. Non-direct-vent appliances installed in beauty shops, barber shops, or other facilities where chemicals that generate corrosive or flammable products such as aerosol sprays are routinely used shall be located in a mechanical room separate or partitioned off from other areas with provisions for combustion and dilution air from outdoors. Direct-vent appliances in such facilities shall be in accordance with the appliance manufacturer’s installation instructions. [NFPA 54:9.1.6.2]

507.11 Process Air. In addition to air needed for combustion in commercial or industrial processes, process air shall be provided as required for cooling of appliances, equipment, or material; for controlling dew point, heating, drying, oxidation, dilution, safety exhaust, odor control, and air for compressors; and for comfort and proper working conditions for personnel. [NFPA 54:9.1.7]

507.12 Flammable Vapors. Appliances shall not be installed in areas where the open use, handling, or dispensing of flammable liquids occurs, unless the design, operation, or installation reduces the potential of ignition of the flammable vapors. Appliances installed in compliance with Section 507.13 through Section 507.15 shall be considered to comply with the intent of this provision. [NFPA 54:9.1.9]

507.13 Installation in Residential Garages. Appliances in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit shall be installed so that all heating elements, switches, burners, and burner-ignition devices are located not less than 18 inches (457 mm) above the floor, unless Exception: Listed as flammable vapor ignition resistant (FVIR) appliances. [NFPA 54:9.1.10.4]

507.13.1 Physical Damage. Appliances installed in garages, warehouses, or other areas subject to mechanical damage shall be guarded against such damage by being installed behind protective barriers or by being elevated or located out of the normal path of vehicles.

507.13.2 Access from the Outside. Where appliances are installed in a separate, enclosed space having access only from outside of the garage, such appliances shall be permitted to be installed at floor level, providing the required combustion air is taken from the exterior of the garage. [NFPA 54:9.1.10.3]


507.14.1 Parking Structures. Appliances installed in enclosed, basement, and underground parking structures shall be installed in accordance with NFPA 88A. [NFPA 54:9.1.11.1]

507.14.2 Repair Garages. Appliances installed in repair garages shall be installed in accordance with NFPA 30A. [NFPA 54:9.1.11.2]

507.15 Installation in Aircraft Hangars. Heaters in aircraft hangars shall be installed in accordance with NFPA 409. [NFPA 54:9.1.12]

507.16 Venting of Flue Gases. Appliances shall be vented in accordance with the provisions of Section 509.0. [NFPA 54:9.1.14]

507.17 Extra Device or Attachment. No device or attachment shall be installed on any appliance that could in any way impair the combustion of gas. [NFPA 54:9.1.15]

507.18 Adequate Capacity of Piping-Addition to Existing System. When additional appliances are being connected to a gas piping system, the existing piping shall be checked to determine whether it has adequate capacity. Where the capacity of the system is determined to be inadequate for the additional appliance, the existing system shall be enlarged as necessary, or separate gas piping of adequate capacity shall be run from the point of delivery to the appliance provided. [NFPA 54:9.1.16.5.1.2]

507.19 Avoiding Strain on Gas Piping. Appliances shall be supported and connected to the piping so as not to exert undue strain on the connections. [NFPA 54:9.1.17.9.1.16]

507.20 Gas Appliance Pressure Regulators. Where the gas supply pressure is higher than that at which the appliance is designed to operate or varies beyond the design pressure limits of the appliance, a gas appliance pressure regulator listed in accordance with ANSI Z21.18/CSA 6.3 shall be installed. [NFPA 54:9.1.18.9.1.17]

507.21 Venting of Gas Appliance Pressure Regulators. Venting of gas appliance pressure regulators shall comply with the following requirements:

1. Appliance pressure regulators requiring access to the atmosphere for successful operation shall be equipped with vent piping leading outdoors or, if the regulator vent is an integral part of the appliance, into the combustion chamber adjacent to a continuous pilot, unless constructed or equipped with a vent limiting means to limit the escape of gas from the vent opening in the event of diaphragm failure.

2. Vent limiting means shall be employed on listed appliance pressure regulators only.

3. In the case of vents leading outdoors, means shall be employed to prevent water from entering the vent piping and also to prevent blockage of vents by insects and foreign matter.

4. Under no circumstances shall a regulator be vented to the appliance flue or exhaust system.

5. In the case of vents entering the combustion chamber, the vent shall be located in the escaping gas is readily ignited by the pilot and the heat liberated thereby does not adversely affect the normal operation of the safety shutoff system. The terminus of the vent shall be securely held in a fixed position relative to the pilot. For manufactured gas, the need for a flame arrester in the vent piping shall be determined.

6. A vent line(s) from an appliance pressure regulator and a bleed line(s) from a diaphragm-type valve shall not be connected to a common manifold terminating in a com-
507.22—507.21 Bleed Lines for Diaphragm-Type Valves. Bleed lines shall comply with the following requirements:

1. Diaphragm-type valves shall be equipped to convey bleed gas to the outdoors or into the combustion chamber adjacent to a continuous pilot.

2. In the case of bleed lines leading outdoors, means shall be employed to prevent water from entering this piping and also to prevent blockage of vents by insects and foreign matter.

3. Bleed lines shall not terminate in the appliance flue or exhaust system.

4. In the case of bleed lines entering the combustion chamber, the bleed line shall be located so the bleed gas is readily ignited by the pilot and the heat liberated thereby does not adversely affect the normal operation of the safety shutoff system. The terminus of the bleed line shall be securely held in a fixed position relative to the pilot. For manufactured gas, the need for a flame arrester in the bleed line piping shall be determined.

5. A bleed line(s) from a diaphragm-type valve and a vent line(s) from an appliance pressure regulator shall not be connected to a common manifold terminating in a combustion chamber. Bleed lines shall not terminate in positive-pressure-type combustion chambers. [NFPA 54:9.1.18]

507.23 Combination of Appliances and Equipment. Any combination of appliances, equipment, attachments, or devices used together in any manner shall comply with the standards that apply to the individual appliance and equipment. [NFPA 54:9.1.20]

507.24 Installation Instructions. The installing agency installer shall conform to the appliance and equipment manufacturer’s recommendations in completing an installation. The installing agency installer shall leave the manufacturer’s installation, operating, and maintenance instructions in a location on the premises where they are readily available for reference and guidance of the Authority Having Jurisdiction, service personnel, and the owner or operator. [NFPA 54:9.2.1]

507.25 Protection of Outdoor Appliances. Appliances not listed for outdoor installation but installed outdoors shall be provided with protection to the degree that the environment requires. Appliances listed for outdoor installation shall be permitted to be installed without protection in accordance with the provisions of the listing and the manufacturer’s installation instructions. [NFPA 54:9.2.1]

507.26 Accessibility for Service. All appliances shall be located with respect to building construction and other equipment so as to permit access to the appliance for repair or replacement of the appliance. Sufficient clearance shall be maintained to permit removal of the appliance; cleaning of heating surfaces; the replacement of filters, blowers, motors, burners, controls, and vent connections; the lubrication of moving parts where necessary; the adjustment and cleaning of burners and pilots; and the proper functioning of explosion vents, if provided. For attic installation, the passageway and servicing area adjacent to the appliance shall be floored in accordance with Section 508.4. [NFPA 54:9.2.1]

Unless otherwise specified, clearances of not less than 30 inches (762 mm) in depth, width, and height of working space shall be maintained.

507.27—507.26 Clearance to Combustible Materials. Appliances and their vent connectors shall be installed with clearances from combustible material so their operation does not create a hazard to persons or property. Minimum clearances between combustible walls and the back and sides of various conventional types of appliances and their vent connectors are specified in Section 509.0. [NFPA 54:9.2.2]

508.0 Appliances on Roofs, in Attics or Under-Floor Spaces.

508.1 General. Appliances on roofs shall be designed or enclosed so as to withstand climatic conditions in the area in which they are installed. Where enclosures are provided, each enclosure shall permit easy entry and movement, shall be of reasonable height, and shall have at least a 30 inch (762 mm) clearance between the entire service access panel(s) of the appliance, and the wall of the enclosure. [NFPA 54:9.4.1.1]

508.1.1 Load Capacity. Roofs on which appliances are to be installed shall be capable of supporting the additional load or shall be reinforced to support the additional load. [NFPA 54:9.4.1.2]

508.1.2 Fasteners. All access locks, screws, and bolts shall be of corrosion-resistant material. [NFPA 54:9.4.1.3]

508.2 Installation of Appliances on Roofs. Appliances shall be installed in accordance with the manufacturer’s installation instructions. [NFPA 54:9.4.2.1]

508.2.1 Edge of Roof Clearance. Appliances shall be installed on a well-drained surface of the roof. At least 6 feet (1829 mm) of clearance shall be available between any part of the appliance and the edge of a roof or similar hazard, or rigidly fixed rails, guards, parapets, or other building structures at least 42 inches (1067 mm) in height shall be provided on the exposed side. [NFPA 54:9.4.2.2]

508.2.1.1 Guards and Rails. Guards or rails shall be required where the following exist:

1. The clearance between the appliance and a roof edge or open end of an equipment platform is less than 6 feet (1829 mm).

2. The open end of the equipment platform is located more than 30 inches (762 mm) above the roof, floor, or grade below.

Where guards or rails are installed, they shall be constructed so as to prevent the passage of a 21 inch (533 mm) diameter ball, resist the imposed loading conditions, and shall extend not less than 30 inches (762 mm) beyond each side of the equipment or appliance.
A readily accessible electrical disconnecting means shall be accessible through an opening and passageway, not less than as large as 22 inches by 24 inches (559 mm by 610 mm) in size, shall open easily permitted in Section 509.2.1 through Section 509.2.7, all appliances requiring an external source of electrical power for operation shall be installed in accordance with NFPA 70, provided with the following:

1. A readily accessible electrical disconnecting means within sight of the appliance that completely de-energizes the appliance.
2. A 120 V ac grounding type receptacle outlet on the roof adjacent to the appliance on the supply side of the disconnect switch. [NFPA 54:9.4.2.3]

508.2.3 Platform or Walkway. Where water stands on the roof at the appliance or in the passageways to the appliance, or where the roof is of a design having a water seal, a suitable platform, walkway, or both shall be provided above the water line. Such platform(s) or walkway(s) shall be located adjacent to the appliance and control panels so that the appliance can be safely serviced where water stands on the roof. [NFPA 54:9.4.2.4]

508.3 Appliances on Roofs. Appliances located on roofs or other elevated locations shall be accessible. [NFPA 54:9.4.3.1]

508.3.1 Access. Buildings of more than 15 feet (4572 mm) in height shall have an inside means of access to the roof, unless other means acceptable to the Authority Having Jurisdiction are used. [NFPA 54:9.4.3.2]

508.3.2 Access Type. The inside means of access shall be a permanent or foldaway inside stairway or ladder, terminating in an enclosure, scuttle, or trapdoor. Such scuttles or trapdoors shall be at least 22 inches by 24 inches (559 mm by 610 mm) in size, shall open easily and safely under all conditions, especially snow, and shall be constructed so as to permit access from the roof side unless deliberately locked on the inside.

At least 6 feet (1829 mm) of clearance shall be available between the access opening and the edge of the roof or similar hazard, or rigidly fixed rails or guards a minimum of 42 inches (1067 mm) in height shall be provided on the exposed side. Where parapets or other building structures are utilized in lieu of guards or rails, they shall be a minimum of 42 inches (1067 mm) in height. [NFPA 54:9.4.3.3]

508.3.3 Permanent Lighting. Permanent lighting shall be provided at the roof access. The switch for such lighting shall be located inside the building near the access means leading to the roof. [NFPA 54:9.4.3.4]

508.4 Appliances in Attics and Under-Floor Spaces. An attic or under-floor space in which an appliance is installed shall be accessible through an opening and passageway, not less than as large as larger than the largest component of the appliance, and not less than 22 inches by 30 inches (559 mm by 762 mm). [NFPA 54:9.4.5.1]

508.4.1 Length of Passageway. Where the height of the passageway is less than 6 feet (1829 mm), the distance from the passageway access to the appliance shall not exceed 20 feet (6096 mm) measured along the centerline of the passageway. [NFPA 54:9.5.1.1] Where the height of the passageway is 6 feet (1829 mm) or more, the distance from the passageway access to the appliance shall not exceed 50 feet (15 240 mm) measured along the centerline of the passageway.

508.4.2 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 appliance. [NFPA 54:9.5.1.2]

508.4.3 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 appliance. [NFPA 54:9.5.2]

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

509.0 Venting of Appliances.

509.1 Listing. Type B and Type B-W gas vents shall comply with UL 441, and Type L gas vents shall comply with UL 641.

509.1.1 Installation. Listed chimneys and vents shall be installed in accordance with Section 509.0 and the manufacturer's installation instructions. [NFPA 54:12.2.1]

509.1.2 Prohibited Discharge. Appliance vents shall not discharge into a space enclosed by screens having openings less than ¼ of an inch (6.4 mm) mesh.

509.2 Connection to Venting Systems. Except as permitted in Section 509.2.1 through Section 509.2.7, all appliances shall be connected to venting systems. [NFPA 54:12.3.1]

509.2.2 Appliances Not Required to be Ventilated. The following appliances shall not be required to be vented:

1. A single listed booster-type (automatic instantaneous) water heater, when designed and used solely for the sanitizing rinse requirements of a dishwashing machine, provided that the appliance is installed with the draft hood in place and unaltered, if a draft hood is required, in a commercial kitchen having a mechanical exhaust system. [Where installed in this manner, the draft hood outlet shall not be less than 36 inches (914 mm) vertically and 6 inches (152 mm) horizontally from any surface other than the appliance.] [NFPA 54:12.3.2(5)]

2. Other appliances listed for unvented use and not provided with flue collars. [NFPA 54:12.3.2(10)]

509.2.2 Maximum Input Rating. Where any or all of the appliances in Section 509.2.1(1) and Section 509.2.1(2) are installed so the aggregate input rating exceeds 20 (Btu/hr) (207 W/m²) of room or space in which it is installed, one or more shall be provided with venting systems or other approved means for conveying the vent gases to the outdoors so that the aggregate input
rating of the remaining unvented appliances does not exceed 20 (Btu/h)/ft³ (207 W/m³). [NFPA 54:12.3.2.1]

509.2.3 Adjacent Room or Space. Where the calculation includes the volume of an adjacent room or space, the room or space in which the appliances are installed shall be directly connected to the adjacent room or space by a doorway, archway, or other opening of comparable size that cannot be closed. [NFPA 54:12.3.2.2]

509.2.4 Ventilating Hoods. The use of ventilating hoods and exhaust systems to vent appliances shall be limited to industrial appliances and appliances installed in commercial applications. [NFPA 54:12.3.4]

509.2.5 Well-Ventilated Spaces. The flue gases from industrial-type appliances shall not be required to be vented to the outdoors where such gases are discharged into a large and well-ventilated industrial space. [NFPA 54:12.3.5]

509.2.6 Direct-Vent Appliances. Listed direct-vent appliances shall be installed in accordance with the manufacturer’s installation instructions and Section 509.8.2. [NFPA 54:12.3.5.1]

509.2.6.1 Through-the-Wall Vent Termination. Through-the-wall vent terminations for listed direct-vent appliances shall be in accordance with Section 509.8.1. [NFPA 54:12.3.5.2]

509.2.7 Appliances with Integral Vents. Appliances incorporating integral venting means shall be installed in accordance with the manufacturer’s installation instructions. Section 509.8 and Section 509.8.4. [NFPA 54:12.3.6]

509.3 Minimum Safe Performance. Venting systems shall be designed and constructed to convey all flue and vent gases to the outdoors. [NFPA 54:12.1]

509.3.1 Appliance Draft Requirements. A venting system shall satisfy the draft requirements of the appliance in accordance with the manufacturer’s instructions. [NFPA 54:12.4.1]

509.3.2 Appliance Venting Requirements. Appliances required to be vented shall be connected to a venting system designed and installed in accordance with the provisions of Section 509.4 through Section 509.15. [NFPA 54:12.4.2]

509.3.3 Mechanical Draft Systems. Mechanical draft systems shall be listed in accordance with UL 378 and installed in accordance with both the appliance and the mechanical draft system manufacturer’s installation instructions. [NFPA 54:12.4.3.1]

509.3.3.1 Venting. Appliances requiring venting shall be permitted to be vented by means of mechanical draft systems of either forced or induced draft design. [NFPA 54:12.4.3.2]

509.3.3.2 Leakage. Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to prevent leakage of flue or vent gases into a building. [NFPA 54:12.4.3.3]

509.3.3.3 Vent Connectors. Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure. [NFPA 54:12.4.3.4]

509.3.3.4 Operation. Where a mechanical draft system is employed, provision shall be made to prevent the flow of gas to the main burners when the draft system is not performing so as to satisfy the operating requirements of the appliance for safe performance. [NFPA 54:12.4.3.5]

509.3.3.5 Exit Terminals. The exit terminals of mechanical draft systems shall not be less than 7 feet (2134 mm) above finished ground level where located adjacent to public walkways and shall be located as specified in Section 509.8 and Section 509.8.1. [NFPA 54:12.4.3.6]

509.3.4 Ventilating Hoods and Exhaust Systems. Where automatically operated appliances, other than commercial cooking/hot food service appliances, are vented through a ventilating hood or exhaust system equipped with a damper or with a power means of exhaust, provisions shall be made to allow the flow of gas to the main burners only when the damper is open to a position to properly vent the appliance and when the power means of exhaust is in operation. [NFPA 54:12.4.4.1]

509.3.5 Circulating Air Ducts, Above-Ceiling Air-Handling Spaces, and Furnace Plenums. Venting systems shall not extend into or pass through any fabricated air duct or furnace plenum. [NFPA 54:12.4.5.1]

509.3.6 Above-Ceiling or Nonducted Air Handling System. Where a venting system passes through an above-ceiling air space or other nonducted portion of an air-handling system, it shall conform to one of the following requirements:

1. The venting system shall be a listed special gas vent, other system serving a Category III or Category IV appliance, or other positive pressure vent, with joints sealed in accordance with the appliance or vent manufacturer’s instructions.

2. The vent system shall be installed such that no fittings or joints between sections are installed in the above-ceiling space.

3. The venting system shall be installed in a conduit or enclosure with joints between the interior of the enclosure and the ceiling space sealed. [NFPA 54:12.4.5.2]

509.4 Type of Venting System to be Used. The type of venting system to be used shall be in accordance with Table 509.4. [NFPA 54:12.5.1]

509.4.1 Plastic Piping. Where plastic piping is used to vent an appliance, the appliance shall be listed for use with such venting materials and the appliance manufacturer’s installation instructions shall identify the specific plastic piping material. The plastic pipe venting materials shall be labeled in accordance with the product standards specified by the appliance manufacturer or shall be listed and labeled in accordance with UL 1738. [NFPA 54:12.5.2]
509.5 Masonry, Metal, and Factory-Built Chimneys. Chimneys shall be installed in accordance with Section 509.5.1 through Section 509.5.3.

509.5.1 Factory-Built Chimneys. Factory-built chimneys shall be listed in accordance with UL 103, UL 959, or UL 2561. Factory-built chimneys shall be installed in accordance with the manufacturer’s installation instructions. Factory-built chimneys used to vent appliances that operate at positive vent pressure shall be listed for such application. [NFPA 54:12.6.1.1]

509.5.1.1 Decorative Shrouds. Decorative shrouds addressed in Section 509.5.4.3 shall comply with UL 103 for factory-built residential chimneys.

509.5.2 Metal Chimneys. Metal chimneys shall be built and installed in accordance with NFPA 211. [NFPA 54:12.6.1.2]

509.5.3 Masonry Chimneys. Masonry chimneys shall be built and installed in accordance with NFPA 211 and lined with one of the following:

1. Approved clay flue lining
2. A chimney lining system listed and labeled in accordance with UL 1777
3. Other approved material that resists corrosion, erosion, softening, or cracking from vent gases at temperatures up to 1800°F (982°C)

Exception: Masonry chimney flues lined with a chimney lining system specifically listed for use with listed appliances with draft hoods, Category I appliances, and other appliances listed for use with Type B vents shall be permitted. The liner shall be installed in accordance with the liner manufacturer’s installation instructions. A permanent identifying label shall be attached at the point where the connection is to be made to the liner. The label shall read “This chimney liner is for appliances that burn gas only. Do not connect to solid or liquid fuel-burning appliances or incinerators.” [NFPA 54:12.6.1.3]

509.5.4 Termination. A chimney for residential-type or low-heat appliances shall extend at least 3 feet (914 mm) above the highest point where it passes through a roof of a building and at least 2 feet (610 mm) higher than any portion of a building within a horizontal distance of 10 feet (3048 mm). [NFPA 54:12.6.2.1] (See Figure 509.5.4)

509.5.4.1 Medium-Heat Gas Appliances. A chimney for medium-heat appliances shall extend at least 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm). [NFPA 54:12.6.2.2]

509.5.4.2 Chimney Height. A chimney shall extend at least 5 feet (1524 mm) above the highest connected appliance draft hood outlet or flue collar. [NFPA 54:12.6.2.3]

509.5.4.3 Decorative Shrouds. Decorative shrouds shall not be installed at the termination of factory-built chimneys except where such shrouds

509.4.2 Plastic Vent Joints. Plastic pipe and fittings used to vent appliances shall be installed in accordance with the appliance manufacturer’s installation instructions. Plastic pipe venting materials listed and labeled in accordance with UL 1738 shall be installed in accordance with the vent manufacturer’s installation instructions. Where primer is required, it shall be of a contrasting color. [NFPA 54:12.5.3]

509.4.3 Special Gas Vents. Special gas vents shall be listed and labeled in accordance with UL 1738 and installed in accordance with the special gas vent manufacturer’s installation instructions. [NFPA 54:12.5.4]
are listed and labeled for use with the specific factory-built chimney system and are installed in accordance with the manufacturer’s installation instructions. [NFPA 54:12.6.2.4]

**509.5.5 Size of Chimneys.** The effective area of a chimney venting system serving listed appliances with draft hoods, Category I appliances, and other appliances listed for use with Type B vents shall be in accordance with one of the following methods:

1. Those listed in Section 510.0.
2. For sizing an individual chimney venting system for a single appliance with a draft hood, the effective areas of the vent connector and chimney flue of a venting system serving a single appliance with a draft hood shall be not less than the area of the appliance flue collar or draft hood outlet or greater than seven times the draft hood outlet area.
3. For sizing the effective area of the chimney flue of a chimney venting system serving two appliances with draft hoods, the effective area of the chimney flue shall be not less than the area of the larger draft hood outlet plus 50 percent of the area of the smaller draft hood outlet or greater than seven times the smaller draft hood outlet area.
4. Chimney venting systems using mechanical draft shall be sized in accordance with approved engineering methods.
5. Other approved engineering methods. [NFPA 54:12.6.3.1]

**509.5.6 Inspection of Chimneys.** Before replacing an existing appliance or connecting a vent connector to a chimney, the chimney passageway shall be examined to ascertain that it is clear and free of obstructions and shall be cleaned if previously used for venting solid or liquid fuel-burning appliances or fireplaces. [NFPA 54:12.6.4.1]

**509.5.6.1 Standard.** Chimneys shall be lined in accordance with NFPA 211.

Exception: Existing chimneys shall be permitted to have their use continued when an appliance is replaced by an appliance of similar type, input rating, and efficiency, where the chimney complies with Section 509.5.6 through Section 509.5.6.3 and the sizing of the chimney is in accordance with Section 509.5.5. [NFPA 54:12.6.4.2]

**509.5.6.2 Cleanouts.** Cleanouts shall be examined and where they do not remain tightly closed when not in use, they shall be repaired or replaced. [NFPA 54:12.6.4.3]

**509.5.6.3 Existing Chimney.** When inspection reveals that an existing chimney is not safe for the intended application, it shall be repaired, rebuilt, lined, relined, or replaced with a vent or chimney to conform to NFPA 211 and shall be suitable for the appliances to be attached. [NFPA 54:12.6.4.4]

**509.5.7 Chimney Serving Appliances Burning Other Fuels.** An appliance shall not be connected to a
chimney flue serving a separate appliance designed to burn solid fuel. [NFPA 54:12.6.5.1]

509.5.7.1 Gas and Liquid Fuel-Burning Appliances. Where one chimney serves gas appliances and liquid fuel-burning appliances, the appliances shall be connected through separate openings or connected through a single opening where joined by a suitable fitting located as close as practical to the chimney. Where two or more openings are provided into one chimney flue, they shall be at different levels. Where the gas appliance is automatically controlled, it shall be equipped with a safety shutoff device. [NFPA 54:12.6.5.2]

509.5.7.2 Gas and Solid Fuel-Burning Appliances. A listed combination gas- and solid-fuel-burning appliance connected to a single chimney flue shall be equipped with a manual reset device to shut off gas to the main burner in the event of sustained backdraft or flue gas spillage. The chimney flue shall be sized to properly vent the appliance. [NFPA 54:12.6.5.3]

509.5.7.3 Combination Gas- and Oil-Burning Appliances. A single chimney flue serving a listed combination gas- and oil-burning appliance shall be sized in accordance with the appliance manufacturer’s instructions. [NFPA 54:12.6.5.4]

509.5.8 Support of Chimneys. All portions of chimneys shall be supported for the design and weight of the materials employed. Listed factory-built chimneys shall be supported and spaced in accordance with the manufacturer’s installation instructions. [NFPA 54:12.6.6]

509.5.9 Cleanouts. Where a chimney that formerly carried flue products from liquid or solid fuel-burning appliances is used with an appliance using fuel gas, an accessible cleanout shall be provided. The cleanout shall have a tight-fitting cover and be installed so its upper edge is at least 6 inches (152 mm) below the lower edge of the lowest chimney inlet opening. [NFPA 54:12.6.7]

509.5.10 Space Surrounding Lining or Vent. The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry chimney shall not be used to vent another appliance.

Exception: The insertion of another liner or vent within the chimney as provided in this code and the liner or vent manufacturer’s instructions. [NFPA 54:12.6.8.1]

509.5.10.1 Combustion Air. The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry, metal, or factory-built chimney flue shall not be used to supply combustion air.

Exception: Direct-vent appliances designed for installation in a solid fuel-burning fireplace where installed in accordance with the manufacturer’s installation instructions. [NFPA 54:12.6.8.2]

509.6 Gas Vents. The installation of gas vents shall meet the following requirements:

1. Gas vents shall be installed in accordance with the manufacturer’s installation instructions.
2. A Type B-W gas vent shall have a listed capacity not less than that of the listed vented wall furnace to which it is connected.
3. Gas vents installed within masonry chimneys shall be installed in accordance with the manufacturer’s installation instructions. Gas vents installed within masonry chimneys shall be identified with a permanent label installed at the point where the vent enters the chimney. The label shall contain the following language: “This gas vent is for appliances that burn gas. Do not connect to solid or liquid fuel-burning appliances or incinerators.”
4. Screws, rivets, and other fasteners shall not penetrate the inner wall of double-wall gas vents, except at the transition from the appliance draft hood outlet, flue collar, or single-wall metal connector to a double-wall vent. [NFPA 54:12.5.7]

509.6.1 Gas Vent Termination. The termination of gas vents shall comply with the following requirements:

(a) Gas vents that are 12 inches (300 mm) or less in size and located not less than 8 feet (2438 mm) from a vertical wall or similar obstruction shall terminate above the roof in accordance with Figure 509.6.1 and Table 509.6.1.
(b) Gas vents that are over 12 inches (300 mm) in size or are located less than 8 feet (2438 mm) from a vertical wall or similar obstruction shall terminate not less than 2 feet (610 mm) above the highest point where they pass through the roof and not less than 2 feet (610 mm) above any portion of a building within 10 feet (3048 mm) horizontally.
(c) Industrial appliances as provided in Section 509.2.5.
(d) Direct-vent systems as provided in Section 509.2.6.
(e) Appliances with integral vents as provided in Section 509.2.7.
(f) Mechanical draft systems as provided in Section 509.3.3 through Section 509.3.3.5.
(g) Ventilating hoods and exhaust systems as provided in Section 509.3.4.

(2) A Type B or a Type L gas vent shall terminate at least 5 feet (1524 mm) in vertical height above the highest connected appliance draft hood or flue collar.

(3) A Type B-W gas vent shall terminate at least 12 feet (3658 mm) in vertical height above the bottom of the wall furnace.
A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below eaves or parapets, except as provided in Section 509.2.6 and Section 509.3.3 through Section 509.3.3.4.

Decorative shrouds shall not be installed at the termination of gas vents except where such shrouds are listed for use with the specific gas venting system and are installed in accordance with the manufacturer’s installation instructions.

All gas vents shall extend through the roof flashing, roof jack, or roof thimble and terminate with a listed cap or listed roof assembly.

A gas vent shall terminate at least 3 feet (914 mm) above a forced air inlet located within 10 feet (3048 mm). [NFPA 54:12.7.3]

509.6.1 Insulation Protection Shield. Where a vent passes through an insulated assembly, an approved metal shield constructed of steel having a thickness of not less than 26 gauge shall be installed between the vent and insulation. The shield shall extend not less than 2 inches (51 mm) above the insulation and be secured to the structure in accordance with the manufacturer’s installation instructions.

509.6.2 Size of Gas Vents. Venting systems shall be sized and constructed in accordance with Section 509.6.2.1 through Section 509.6.2.3 and the appliance manufacturer’s instructions. [NFPA 54:12.7.4]

509.6.2.1 Category I Appliances. The sizing of natural draft venting systems serving one or more listed appliances equipped with a draft hood or appliances listed for use with a Type B gas vent, installed in a single story of a building, shall be in accordance with one of the following:

1. The provisions of Section 510.0.
2. Vents serving fan-assisted combustion system appliances, or combinations of fan-assisted combustion system and draft hood-equipped appliances, shall be sized in accordance with Section 510.0 or other approved engineering methods.
3. For sizing an individual gas vent for a single, draft hood-equipped appliance, the effective area of the vent connector and the gas vent shall be not less than the area of the appliance draft hood outlet or greater than seven times the draft hood outlet area.
4. For sizing a gas vent connected to two appliances with draft hoods, the effective area of the vent shall be not less than the area of the larger draft hood outlet plus 50 percent of the area of the smaller draft hood outlet or greater than seven times the smaller draft hood outlet area.
5. Other approved engineering practices. [NFPA 54:12.7.4.1]

509.6.2.2 Vent Offsets. Type B and Type L vents sized in accordance with Section 509.6.2.1(3) or Section 509.6.2.1(4) shall extend in a generally vertical direction with offsets not exceeding 45 degrees (0.79 rad), except that a vent system having not more than one 60 degree (1.05 rad) offset shall be permitted. Any angle greater than 45 degrees (0.79 rad) from the vertical is considered horizontal. The total horizontal distance of a vent plus the horizontal vent connector serving draft hood-equipped appliances shall not be greater than 75 percent of the vertical height of the vent. [NFPA 54:12.7.4.2]

509.6.2.3 Category II, Category III, and Category IV Appliances. The sizing of gas vents for Category II, Category III, and Category IV appliances shall be in accordance with the appliance manufacturer’s instructions. The sizing of plastic pipe

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

<table>
<thead>
<tr>
<th>ROOF SLOPE</th>
<th>H (minimum) (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat to ½</td>
<td>1.0</td>
</tr>
<tr>
<td>Over ½ to 7⁄12</td>
<td>1.25</td>
</tr>
<tr>
<td>Over 7⁄12 to 9⁄12</td>
<td>1.5</td>
</tr>
<tr>
<td>Over 9⁄12 to 13⁄12</td>
<td>2.0</td>
</tr>
<tr>
<td>Over 13⁄12 to 15⁄12</td>
<td>2.5</td>
</tr>
<tr>
<td>Over 15⁄12 to 19⁄12</td>
<td>3.25</td>
</tr>
<tr>
<td>Over 19⁄12 to 21⁄12</td>
<td>4.0</td>
</tr>
<tr>
<td>Over 21⁄12 to 25⁄12</td>
<td>5.0</td>
</tr>
<tr>
<td>Over 25⁄12 to 29⁄12</td>
<td>6.0</td>
</tr>
<tr>
<td>Over 29⁄12 to 31⁄12</td>
<td>7.0</td>
</tr>
<tr>
<td>Over 31⁄12 to 33⁄12</td>
<td>7.5</td>
</tr>
<tr>
<td>Over 33⁄12 to 35⁄12</td>
<td>8.0</td>
</tr>
</tbody>
</table>

TABLE 509.6.1 ROOF SLOPE HEIGHTS [NFPA 54: TABLE 12.7.3]
specified by the appliance manufacturer as a venting material for Category II, III, and IV appliances shall be in accordance with the appliance manufacturers’ instructions. [NFPA 54:12.7.4.3]

509.6.2.4 Sizing. Chimney venting systems using mechanical draft shall be sized in accordance with approved engineering methods. [NFPA 54:12.7.4.4]

509.6.3 Gas Vents Serving Appliances on More than One Floor. A common vent shall be permitted in a multistory installation to vent Category I appliances located on more than one floor level, provided the venting system shall be designed and installed in accordance with approved engineering methods. For the purpose of this section, crawl spaces, basements, and attics shall be considered as floor levels. [NFPA 54:12.7.5.1]

509.6.3.1 Occupiable Space. All appliances connected to the common vent shall be located in rooms separated from occupiable space. Each of these rooms shall have provisions for an adequate supply of combustion, ventilation, and dilution air that is not supplied from occupiable space. [NFPA 54:12.7.5.2] (See Figure 509.6.3.1)

509.6.3.2 Multistory Venting System. The size of the connectors and common segments of multistory venting systems for appliances listed for use with a Type B double-wall gas vent shall be in accordance with Table 510.2(1), provided all of the following apply:

1. The available total height \( H \) for each segment of a multistory venting system is the vertical distance between the level of the highest draft hood outlet or flue collar on that floor and the centerline of the next highest interconnection tee.

2. The size of the connector for a segment is determined from the appliance’s gas input rate and available connector rise and shall not be smaller than the draft hood outlet or flue collar size.

3. The size of the common vertical vent segment, and of the interconnection tee at the base of that segment, is based on the total appliance’s gas input rate entering that segment and its available total height. [NFPA 54:12.7.5.3]

509.6.4 Support of Gas Vents. Gas vents shall be supported and spaced in accordance with the manufacturer’s installation instructions. [NFPA 54:12.7.6]

509.6.5 Marking. In those localities where solid and liquid fuels are used extensively, gas vents shall be permanently identified by a label attached to the wall or ceiling at a point where the vent connector enters the gas vent. The label shall read: “This gas vent is for appliances that burn gas. Do not connect to solid or liquid fuel-burning appliances or incinerators.” The Authority Having Jurisdiction shall determine whether its area constitutes such a locality. [NFPA 54:12.7.7]

509.7 Single-Wall Metal Pipe. Single-wall metal pipe shall be constructed of galvanized sheet steel not less than 0.0304 of an inch (0.7722 mm) thick or of other approved, noncombustible, corrosion-resistant material. [NFPA 54:12.8.1]

509.7.1 Cold Climate. Uninsulated single-wall metal pipe shall not be used outdoors for venting appliances in regions where the 99 percent winter design temperature is below 32°F (0°C). [NFPA 54:12.8.2]

509.7.2 Termination. The termination of single-wall metal pipe shall meet the following requirements:

1. Single-wall metal pipe shall terminate at least 5 feet (1524 mm) in vertical height above the highest connected appliance draft hood outlet or flue collar. [NFPA 54:12.8.3(1)]

2. Single-wall metal pipe shall extend at least 2 feet (610 mm) above the highest point where it passes through a roof of a building and at least 2 feet (610 mm) higher than any portion of a building within a horizontal distance of 10 feet (3048 mm). [NFPA 54:12.8.3(2)] (See Figure 509.5.4)

3. An approved cap or roof assembly shall be attached to the terminus of a single-wall metal pipe. [NFPA 54:12.8.3(3)]

509.7.3 Installation with Appliances Permitted by Section 509.4. Single-wall metal pipe shall not be used as a vent in dwellings and residential occupancies. [NFPA 54:12.8.4.1]

509.7.3.1 Limitations. Single-wall metal pipe shall be used only for runs directly from the space in which the appliance is located through the roof or exterior wall to the outer air. A pipe passing through a roof shall extend without interruption through the roof flashing, roof jacket, or roof thimble. [NFPA 54:12.8.4.2]
509.7.3.2 Attic or Concealed Space. Single-wall metal pipe shall not originate in any unoccupied attic or concealed space and shall not pass through any attic, inside wall, concealed space, or floor. [NFPA 54:12.8.4.3]

509.7.3.3 Incinerator. Single-wall metal pipe used for venting an incinerator shall be exposed and readily examinable for its full length and shall have required clearances maintained.

509.7.3.4 Clearances. Minimum clearances from single-wall metal pipe to combustible material shall be in accordance with Table 509.7.3.4(1). Reduced clearances from single-wall metal pipe to combustible material shall be as specified for vent connectors in Table 509.7.3.4(2). [NFPA 54:12.8.4.4]

509.7.3.5 Combustible Exterior Wall. Single-wall metal pipe shall not pass through a combustible exterior wall unless guarded at the point of passage by a ventilated metal thimble not smaller than the following:

1. For listed appliances with draft hoods and appliances listed for use with Type B gas vents, the thimble shall be a minimum of 4 inches (100 mm) larger in diameter than the metal pipe. Where there is a run of not less than 6 feet (1829 mm) of metal pipe in the opening between the draft hood outlet and the thimble, the thimble shall be a minimum of 2 inches (50 mm) larger in diameter than the metal pipe.
2. For unlisted appliances having draft hoods, the thimble shall be a minimum of 6 inches (150 mm) larger in diameter than the metal pipe.
3. For residential and low-heat appliances, the thimble shall be a minimum of 12 inches (300 mm) larger in diameter than the metal pipe.

Notes:
1. A – Equals the clearance with no protection specified in Table 509.7.3.4(1) and Table 509.7.3.4(2) in the sections applying to various types of equipment.
2. B – Equals the reduced clearance permitted in accordance with Table 509.7.3.4(2).
3. The protection applied to the construction using combustible material shall extend far enough in each direction to make C equal to A.

For SI units: 1 inch = 25.4 mm

Note: Masonry walls shall be attached to combustible walls using wall ties. Spacers shall not be used directly behind appliance or connector.
TABLE 509.7.3.4(1)
CLEARANCES FOR CONNECTORS
[NFPA 54: TABLE 12.8.4.4]*

<table>
<thead>
<tr>
<th>APPLIANCE</th>
<th>LISTED TYPE B GAS VENT MATERIAL</th>
<th>LISTED TYPE L VENT MATERIAL</th>
<th>SINGLE-WALL METAL PIPE</th>
<th>FACTORY-builtin CHIMNEY SECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed appliances with draft hoods and appliances listed for use with Type B gas vents</td>
<td>As listed</td>
<td>As listed</td>
<td>6</td>
<td>As listed</td>
</tr>
<tr>
<td>Residential boilers and furnaces with listed gas conversion burner and with draft hood</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>As listed</td>
</tr>
<tr>
<td>Residential appliances listed for use with Type L vents</td>
<td>Not permitted</td>
<td>As listed</td>
<td>9</td>
<td>As listed</td>
</tr>
<tr>
<td>Unlisted residential appliances with draft hood</td>
<td>Not permitted</td>
<td>6</td>
<td>9</td>
<td>As listed</td>
</tr>
<tr>
<td>Residential and low-heat appliances other than those above</td>
<td>Not permitted</td>
<td>9</td>
<td>18</td>
<td>As listed</td>
</tr>
<tr>
<td>Medium-heat appliances</td>
<td>Not permitted</td>
<td>Not permitted</td>
<td>36</td>
<td>As listed</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

* These clearances shall apply unless the installation instructions of a listed appliance or connector specify different clearances, in which case the listed clearances shall apply.

**Exception:** In lieu of thimble protection, all combustible material in the wall shall be removed a sufficient distance from the metal pipe to provide the specified clearance from such metal pipe to combustible material. Any material used to close up such opening shall be noncombustible. [NFPA 54:12.8.4.6]

509.7.3.6 Roof Thimble. Where a single-wall metal pipe passes through a roof constructed of combustible material, a noncombustible, nonventilating thimble shall be used at the point of passage. The thimble shall extend at least 18 inches (457 mm) above and 6 inches (152 mm) below the roof with the annular space open at the bottom and closed only at the top. The thimble shall be sized in accordance with Section 509.7.3.5. [NFPA 54:12.8.4.5]

509.7.4 Size of Single-Wall Metal Pipe. Single-wall metal piping shall comply with the following requirements:

(1) A venting system of a single-wall metal pipe shall be sized in accordance with one of the following methods and the appliance manufacturer’s instructions:
   (a) For a draft hood-equipped appliance, in accordance with Section 510.0.
   (b) For a venting system for a single appliance with a draft hood, the areas of the connector and the pipe each shall not be less than the area of the appliance flue collar or draft hood outlet, whichever is smaller. The vent area shall not be greater than seven times the draft hood outlet area.
   (c) Other approved engineering methods.

(2) Where a single-wall metal pipe is used and has a shape other than round, it shall have an equivalent effective area equal to the effective area of the round pipe for which it is substituted and the minimum internal dimension of the pipe shall be 2 inches (50 mm).

(3) The vent cap or a roof assembly shall have a venting capacity not less than that of the pipe to which it is attached. [NFPA 54:12.8.5]

509.7.5 Support of Single-Wall Metal Pipe. All portions of single-wall metal pipe shall be supported for the design and weight of the material employed. [NFPA 54:12.8.6]

509.7.6 Marking. Single-wall metal pipe shall comply with the marking provisions of Section 509.6.5. [NFPA 54:12.8.7]

509.8 Through-the-Wall Vent Termination. A mechanical draft venting system shall terminate at least 2 feet (610 mm) above any forced air inlet located within 10 feet (3048 mm).

(See Figure 509.8). Through-the-wall vent termination shall be in accordance with Section 509.8.1 through Section 509.8.3.

**Exception:**

(1) This provision shall not apply to the combustion air intake of a direct-vent appliance.

(2) This provision shall not apply to the separation of the integral outdoor air inlet and flue gas discharge of listed outdoor appliances. [NFPA 54:12.9.1]

509.8.1 Mechanical Draft Venting System. A mechanical draft venting system of other than direct-vent type shall terminate at least 1 foot (305 mm) above any door, operable window, or gravity air inlet into any building. The bottom of the vent terminal shall be located at least 12 inches (305 mm) above finished ground level. [NFPA 54:12.9.2]

509.8.2 Direct-Vent Appliance 509.8.1 Clearance for Through-the-Wall Vent Termination. The clearances for through-the-wall direct-vent and non-direct vent terminals shall be in accordance with Table 509.8.2 and Figure 509.8.1. The bottom of the vent terminal and the air intake shall be located not less than 12 inches (305 mm) above finished ground level.

**Exception:** The clearances in Table 509.8.1 shall not apply to the combustion air intake of a direct vent appliance. [NFPA 54:12.9.3]
### Table 509.7.4(2)

**REDUCTION OF CLEARANCES WITH SPECIFIED FORMS OF PROTECTION**

[NFPA 54: TABLE 10.2.3-10.2.4]

<table>
<thead>
<tr>
<th>TYPE OF PROTECTION APPLIED TO AND COVERING ALL SURFACES OF COMBUSTIBLE MATERIAL WITHIN THE DISTANCE SPECIFIED AS THE REQUIRED CLEARANCE WITH NO PROTECTION (SEE FIGURE 509.7.3.4(1) THROUGH FIGURE 509.7.3.4(3))</th>
<th>WHERE THE REQUIRED CLEARANCE WITH NO PROTECTION FROM APPLIANCE, VENT CONNECTOR, OR SINGLE-WALL METAL PIPE IS:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>36 (inches)</td>
</tr>
<tr>
<td>ALLOWABLE CLEARANCES WITH SPECIFIED PROTECTION (inches)</td>
<td>ABOVE COLUMN 1</td>
</tr>
<tr>
<td>(1) 3(\frac{1}{2}) inch thick masonry wall without ventilated air space</td>
<td>—</td>
</tr>
<tr>
<td>(2) 1(\frac{1}{2}) of an inch insulation board over 1 inch glass fiber or mineral wool batts</td>
<td>24</td>
</tr>
<tr>
<td>(3) 0.024 inch (nominal 24 gauge) sheet metal over 1 inch glass fiber or mineral wool batts reinforced with wire on rear face with ventilated air space</td>
<td>18</td>
</tr>
<tr>
<td>(4) 3(\frac{1}{2}) inch thick masonry wall with ventilated air space</td>
<td>—</td>
</tr>
<tr>
<td>(5) 0.024 inch (nominal 24 gauge) sheet metal with ventilated air space</td>
<td>18</td>
</tr>
<tr>
<td>(6) 1(\frac{1}{2}) of an inch thick insulation board with ventilated air space</td>
<td>18</td>
</tr>
<tr>
<td>(7) 0.024 inch (nominal 24 gauge) sheet metal with ventilated air space over 0.024 inch (nominal 24 gauge) sheet metal with ventilated air space</td>
<td>18</td>
</tr>
<tr>
<td>(8) 1 inch glass fiber or mineral wool batts sandwiched between two sheets 0.024 inch (nominal 24 gauge) sheet metal with ventilated air space</td>
<td>18</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, °C = (°F-32)/1.8

**Notes:**

1. Reduction of clearances from combustible materials shall not interfere with combustion air, draft hood clearance and relief, and accessibility of servicing.

2. All clearances shall be measured from the outer surface of the combustible material to the nearest point on the surface of the appliance, disregarding any intervening protection applied to the combustible material.

3. Spacers and ties shall be of noncombustible material. No spacer or tie shall be used directly opposite the appliance or connector.

4. Where all clearance reduction systems use a ventilated air space, adequate provision for air circulation shall be provided as described. [See Figure 509.7.3.4(2) and Figure 509.7.4(3)]

5. At least 1 inch (25.4 mm) shall be between clearance reduction systems and combustible walls and ceilings for reduction systems using a ventilated air space.

6. Where a wall protector is mounted on a single flat wall away from corners, it shall have a minimum 1 inch (25.4 mm) air gap. To provide adequate air circulation, the bottom and top edges, or only the side and top edges, or all edges shall be left open.

7. Mineral wool batts (blanket or board) shall have a minimum density of 8 pounds per cubic foot (lb/ft³) (128 kg/m³) and a minimum melting point of 1500°F (816°C).

8. Insulation material used as part of a clearance reduction system shall have a thermal conductivity of 0.06 British thermal unit inch per hour square foot degree Fahrenheit [Btu•in/(h•ft²•°F)] [0.1 W/(m•K)] or less.

9. At least 1 inch (25.4 mm) shall be between the appliance and the protector. The clearance between the appliance and the combustible surface shall not be reduced below that allowed in this table.

10. All clearances and thicknesses are minimum; larger clearances and thicknesses are acceptable.

11. Listed single-wall connectors shall be installed in accordance with the terms of their listing and the manufacturer’s installation instructions.
FIGURE 509.8.1
EXIT TERMINALS OF MECHANICAL DRAFT AND DIRECT-VENT VENTING SYSTEMS
[NFPA 54: FIGURE A.12.9.12.9.1]
509.8.3 Category I through Category IV and Non-categorized Appliances. Through-the-wall vents for Category II and Category IV appliances and non-categorized condensing appliances shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment. Where local experience indicates that condensate is a problem with Category I and Category III appliances, this provision shall also apply.

Drains for condensate shall be installed in accordance with the appliance and the vent manufacturer’s instructions. [NFPA 54:12.9.4]

**TABLE 509.8.1**

<table>
<thead>
<tr>
<th>FIGURE CLEARANCE</th>
<th>CLEARANCE LOCATION</th>
<th>MINIMUM CLEARANCES FOR DIRECT VENT TERMINALS</th>
<th>MINIMUM CLEARANCES FOR NON-DIRECT VENT TERMINALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Clearance above finished grade level, veranda, porch, deck, or balcony</td>
<td>12 inches</td>
<td>12 inches</td>
</tr>
<tr>
<td>B</td>
<td>Clearance to window or door that is openable</td>
<td>6 inches for appliances ≤ 10,000 Btu/hr, 9 inches for appliances &gt; 10,000 Btu/hr ≤ 50,000 Btu/hr, 12 inches for appliances &gt; 50,000 Btu/hr ≤ 150,000 Btu/hr, in accordance with the appliance manufacturer’s instructions and not less than the clearances specified for non-direct vent terminals in row B</td>
<td>4 feet below or to side of opening or 1 foot above opening</td>
</tr>
<tr>
<td>C</td>
<td>Clearance to non-openable window</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
</tr>
<tr>
<td>D</td>
<td>Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610 mm) from the center line of the terminal</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
</tr>
<tr>
<td>E</td>
<td>Clearance to unventilated soffit</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
</tr>
<tr>
<td>F</td>
<td>Clearance to outside corner of building</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
</tr>
<tr>
<td>G</td>
<td>Clearance to inside corner of building</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
<td>None unless otherwise specified by the appliance manufacturer</td>
</tr>
<tr>
<td>H</td>
<td>Clearance to non-mechanical air supply inlet to building and the combustion air inlet to any other appliance</td>
<td>Same clearance as specified for row B</td>
<td>Same clearance as specified for row B</td>
</tr>
<tr>
<td>I</td>
<td>Clearance to a mechanical air supply inlet</td>
<td>10 feet horizontally from inlet or 3 feet above inlet</td>
<td>10 feet horizontally from inlet or 3 feet above inlet</td>
</tr>
<tr>
<td>J</td>
<td>Clearance above paved sidewalk or paved driveway located on public property or other areas where condensate or vapor can cause a nuisance or hazard</td>
<td>7 feet and not located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard</td>
<td>7 feet and not located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard</td>
</tr>
<tr>
<td>K</td>
<td>Clearance to underside of veranda, porch, deck, or balcony</td>
<td>12 inches where the area beneath the veranda, porch, deck, or balcony is open on not less than two sides. The vent terminal is prohibited in this location where only one side is open.</td>
<td>12 inches where the area beneath the veranda, porch, deck, or balcony is open on not less than two sides. The vent terminal is prohibited in this location where only one side is open.</td>
</tr>
</tbody>
</table>

For SI Units: 1 inch = 25.4 mm, 1000 British thermal units per hour = 0.293 kW

**TABLE 509.8.2**

<table>
<thead>
<tr>
<th>DIRECT VENT APPLIANCE INPUT RATING</th>
<th>TERMINAL CLEARANCE FROM ANY AIR OPENING INTO A BUILDING (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000 Btu/hr and less</td>
<td>6</td>
</tr>
<tr>
<td>Greater than 10,000 Btu/hr and not exceeding 50,000 Btu/hr</td>
<td>9</td>
</tr>
<tr>
<td>Greater than 50,000 Btu/hr and not exceeding 150,000 Btu/hr</td>
<td>12</td>
</tr>
<tr>
<td>&gt; 150,000 Btu/hr</td>
<td>In accordance with the appliance manufacturer’s instructions and in no case less than the clearances specified in Section 509.8.1.</td>
</tr>
</tbody>
</table>

For SI Units: 1 inch = 25.4 mm, 1000 British thermal units per hour = 0.293 kW

509.8.3 Category I through Category IV and Non-categorized Appliances. Through-the-wall vents for Category II and Category IV appliances and non-categorized condensing appliances shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment. Where local experience indicates that condensate is a problem with Category I and Category III appliances, this provision shall also apply.

Drains for condensate shall be installed in accordance with the appliance and the vent manufacturer’s installation instructions. [NFPA 54:12.9.4]

509.8.4 Annular Spaces. Where vents, including those for direct-vent appliances or combustion air intake pipes, penetrate outside walls of buildings, the annular spaces around such penetrations shall be perma-
nently sealed using approved materials to prevent entry of combustion products into the building. [NFPA 54:4.2.9.6.12.9.2]

509.8.5 509.8.3 Vent Terminals. Vent systems for Category IV appliances that terminate through an outside wall of a building and discharge flue gases perpendicular to the adjacent wall shall be located not less than 10 feet (3048 mm) horizontally from an operable opening in an adjacent building.

Exception: This shall not apply to vent terminals that are 2 feet (610 mm) or more above or 25 feet (7620 mm) or more below operable openings. [NFPA 54:4.2.9.6.12.9.3]

509.9 Condensation Drain. Provision shall be made to collect and dispose of condensate from venting systems serving Category II and Category IV appliances and noncategorized condensing appliances in accordance with Section 509.8.3. [NFPA 54:12.10.1]

509.9.1 Local Experience Installation. Where local experience indicates that condensation is a problem, provision shall be made to drain off and dispose of condensate from venting systems serving Category I and Category III appliances in accordance with Section 509.8.3. Drains for condensate shall be installed in accordance with the appliance and vent manufacturers’ installation instructions. [NFPA 54:12.10.2]

509.10 Vent Connectors for Category I Appliances. A vent connector shall be used to connect an appliance to a gas vent, chimney, or single-wall metal pipe, except where the gas vent, chimney, or single-wall metal pipe is directly connected to the appliance. [NFPA 54:12.11.1]

509.10.1 Materials. A vent connector shall be made of noncombustible, corrosion-resistant material capable of withstanding the vent gas temperature produced by the appliance and of sufficient thickness to withstand physical damage. [NFPA 54:12.11.2.1]

509.10.1.1 Unconditioned Area. Where the vent connector used for an appliance having a draft hood or a Category I appliance is located in or passes through an unconditioned area, attic, or crawl space, that portion of the vent connector shall be listed Type B, Type L, or listed vent material having equivalent insulation qualities.

Exception: Single-wall metal pipe located within the exterior walls of the building and located in an unconditioned area other than an attic or a crawl space having a local 99 percent winter design temperature of 5°F (-15°C) or higher. [NFPA 54:12.11.2.2]

509.10.1.2 Residential-Type Appliances. Vent connectors for residential-type appliances shall comply with the following:

(1) Vent connectors for listed appliances having draft hoods, appliances having draft hoods and equipped with listed conversion burners, and Category I appliances that are not installed in attics, crawl spaces, or other unconditioned areas shall be one of the following:

(a) Type B or Type L vent material.
(b) Galvanized sheet steel not less than 0.018 of an inch (0.457 mm) thick.
(c) Aluminum (1100 or 3003 alloy or equivalent) sheet not less than 0.027 of an inch (0.686 mm) thick.
(d) Stainless steel sheet not less than 0.012 of an inch (0.305 mm) thick.
(e) Smooth interior wall metal pipe having resistance to heat and corrosion equal to or greater than that of Section 509.10.1.2(1)(b), Section 509.10.1.2(1)(c), or Section 509.10.1.2(1)(d).

(f) A listed vent connector.

(2) Vent connectors shall not be covered with insulation.

Exception: Listed insulated vent connectors shall be installed in accordance with the manufacturer’s installation instructions. [NFPA 54:12.11.2.3]

509.10.1.3 Nonresidential Low-Heat Appliances. A vent connector for a nonresidential low-heat appliance shall be a factory-built chimney section or steel pipe having resistance to heat and corrosion equivalent to that for the appropriate galvanized pipe as specified in Table 509.10.1.3. Factory-built chimney sections shall be joined together in accordance with the chimney manufacturer’s instructions. [NFPA 54:12.11.2.4]

<table>
<thead>
<tr>
<th>TABLE 509.10.1.3</th>
<th>MINIMUM THICKNESS FOR GALVANIZED STEEL VENT CONNECTORS FOR LOW-HEAT APPLIANCES [NFPA 54: TABLE 12.11.2.4]</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIAMETER OF CONNECTOR (inches)</td>
<td>MINIMUM THICKNESS (inches)</td>
</tr>
<tr>
<td>Less than 6</td>
<td>0.019</td>
</tr>
<tr>
<td>6 to less than 10</td>
<td>0.023</td>
</tr>
<tr>
<td>10 to 12 inclusive</td>
<td>0.029</td>
</tr>
<tr>
<td>14 to 16 inclusive</td>
<td>0.034</td>
</tr>
<tr>
<td>Over 16</td>
<td>0.056</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 square inch = 0.000645 m²

509.10.1.4 Medium-Heat Appliances. Vent connectors for medium-heat appliances shall be constructed of factory-built, medium-heat chimney sections or steel of a thickness not less than that specified in Table 509.10.1.4 and shall comply with the following:

(1) A steel vent connector for an appliance with a vent gas temperature in excess of 1000°F (538°C) measured at the entrance to the connector shall be lined with medium-duty fire brick or the equivalent.
(2) The lining shall be at least 2½ inches (64 mm) thick for a vent connector having a diameter or greatest cross-sectional dimension of 18 inches (457 mm) or less.

(3) The lining shall be at least 4½ inches (114 mm) thick laid on the 4½ inches (114 mm) bed for a vent connector having a diameter or greatest cross-sectional dimension greater than 18 inches (457 mm).

(4) Where factory-built chimney sections are employed, they shall be joined together in accordance with the chimney manufacturer’s instructions. [NFPA 54:12.11.2.5]

<table>
<thead>
<tr>
<th>VENT CONNECTOR SIZE</th>
<th>DIAMETER (inches)</th>
<th>AREA (square inches)</th>
<th>MINIMUM THICKNESS (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Up to 14</td>
<td>Up to 154</td>
<td>0.053</td>
</tr>
<tr>
<td></td>
<td>Over 14 to 16</td>
<td>154 to 201</td>
<td>0.067</td>
</tr>
<tr>
<td></td>
<td>Over 16 to 18</td>
<td>201 to 254</td>
<td>0.093</td>
</tr>
<tr>
<td></td>
<td>Over 18</td>
<td>Exceeding 254</td>
<td>0.123</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 square inch = 0.000645 m²

509.10.2 Size of Vent Connector. A vent connector for an appliance with a single draft hood or for a Category I fan-assisted combustion system appliance shall be sized and installed in accordance with Section 510.0 or other approved engineering methods. [NFPA 54:12.11.3.1]

509.10.2.1 Manifold. For a single appliance having more than one draft hood outlet or flue collar, the manifold shall be constructed according to the instructions of the appliance manufacturer. Where there are no instructions, the manifold shall be designed and constructed in accordance with approved engineering practices. As an alternative method, the effective area of the manifold shall equal the combined area of the flue collars or draft hood outlets, and the vent connectors shall have a minimum 1 foot (305 mm) rise. [NFPA 54:12.11.3.2]

509.10.2.2 Size. Where two or more appliances are connected to a common vent or chimney, each vent connector shall be sized in accordance with Section 510.0 or other approved engineering methods. [NFPA 54:12.11.3.3]

As an alternative method applicable only where all of the appliances are draft hood-equipped, each vent connector shall have an effective area not less than the area of the draft hood outlet of the appliance to which it is connected. [NFPA 54:12.11.3.4]

509.10.2.3 Height. Where two or more appliances are vented through a common vent connector or vent manifold, the common vent connector or vent manifold shall be located at the highest level consistent with available headroom and clearance to combustible material and sized in accordance with Section 510.0 or other approved engineering methods. [NFPA 54:12.11.3.5]

As an alternative method applicable only where there are two draft hood-equipped appliances, the effective area of the common vent connector or vent manifold and all junction fittings shall be not less than the area of the larger vent connector plus 50 percent of the area of the smaller flue collar outlet. [NFPA 54:12.11.3.6]

509.10.2.4 Size Increase. Where the size of a vent connector is increased to overcome installation limitations and obtain connector capacity equal to the appliance input, the size increase shall be made at the appliance draft hood outlet. [NFPA 54:12.11.3.7]

509.10.3 Two or More Appliances Connected to a Single Vent. Where two or more openings are provided into one chimney flue or vent, either of the following shall apply:

(1) The openings shall be at different levels.

(2) The connectors shall be attached to the vertical portion of the chimney or vent at an angle of 45 degrees (0.79 rad) or less relative to the vertical. [NFPA 54:12.11.4.1]

509.10.3.1 Height of Connector. Where two or more vent connectors enter a common vent, chimney flue, or single-wall metal pipe, the smaller connector shall enter at the highest level consistent with the available headroom or clearance to combustible material. [NFPA 54:12.11.4.2]

509.10.3.2 Pressure. Vent connectors serving Category I appliances shall not be connected to any portion of a mechanical draft system operating under positive static pressure, such as those serving Category III or Category IV appliances. [NFPA 54:12.11.4.3]

509.10.4 Clearance. Minimum clearances from vent connectors to combustible material shall be in accordance with Table 509.7.3.4(1).

Exception: The clearance between a vent connector and combustible material shall be permitted to be reduced where the combustible material is protected as specified for vent connectors in Table 509.7.3.4(2). [NFPA 54:12.11.5]

509.10.5 Joints. Joints between sections of connector piping and connections to flue collars or draft hood outlets shall be fastened in accordance with one of the following methods:

(1) Sheet metal screws. Mechanically fastened by means of not less than three sheet-metal screws equally spaced around the joint.

(2) Vent connectors of listed vent material assembled and connected to flue collars or draft hood outlets in accordance with the manufacturer’s instructions.

(3) Other approved means. [NFPA 54:12.11.6]
509.10.6 Connector Junctions. Where vent connectors are joined together, the connection shall be made with a manufactured tee or wye fitting. [NFPA 54:12.11.7]

509.10.6-509.10.7 Slope. A vent connector shall be installed without any dips or sags and shall slope upward toward the vent or chimney at least 1⁄4 inch per foot (20.8 mm/m).

Exception: Vent connectors attached to a mechanical draft system installed in accordance with appliance and the draft system manufacturer’s instructions. [NFPA 54:12.11.7-12.11.8]

509.10.7-509.10.8 Length of Vent Connector. The length of vent connectors shall comply with Section 509.10.7.1 or Section 509.10.7.2-509.10.8.2.

509.10.7.1-509.10.8.1 Single Wall Connector. The maximum horizontal length of a single-wall connector shall be 75 percent of the height of the chimney or vent, except for engineered systems. [NFPA 54:12.11.8.4-12.11.9.1]

509.10.7.2-509.10.8.2 Type B Double Wall Connector. The maximum horizontal length of a Type B double-wall connector shall be 100 percent of the height of the chimney or vent, except for engineered systems. The maximum length of an individual connector for a chimney or vent system serving multiple appliances, from the appliance outlet to the junction with the common vent or another connector, shall be 100 percent of the height of the chimney or vent. [NFPA 54:12.11.8.2-12.11.9.2]

509.10.8-509.10.9 Support. A vent connector shall be supported for the design and weight of the material employed to maintain clearances and prevent physical damage and separation of joints. [NFPA 54:12.11.8.1-12.11.10]

509.10.9-509.10.10 Chimney Connection. Where entering a flue in a masonry or metal chimney, the vent connector shall be installed above the extreme bottom to avoid stoppage. Where a thimble or slip joint is used to facilitate removal of the connector, the connector shall be firmly attached to or inserted into the thimble or slip joint to prevent the connector from falling out. Means shall be employed to prevent the connector from entering so far as to restrict the space between its end and the opposite wall of the chimney flue. [NFPA 54:12.11.10-12.11.11.1 – 12.11.11.3]

509.10.10-509.11 Inspection. The entire length of a vent connector shall be readily accessible for inspection, cleaning, and replacement. [NFPA 54:12.11.11-12.11.12]

509.10.11-509.10.12 Fireplaces. A vent connector shall not be connected to a chimney flue serving a fireplace unless the fireplace flue opening is permanently sealed. [NFPA 54:12.11.12-12.11.13]

509.10.12-509.10.13 Passage Through Ceilings, Floors, or Walls. A vent connector shall not pass through a ceiling, floor, or fire-resistance-rated wall. A single-wall metal pipe connector shall not pass through an interior wall.

Exceptions:

(1) Vent connectors made of listed Type B or Type L vent material and serving listed appliances with draft hoods and other appliances listed for use with Type B gas vents that pass through walls or partitions constructed of combustible material shall be installed with not less than the listed clearance to combustible material.

(2) Vent connectors shall be permitted to pass through ceilings, floors, or walls in accordance with Section 509.7.3.1 and Section 509.7.3.5.

509.10.12-509.10.13 Medium-Heat Appliances. Vent connectors for medium-heat appliances shall not pass through walls or partitions constructed of combustible material. [NFPA 54:12.11.13-12.11.14.2]

509.11 Vent Connectors for Category II, Category III, and Category IV Appliances. The vent connectors for Category II, Category III, and Category IV appliances shall be in accordance with Section 509.4 through Section 509.4.3. [NFPA 54:12.12]

509.12 Appliances Requiring Draft Hoods and Draft Controls. Vented appliances shall be installed with draft hoods.

Exception: Dual oven-type combination ranges; incinerators; direct-vent direct vent appliances; fan-assisted combustion system appliances; appliances requiring chimney draft for operation; single-firebox boilers equipped with conversion burners with inputs exceeding greater than 400 000 Btu/h (117 kW); appliances equipped with blast, power, or pressure burners that are not listed for use with draft hoods; and appliances designated for forced venting. [NFPA 54:12.13.1]

509.12.1 Installation. A draft hood supplied with or forming a part of a listed vented appliance shall be installed without alteration, exactly as furnished and specified by the appliance manufacturer. [NFPA 54:12.13.2]

If a draft hood is not supplied by the appliance manufacturer where one is required, a draft hood shall be installed, be of a listed or approved type, and, in the absence of other instructions, be of the same size as the appliance flue collar. Where a draft hood is required with a conversion burner, it shall be of a listed or approved type. [NFPA 54:12.13.2.1]

Where a draft hood of special design is needed or preferable, the installation shall be approved and in accordance with the recommendations of the appliance manufacturer. [NFPA 54:12.13.2.2]

509.12.2 Draft Control Devices. Where a draft control device is part of the appliance or is supplied by the appliance manufacturer, it shall be installed in accordance with the manufacturer’s instructions. In the absence of manufacturer’s instructions, the device shall be attached to the flue collar of the appliance or as near to the appliance as practical. [NFPA 54:12.13.3]

509.12.3 Additional Devices. Appliances requiring controlled chimney draft shall be permitted to be
equipped with listed double-acting barometric draft regulators installed and adjusted in accordance with the manufacturer's instructions. [NFPA 54:12.13.4]

509.12.4 Location. Draft hoods and barometric draft regulators shall be installed in the same room or enclosure as the appliance in such a manner as to prevent any difference in pressure between the hood or regulator and the combustion air supply. [NFPA 54:12.13.5]

509.12.5 Positioning. Draft hoods and draft regulators shall be installed in the position for which they were designed with reference to the horizontal and vertical planes and shall be located so that the relief opening is not obstructed by any part of the appliance or adjacent construction. The appliance and its draft hood shall be located so that the relief opening is accessible for checking vent operation. [NFPA 54:12.13.6]

509.13 Manually Operated Dampers. A manually operated damper shall not be placed in any appliance vent connector. Fixed baffles and balancing baffles shall not be classified as manually operated dampers. [NFPA 54:12.14.1]

Balancing baffles shall be mechanically locked in the desired position before placing the appliance in service. [NFPA 54:12.14.2] Balancing baffles shall be listed in accordance with UL 378. [NFPA 54:12.14.3]

509.14 Automatically Operated Vent Dampers. An automatically operated vent damper shall be UL-listed. [NFPA 54:12.15]

509.14.1 Listing. Automatically operated vent dampers for oil fired appliances shall comply with UL 17. The automatic damper control shall comply with UL 378.

509.15 Obstructions. Devices that retard the flow of vent gases shall not be installed in a vent connector, chimney, or vent. The following shall not be considered as obstructions:

(1) Draft regulators and safety controls specifically listed for installation in venting systems and installed in accordance with the manufacturer's installation instructions.

(2) Approved draft regulators and safety controls designed and installed in accordance with approved engineering methods.

(3) Listed heat reclaimers and automatically operated vent dampers installed in accordance with the manufacturer's installation instructions.

(4) Vent dampers serving listed appliances installed in accordance with Section 510.1 or Section 510.2 or other approved engineering methods.

(5) Approved economizers, heat reclaimers, and recuperators installed in venting systems of appliances not required to be equipped with draft hoods, provided the appliance manufacturer's instructions cover the installation of such a device in the venting system and performance in accordance with Section 509.3 and Section 509.3.1 is obtained. [NFPA 54:12.16]

510.0 Sizing of Category I Venting Systems.

510.1 Single Appliance Vent Table 510.1.2(1) through Table 510.1.2(6). Venting Table 510.1.2(1) through Table 510.1.2(6) shall not be used where obstructions are installed in the venting system. The installation of vents serving listed appliances with vent dampers shall be in accordance with the appliance manufacturer's instructions or in accordance with the following:

(1) The maximum capacity of the vent system shall be determined using the "NAT Max" column.

(2) The minimum capacity shall be determined as though the appliance were a fan-assisted appliance, using the "FAN Min" column to determine the minimum capacity of the vent system. Where the corresponding "FAN Min" is "NA," the vent configuration shall not be permitted and an alternative venting configuration shall be utilized. [NFPA 54:13.1.1]

510.1.1 Vent Downsizing. Where the vent size determined from the tables is smaller than the appliance draft hood outlet or flue collar, the use of the smaller size shall be permitted, provided that the installation complies with all of the following requirements:

(1) The total vent height (H) is at least 10 feet (3048 mm).

(2) Vents for appliance draft hood outlets or flue collars 12 inches (300 mm) in diameter or smaller are not reduced more than one table size.

(3) Vents for appliance draft hood outlets or flue collars larger than 12 inches (300 mm) in diameter are not reduced more than two table sizes.

(4) The maximum capacity listed in the tables for a fan-assisted appliance is reduced by 10 percent (0.90 x maximum table capacity).

(5) The draft hood outlet is greater than 4 inches (100 mm) in diameter. A 3 inch (80 mm) diameter vent shall not be connected to a 4 inch (100 mm) diameter draft hood outlet. This provision shall not apply to fan-assisted appliances. [NFPA 54:13.1.2]

510.1.2 Elbows. Single-appliance venting configurations with zero (0) lateral lengths in Table 510.1.2(1), Table 510.1.2(2), and Table 510.1.2(5) shall not have elbows in the venting system. Single-appliance venting with lateral lengths include two 90 degree (1.57 rad) elbows. For each additional elbow up to and including 45 degrees (0.79 rad), the maximum capacity listed in the venting tables shall be reduced by 5 percent. For each additional elbow greater than 45 degrees (0.79 rad) up to and including 90 degrees (1.57 rad), the maximum capacity listed in the venting tables shall be reduced by 10 percent. Where multiple offsets occur in a vent, the total lateral length of all offsets combined shall not exceed that specified in Table 510.1.2(1) through Table 510.1.2(5). [NFPA 54:13.1.3]
510.1.3 Zero Lateral. Zero (0) lateral (L) shall apply only to a straight vertical vent attached to a top outlet draft hood or flue collar. [NFPA 54:13.1.4]

510.1.4 High-Altitude Installations. Sea level input ratings shall be used when determining maximum capacity for high-altitude installation. Actual input (derated for altitude) shall be used for determining minimum capacity for high-altitude installation. [NFPA 54:13.1.5]

510.1.5 Multiple Input Ratings. For appliances with more than one input rate, the minimum vent capacity (FAN Min) determined from Table 510.1.2(1) through Table 510.2(9) shall be less than the lowest appliance input rating, and the maximum vent capacity (FAN Max/NAT Max) determined from the tables shall be greater than the highest appliance input rating. [NFPA 54:13.1.6]  

510.1.6 Corrugated Chimney Liners—Reduction. Listed corrugated metallic chimney liner systems in masonry chimneys shall be sized by using Table 510.1.2(1) or Table 510.1.2(2) for Type B vents with the maximum capacity reduced by 20 percent (0.80 x maximum capacity) and the minimum capacity as shown in Table 510.1.2(1) or Table 510.1.2(2).

Corrugated metallic liner systems installed with bends or offsets shall have their maximum capacity further reduced in accordance with Section 510.1.2. The 20 percent reduction for corrugated metallic chimney liner systems includes an allowance for one long radius 90 degree (1.57 rad) turn at the bottom of the liner. [NFPA 54:13.1.7]

510.1.7 Connection to Chimney Liners. Connections between chimney liners and listed double-wall connectors shall be made with listed adapters designed for such purpose. [NFPA 54:13.1.8]

510.1.8 Vertical Vent Upsizing Using the 7 x Times Rule. Where the vertical vent has a larger diameter than the vent connector, the vertical vent diameter shall be used to determine the minimum vent capacity, and the connector diameter shall be used to determine the maximum vent capacity. The flow area of the vertical vent shall not exceed seven times the flow area of the listed appliance categorized vent area, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods. [NFPA 54:13.1.9]  

510.1.9 Draft Hood Conversion Accessories. Draft hood conversion accessories for use with masonry chimneys venting listed Category I fan-assisted appliances shall be listed and installed in accordance with the listed accessory manufacturer’s installation instructions. [NFPA 54:13.1.10]

510.1.10 Chimney and Vent Locations. Table 510.1.2(1) through Table 510.1.2(5) shall be used only for chimneys and vents not exposed to the outdoors below the roof line. A Type B vent or listed chimney lining system passing through an unlined masonry chimney flue shall not be considered to be exposed to the outdoors. Where vents extend outdoors above the roof more than 5 feet (1524 mm) higher than required by Table 509.6.1. and where vents terminate in accordance with Section 509.6.1(1)(b), the outdoor portion of the vent shall be enclosed as required by this paragraph for vents not considered to be exposed to the outdoors, or such venting system shall be engineered. A Type B vent passing through an unventilated enclosure or chase insulated to a value of not less than R-8 shall not be considered to be exposed to the outdoors. Table 510.1.2(3) in combination with Table 510.1.2(6) shall be used for claytile-lined exterior masonry chimneys, provided all of the following requirements are met:

1. The vent connector is Type B double wall.
2. The vent connector length is limited to 18 inches per inch (18 mm/mm) of vent connector diameter.
3. The appliance is draft hood equipped.
4. The input rating is less than the maximum capacity given in Table 510.1.2(3).
5. For a water heater, the outdoor design temperature shall not be less than 5°F (-15°C).
6. For a space heating appliance, the input rating is greater than the minimum capacity given by Table 510.1.2(6). [NFPA 54:13.1.11]  

510.1.11 Corrugated Vent Connector Size. Corrugated vent connectors shall not be smaller than the listed appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter. [NFPA 54:13.1.12]  

510.1.12 Upsizing. Vent connectors shall not be upsized more than two sizes greater than the listed appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter. [NFPA 54:13.1.13]  

510.1.13 Single Run of Vent Multiple Vertical Vent Sizes. In a single run of vent or vent connector, more than one diameter and type shall be permitted to be used, provided that all the sizes and types are permitted by the tables. [NFPA 54:13.1.14]  

510.1.14 Interpolation. Interpolation shall be permitted in calculating capacities for vent dimensions that fall between table entries. [NFPA 54:13.1.15]  

510.1.15 Extrapolation. Extrapolation beyond the table entries shall not be permitted. [NFPA 54:13.1.16]  

510.1.16 Engineering Methods—Sizing Vents Not Covered by Tables. For Where a vent height is lower than 6 feet (1829 mm) and/or higher than shown in Table 510.1.2(1) through Table 510.2(9), an engineering method shall be used to calculate the vent capacity. [NFPA 54:13.1.17]  

510.1.17 Height Entries. Where the actual height of a vent falls between entries in the height column of the applicable table in Table 510.1.2(1) through Table 510.1.2(6), either of the following shall be used:

1. Interpolation.
2. The lower appliance input rating shown in the table entries for FAN Max and NAT Max column values; and the higher appliance input rating for the FAN Min column values. [NFPA 54:13.1.18]  

510.2 Multiple Appliance Vent Table 510.2(1) through Table 510.2(9)—Obstructions and Vent Dampers. Venting Table 510.2(1) through Table 510.2(9) shall not be used
where obstructions are installed in the venting system. The installation of vents serving listed appliances with vent dampers shall be in accordance with the appliance manufacturer’s instructions, or in accordance with the following:

1. The maximum capacity of the vent connector shall be determined using the NAT Max column.

2. The maximum capacity of the vertical vent or chimney shall be determined using the FAN + NAT column when the second appliance is a fan-assisted appliance, or the NAT + NAT column when the second appliance is equipped with a draft hood.

3. The minimum capacity shall be determined as if the appliance were a fan-assisted appliance, as follows:
   a. The minimum capacity of the vent connector shall be determined using the FAN Min column.
   b. The FAN + FAN column shall be used when the second appliance is a fan-assisted appliance, and the FAN + NAT column shall be used when the second appliance is equipped with a draft hood, to determine whether the vertical vent or chimney configuration is not permitted (NA). Where the vent configuration is NA, the vent configuration shall not be permitted and an alternative venting configuration shall be utilized. [NFPA 54:13.2.1]

510.2.1 Vent Connector Maximum Length. The maximum vent connector horizontal length shall be 18 inches per inch (18 mm/mm) of connector diameter as shown in Table 510.2.1, or as permitted by Section 510.2.2. [NFPA 54:13.2.2]

<table>
<thead>
<tr>
<th>CONNECTOR DIAMETER (inches)</th>
<th>MAXIMUM CONNECTOR HORIZONTAL LENGTH (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4½</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>7½</td>
</tr>
<tr>
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<td>9</td>
</tr>
<tr>
<td>7</td>
<td>10½</td>
</tr>
<tr>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>13½</td>
</tr>
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<td>30</td>
</tr>
<tr>
<td>22</td>
<td>33</td>
</tr>
<tr>
<td>24</td>
<td>36</td>
</tr>
</tbody>
</table>

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

510.2.2 Vent Connector Exceeding Maximum Length. The vent connector shall be routed to the vent utilizing the shortest possible route. Connectors with longer horizontal lengths than those listed in Table 510.2.1 are permitted under the following conditions:

1. The maximum capacity (FAN Max or NAT Max) of the vent connector shall be reduced 10 percent for each additional multiple of the length listed in Table 510.2.1. For example, the maximum length listed for a 4 inch (100 mm) connector is 6 feet (1829 mm). With a connector length greater than 6 feet (1829 mm) but not exceeding 12 feet (3658 mm), the maximum capacity must be reduced by 10 percent (0.90 x maximum vent connector capacity). With a connector length greater than 12 feet (3658 mm) but not exceeding 18 feet (5486 mm), the maximum capacity shall be reduced by 20 percent (0.80 x maximum vent capacity).

2. For a connector serving a fan-assisted appliance, the minimum capacity (FAN Min) of the connector shall be determined by referring to the corresponding single appliance table. For Type B double-wall connectors, Table 510.1.2(1) shall be used. For single-wall connectors, Table 510.1.2(2) shall be used. The height (H) and lateral (L) shall be measured according to the procedures for a single appliance vent, as if the other appliances were not present. [NFPA 54:13.2.3]

510.2.3 Vent Connector Manifolds. Where the vent connectors are combined prior to entering the vertical portion of the common vent to form a common vent manifold, the size of the common vent manifold and the common vent shall be determined by applying a 10 percent reduction (0.90 x maximum common vent capacity) to the common vent capacity part of the common vent tables. The length of the common vent manifold (LM) shall not exceed 18 inches per inch (18 mm/mm) of common vent diameter (D). [NFPA 54:13.2.4]

510.2.4 Vent Offsets. Where the common vertical vent is offset, the maximum capacity of the common vent shall be reduced in accordance with Section 510.2.5, and the horizontal length of the common vent offset shall not exceed 18 inches per inch (18 mm/mm) of common vent diameter (D). Where multiple offsets occur in a common vent, the total horizontal length of all offsets combined shall not exceed 18 inches per inch (18 mm/mm) of the common vent diameter. [NFPA 54:13.2.5]

510.2.5 Elbows in Vents. For each elbow up to and including 45 degrees (0.79 rad) in the common vent, the maximum common vent capacity listed in the venting tables shall be reduced by 5 percent. For each elbow greater than 45 degrees (0.79 rad) up to and including 90 degrees (1.57 rad), the maximum common vent capacity listed in the venting tables shall be reduced by 10 percent. [NFPA 54:13.2.6]

510.2.6 Elbows in Connectors. The vent connector capacities listed in the common vent sizing tables include allowance for two 90 degree (1.57 rad) elbows. For each additional elbow up to and including 45 degrees (0.79 rad), the maximum vent connector capacity listed in the venting tables shall be reduced by 5 percent. For each elbow greater than 45 degrees (0.79 rad) up to and
including 90 degrees (1.57 rad), the maximum vent connector capacity listed in the venting tables shall be reduced by 10 percent. [NFPA 54:13.2.7]

510.2.7 Common Vent Minimum Size. The cross-sectional area of the common vent shall be equal to or greater than the cross-sectional area of the largest connector. [NFPA 54:13.2.8]

510.2.8 Tee and Wye Fittings. Tee and wye fittings connected to a common gas vent shall be considered as part of the common gas vent and constructed of materials consistent with that of the common gas vent. [NFPA 54:13.2.9]

510.2.9 Size of Fittings. At the point where tee or wye fittings connect to a common gas vent, the opening size of the fitting shall be equal to the size of the common vent. Such fittings shall not be prohibited from having reduced size openings at the point of connection of appliance gas vent connectors. [NFPA 54:13.2.10]

510.2.10 High-Altitude Installations. Sea level input ratings shall be used when determining maximum capacity for high-altitude installation. Actual input (derated for altitude) shall be used for determining minimum capacity for high-altitude installation. [NFPA 54:13.2.11]

510.2.11 Vent Connector Rise. The vent connector rise (R) for each appliance connector shall be measured from the draft hood outlet or flue collar to the centerline where the vent gas streams come together. [NFPA 54:13.2.12]

510.2.12 Vent Height. For the available total height (H) for multiple appliances all located on one-the-same floor, available total height (H) shall be measured from the highest draft hood outlet or flue collar up to the level of the outlet of the common vent. [NFPA 54:13.2.13]

510.2.13 Multistory Installations Vent Height. For multistory installations, where appliances are located on more than one floor, the available total height (H) for each segment of the system shall be the vertical distance between the highest draft hood outlet or flue collar entering that segment and the centerline of the next higher interconnection tee. [NFPA 54:13.2.14]

510.2.14 Size of Vents for Multistory Installations. The size of the lowest connector and of the vertical vent leading to the lowest interconnection of a multistory system shall be in accordance with Table 510.1.2(1) or Table 510.1.2(2) for available total height (H) up to the lowest interconnection. [NFPA 54:13.2.15]

510.2.15 Vent Type Multistory Installations Type B Vents Required. Where used in multistory systems, vertical common vents shall be Type B double wall and shall be installed with a listed vent cap. [NFPA 54:13.2.16]

510.2.16 Offsets in Multistory Installations Vent Offsets and Capacity. Offsets in multistory common vents shall be limited to a single offset in each system, and systems with an offset shall comply with all of the following:

(1) The offset angle shall not exceed 45 degrees (0.79 rad) from vertical.

(2) The horizontal length of the offset shall not exceed 18 inches per inch (18 mm/mm) of common vent diameter of the segment in which the offset is located.

(3) For the segment of the common vertical vent containing the offset, the common vent capacity listed in the common venting tables shall be reduced by 20 percent (0.80 x maximum common vent capacity).

(4) A multistory common vent shall not be reduced in size above the offset. [NFPA 54:13.2.17]

510.2.17 Vertical Vent Size Limitation. Where two or more appliances are connected to a vertical vent or chimney, the flow area of the largest section of vertical vent or chimney shall not exceed seven times the smallest listed appliance categorized vent areas, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods. [NFPA 54:13.2.18]

510.2.18 Multiple Input Ratings. For appliances with more than one input rate, the minimum vent connector capacity (FAN Min) of appliances with more than one input rate shall be determined from the tables and shall be less than the lowest appliance input rate. The maximum vent connector capacity (FAN Max or NAT Max) shall be determined from the tables and shall be greater than the highest appliance input rating. [NFPA 54:13.2.19]

510.2.19 Corrugated Metallic Chimney Liner Reduction. Listed corrugated metallic chimney liner systems in masonry chimneys shall be sized by using Table 510.2(1) or Table 510.2(2) for Type B vents, with the maximum capacity reduced by 20 percent (0.80 x maximum capacity) and the minimum capacity as shown in Table 510.2(1) or Table 510.2(2). Corrugated metallic liner systems installed with bends or offsets shall have their maximum capacity further reduced in accordance with Section 510.2.4 and Section 510.2.5. The 20 percent reduction for corrugated metallic chimney liner systems includes an allowance for one long radius 90 degree (1.57 rad) turn at the bottom of the liner. [NFPA 54:13.2.20]

510.2.20 Chimneys and Vents. Table 510.2(1) through Table 510.2(5) shall be used only for chimneys and vents not exposed to the outdoors below the roof line. A Type B vent or listed chimney lining system passing through an unused masonry chimney flue shall not be considered to be exposed to the outdoors. A Type B vent passing through an unventilated enclosure or chase insulated to a value of not less than R8 shall not be considered to be exposed to the outdoors. Where vents extend outdoors above the roof more than 5 feet (1524 mm) higher than required by Table 509.6.1, and where vents terminate in accordance with Section 509.6.1(1)(b), the outdoor portion of the vent shall be enclosed as required by this section for vents not considered to be exposed to the outdoors, or such venting system shall be engineered. Table 510.2(6) through Table 510.2(9) shall be used for clay tile lined exterior masonry chimneys, provided all the following conditions are met:
(1) The vent connector is Type B double wall.

(2) At least one appliance is draft hood equipped.

(3) The combined appliance input rating is less than the maximum capacity given by Table 510.2(6) (for NAT + NAT) or Table 510.2(8) (for FAN + NAT).

(4) The input rating of each space-heating appliance is greater than the minimum input rating given by Table 510.2(7) (for NAT + NAT) or Table 510.2(9) (for FAN + NAT).

(5) The vent connector sizing is in accordance with Table 510.2(3). [NFPA 54:13.2.22]

510.2.21 Vent Connector Sizing. Vent connectors shall not be increased more than two sizes greater than the listed appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter. Vent connectors for draft hood-equipped appliances shall not be smaller than the draft hood outlet diameter. Where a vent connector size(s) determined from the tables for a fan-assisted appliance(s) is smaller than the flue collar diameter, the use of the smaller size(s) shall be permitted, provided that the installation complies with all of the following conditions:

(1) Vent connectors for fan-assisted appliance flue collars 12 inches (300 mm) in diameter or smaller are not reduced by more than one table size [e.g., 12 inches to 10 inches (300 mm to 250 mm) is a one-size reduction], and those larger than 12 inches (300 mm) in diameter are not reduced more than two table sizes [e.g., 24 inches to 20 inches (600 mm to 500 mm) is a two-size reduction].

(2) The fan-assisted appliance(s) is common vented with a draft hood-equipped appliance(s).

(3) The vent connector has a smooth interior wall. [NFPA 54:13.2.24]

510.2.22 Combination of Pipe Types and Sizes. All combinations of pipe sizes, single-wall metal pipe, and double-wall metal pipe shall be allowed within any connector run(s) or within the common vent, provided ALL of the appropriate tables permit ALL of the desired sizes and types of pipe, as if they were used for the entire length of the subject connector or vent. Where single-wall and Type B double-wall metal pipes are used for vent connectors within the same venting system, the common vent shall be sized using Table 510.2(2) or Table 510.2(4) as appropriate. [NFPA 54:13.2.25]

510.2.23 Multiple Connector and Vent Sizes. Where Table 510.2(1) through Table 510.2(9) permits more than one diameter of pipe to be used for a connector or vent, all the permitted sizes shall be permitted to be used. [NFPA 54:13.2.26]

510.2.24 Interpolation. Interpolation shall be permitted in calculating capacities for vent dimensions that fall between table entries. [NFPA 54:13.2.27]

510.2.25 Extrapolation. Extrapolation beyond the table entries shall not be permitted. [NFPA 54:13.2.28]

510.2.26 Engineering Methods. For vent heights lower than 6 feet (1829 mm) and higher than shown in the tables, engineering methods shall be used to calculate vent capacities. [NFPA 54:13.2.29]

510.2.27 Height Entries. Where the actual height of a vent falls between entries in the height column of the applicable table in Table 510.2(1) through Table 510.2(9), either of the following shall be used:

(1) Interpolation.

(2) The lower appliance input rating shown in the table entries, for FAN Max and NAT Max column values; and the higher appliance input rating for the FAN Min column values. [NFPA 54:13.2.30]
99% Winter Design Temperatures for the Contiguous United States

This map is a necessarily generalized guide to temperatures in the contiguous United States. Temperatures shown for areas such as mountainous regions and large urban centers are not necessarily accurate. The climate data used to develop this map are from the ASHRAE Handbook — Fundamentals (Climate Conditions for the United States).

For 99% winter design temperatures in Alaska, consult the ASHRAE Handbook — Fundamentals.

99% winter design temperatures for Hawaii are greater than 37°F

For SI units: °C = (°F - 32)/1.8

FIGURE 510.1.10
RANGE OF WINTER DESIGN TEMPERATURES USED IN ANALYZING EXTERIOR MASONRY CHIMNEYS IN THE UNITED STATES
[NFPA 54: FIGURE F.2.4]
**WATER HEATERS**

**TABLE 510.12(1)**

**TYPE B DOUBLE-WALL GAS VENT [NFPA 54: TABLE 13.1(a)]**

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</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

*NA: Not applicable.*
### TABLE 510.1.2(1)
TYPE B DOUBLE-WALL GAS VENT [NFPA 54: TABLE 13.1(a)] (continued)

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<thead>
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<th>NUMBER OF APPLIANCES: SINGLE</th>
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<tr>
<td>APPLIANCE TYPE: CATEGORY I</td>
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<tr>
<td>APPLIANCE VENT CONNECTION: CONNECTED DIRECTLY TO VENT</td>
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<td>VENT DIAMETER – D (inch)</td>
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<th>APPLIANCE INPUT RATING IN THOUSANDS OF BTU PER HOUR</th>
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<td>Min</td>
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</table>

<table>
<thead>
<tr>
<th>HEIGHT ( H ) (feet)</th>
<th>LATERAL ( L ) (feet)</th>
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<th>NAT</th>
<th>FAN</th>
<th>NAT</th>
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</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

**UNIFORM PLUMBING CODE - PREPRINT**
### TABLE 510.12(1)

**TYPE B DOUBLE-WALL GAS VENT [NFPA 54: TABLE 13.1(a)] (continued)**

<table>
<thead>
<tr>
<th>HEIGHT H (feet)</th>
<th>LATERNAL L (feet)</th>
<th>FAN</th>
<th>NAT</th>
<th>NUMBER OF APPLIANCES: SINGLE</th>
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<tbody>
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<td>Max</td>
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<tr>
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<td>Min</td>
<td>Max</td>
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<td>VENT DIAMETER – D (inch)</td>
</tr>
</tbody>
</table>

#### ALPINE INPUT RATING IN THOUSANDS OF BTU PER HOUR

<table>
<thead>
<tr>
<th>HEIGHT H (feet)</th>
<th>LATERNAL L (feet)</th>
<th>FAN</th>
<th>NAT</th>
<th>NUMBER OF APPLIANCES: SINGLE</th>
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<td>VENT DIAMETER – D (inch)</td>
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</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²
### Type B Double-Wall Gas Vent (NFPA 54: Table 13.1(b))

| Height (feet) | Lateral Length (feet) | Fan | Nat | Fan | Nat | Fan | Nat | Fan | Nat | Fan | Nat |
|--------------|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 6            | 0                     | 38  | 77  | 45  |     | 59  | 151 | 85  | 85  | 249 | 140 |    |
|              | 2                     | 39  | 51  | 36  |     | 60  | 96  | 66  | 85  | 156 | 104 |    |
|              | 4                     | NA  | NA  | 33  |     | 74  | 92  | 63  | 102 | 152 | 102 |    |
|              | 6                     | NA  | NA  | 31  |     | 83  | 89  | 60  | 114 | 147 | 99  |    |
| 8            | 0                     | 37  | 83  | 50  |     | 58  | 164 | 93  | 83  | 273 | 154 |    |
|              | 2                     | 39  | 56  | 39  |     | 59  | 108 | 75  | 83  | 176 | 119 |    |
|              | 5                     | NA  | NA  | 37  |     | 77  | 102 | 69  | 107 | 168 | 114 |    |
|              | 8                     | NA  | NA  | 33  |     | 90  | 95  | 64  | 122 | 161 | 107 |    |
| 10           | 0                     | 37  | 87  | 53  |     | 57  | 174 | 99  | 82  | 203 | 145 |    |
|              | 2                     | 39  | 61  | 41  |     | 59  | 117 | 80  | 82  | 193 | 128 |    |
|              | 5                     | 52  | 56  | 39  |     | 76  | 111 | 76  | 105 | 185 | 122 |    |
|              | 10                    | NA  | NA  | 34  |     | 97  | 100 | 68  | 132 | 171 | 112 |    |
| 15           | 0                     | 36  | 93  | 57  |     | 56  | 190 | 111 | 80  | 325 | 186 |    |
|              | 2                     | 38  | 69  | 47  |     | 57  | 136 | 93  | 80  | 225 | 149 |    |
|              | 5                     | 51  | 63  | 44  |     | 75  | 128 | 86  | 102 | 216 | 140 |    |
|              | 10                    | NA  | NA  | 39  |     | 95  | 116 | 79  | 128 | 201 | 131 |    |
|              | 15                    | NA  | NA  | NA  |     | 72  | 158 | 126 | 182 | 200 | 116 |    |
| 20           | 0                     | 35  | 96  | 60  |     | 54  | 200 | 118 | 78  | 346 | 201 |    |
|              | 2                     | 37  | 74  | 50  |     | 56  | 148 | 99  | 78  | 248 | 165 |    |
|              | 5                     | 50  | 68  | 47  |     | 73  | 140 | 94  | 100 | 239 | 158 |    |
|              | 10                    | NA  | NA  | 41  |     | 93  | 129 | 86  | 125 | 223 | 146 |    |
|              | 15                    | NA  | NA  | NA  |     | 60  | 155 | 146 | 246 | 325 | 210 |    |
|              | 20                    | NA  | NA  | NA  |     | 72  | 192 | 126 | 254 | 306 | 196 |    |
| 30           | 0                     | 34  | 99  | 63  |     | 53  | 211 | 127 | 76  | 372 | 219 |    |
|              | 2                     | 37  | 80  | 56  |     | 55  | 164 | 111 | 76  | 281 | 183 |    |
|              | 5                     | 49  | 74  | 52  |     | 72  | 157 | 106 | 98  | 271 | 173 |    |
|              | 10                    | NA  | NA  | 91  |     | 144 | 98  | 122 | 125 | 255 | 168 |    |
|              | 15                    | NA  | NA  | NA  |     | 115 | 131 | NA  | 151 | 239 | 157 |    |
|              | 20                    | NA  | NA  | NA  |     | 181 | 223 | NA  | 246 | 357 | 228 |    |
|              | 30                    | NA  | NA  | NA  |     | 216 | 357 | NA  | 285 | 457 | 303 |    |
| 50           | 0                     | 33  | 99  | 66  |     | 51  | 213 | 133 | 73  | 394 | 230 |    |
|              | 2                     | 36  | 84  | 61  |     | 53  | 181 | 121 | 73  | 318 | 205 |    |
|              | 5                     | 48  | 80  | NA  |     | 70  | 174 | 117 | 94  | 308 | 198 |    |
|              | 10                    | NA  | NA  | 89  |     | 160 | NA  | 118 | 292 | 186 |    |
|              | 15                    | NA  | NA  | 112 |     | 148 | NA  | 145 | 275 | 174 |    |
|              | 20                    | NA  | NA  | NA  |     | 176 | 257 | NA  | 236 | 420 | 267 |    |
|              | 30                    | NA  | NA  | NA  |     | 315 | 376 | NA  | 373 | 573 | NA  |    |
| 100          | 0                     | NA  | NA  | 49  |     | 214 | NA  | 69  | 403 | NA  | 100 |    |
|              | 2                     | NA  | NA  | 51  |     | 192 | NA  | 70  | 351 | NA  | 98  |    |
|              | 5                     | NA  | NA  | 67  |     | 186 | NA  | 90  | 342 | NA  | 125 |    |
|              | 10                    | NA  | NA  | 85  |     | 175 | NA  | 113 | 324 | NA  | 153 |    |
|              | 15                    | NA  | NA  | 132 |     | 162 | NA  | 138 | 310 | NA  | 188 |    |
|              | 20                    | NA  | NA  | NA  |     | 168 | 295 | NA  | 224 | 487 | NA  |    |
|              | 30                    | NA  | NA  | NA  |     | 231 | 264 | NA  | 301 | 448 | NA  |    |
|              | 50                    | NA  | NA  | NA  |     | NA  | NA  | NA  | NA  | NA  | NA  |    |

**For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²**

* NA: Not applicable.
### TABLE 510.1.2(2)

**TYPE B DOUBLE-WALL GAS VENT [NFPA 54: TABLE 13.1(b)] (continued)*

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<td>APPLIANCE VENT CONNECTION: SINGLE-WALL METAL CONNECTOR</td>
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For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
### TABLE 510.12(3)
MASONRY CHIMNEY [NFPA 54: TABLE 13.1(c)]*

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<td>APPLIANCE VENT CONNECTION:</td>
<td>TYPE B DOUBLE-WALL CONNECTOR</td>
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TYPE B DOUBLE-WALL CONNECTOR DIAMETER — D (inch) TO BE USED WITH CHIMNEY AREAS WITHIN THE SIZE LIMITS AT BOTTOM

| HEIGHT H (feet) | LATERAL L (feet) | FAN | NAT | FAN | NAT | FAN | NAT | FAN | NAT | FAN | NAT |
|-----------------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                 |                  | Min | Max |     |     | Min | Max |     |     | Min | Max |     |     |
| 3               |                  |     |     |     |     |     |     |     |     |     |     |     |     |
| 4               |                  |     |     |     |     |     |     |     |     |     |     |     |     |
| 5               |                  |     |     |     |     |     |     |     |     |     |     |     |     |
| 6               |                  |     |     |     |     |     |     |     |     |     |     |     |     |
| 7               |                  |     |     |     |     |     |     |     |     |     |     |     |     |

APPLIANCE VENT CONNECTION:

**APPLIANCE INPUT RATING IN THOUSANDS OF BTU PER HOUR**

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</table>

**Minimum internal area of chimney (square inches)**

| 12 | 19 | 28 | 38 | 50 |

**Maximum internal area of chimney (square inches)**

Seven times the listed appliance categorized vent area, flue collar area, or draft hood outlet areas.

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
### TABLE 510.1.2(3)
MASONRY CHIMNEY [NFPA 54: TABLE 13.1(c)] (continued)*

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</tr>
</tbody>
</table>

**For SI units:** 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

*NA: Not applicable.

Minimum internal area of chimney (square inches)

<table>
<thead>
<tr>
<th><strong>Height</strong></th>
<th><strong>Fan</strong></th>
<th><strong>NAT</strong></th>
<th><strong>Fan</strong></th>
<th><strong>NAT</strong></th>
<th><strong>Fan</strong></th>
<th><strong>NAT</strong></th>
<th><strong>Fan</strong></th>
<th><strong>NAT</strong></th>
<th><strong>Fan</strong></th>
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</tbody>
</table>

Maximum internal area of chimney (square inches)

Seven times the listed appliance categorized vent area, flue collar area, or draft hood outlet areas.

*For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²*
### TABLE 510.12(4)
MASONRY CHIMNEY [NFPA 54: TABLE 13.1(d)]

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<th>NUMBER OF APPLIANCES:</th>
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<td>APPLIANCE TYPE:</td>
<td>CATEGORY I</td>
</tr>
<tr>
<td>APPLIANCE VENT CONNECTION:</td>
<td>SINGLE-WALL METAL CONNECTOR</td>
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**SINGLE-WALL METAL CONNECTOR DIAMETER – D (inch)**

TO BE USED WITH CHIMNEY AREAS WITHIN THE SIZE LIMITS AT BOTTOM

<table>
<thead>
<tr>
<th>APPLIANCE INPUT RATING IN THOUSANDS OF BTU PER HOUR</th>
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<tbody>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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<table>
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<tr>
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<th>FAN</th>
<th>NAT</th>
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</tbody>
</table>

Minimum internal area of chimney (square inches)

12  19  28  38  50

Maximum internal area of chimney (square inches)

Seven times the listed appliance categorized vent area, flue collar area, or draft hood outlet areas.

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

*NA: Not applicable.
### TABLE 510.1.2(4)
MASONRY CHIMNEY [NFPA 54: TABLE 13.1(d)] (continued)*

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<th>APPLIANCE TYPE: CATEGORY I</th>
<th>APPLIANCE VENT CONNECTION: SINGLE-WALL METAL CONNECTOR</th>
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</table>

| SINGLE-WALL METAL CONNECTOR DIAMETER – D (inch) TO BE USED WITH CHIMNEY AREAS WITHIN THE SIZE LIMITS AT BOTTOM |
|-----------------------------|---------------------------|------------------------------------------------------|
| 8                           | 9                         | 10                                                   |

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<th>APPLIANCE INPUT RATING IN THOUSANDS OF BTU PER HOUR</th>
</tr>
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<tbody>
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Minimum internal area of chimney (square inches)

<table>
<thead>
<tr>
<th>Minimum internal area of chimney (square inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
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<tr>
<td>78</td>
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Maximum internal area of chimney (square inches)

<table>
<thead>
<tr>
<th>Maximum internal area of chimney (square inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seven times the listed appliance categorized vent area, flue collar area, or draft hood outlet areas.</td>
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</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
### TABLE 510.1.2(5)
SINGLE-WALL METAL PIPE OR TYPE B ASBESTOS-CEMENT VENT [NFPA 54: TABLE 13.1(e)]*

<table>
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<th>HEIGHT ( H ) (feet)</th>
<th>LATERAL ( L ) (feet)</th>
<th>NUMBER OF APPLIANCES: SINGLE</th>
<th>APPLIANCE TYPE: DRAFT HOOD-EQUIPPED</th>
<th>APPLIANCE VENT CONNECTION: CONNECTED DIRECTLY TO PIPE OR VENT</th>
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</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
## WATER HEATERS

### TABLE 510.1.2(6)
**EXTERIOR MASONRY CHIMNEY [NFPA 54: TABLE 13.1(f)]**

<table>
<thead>
<tr>
<th>NUMBER OF APPLIANCES:</th>
<th>SINGLE</th>
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</thead>
<tbody>
<tr>
<td>APPLIANCE TYPE:</td>
<td>NAT</td>
</tr>
<tr>
<td>APPLIANCE VENT CONNECTION:</td>
<td>TYPE B DOUBLE-WALL CONNECTOR</td>
</tr>
</tbody>
</table>

**MINIMUM ALLOWABLE INPUT RATING OF SPACE-HEATING APPLIANCE IN THOUSANDS OF BTU PER HOUR**

<table>
<thead>
<tr>
<th>VENT HEIGHT h (feet)</th>
<th>INTERNAL AREA OF CHIMNEY (square inches)</th>
<th>12</th>
<th>19</th>
<th>28</th>
<th>38</th>
<th>50</th>
<th>63</th>
<th>78</th>
<th>113</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Local 99% winter design temperature: 37°F or greater</td>
<td></td>
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<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>579</td>
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</tr>
</tbody>
</table>

|                      | Local 99% winter design temperature: 27°F to 36°F |    |    |    |    |    |    |    |     |
| 6                    | 0                                          | 0  | 68 | 116| 156| 180| 212| 266|     |
| 8                    | 0                                          | 0  | 82 | 127| 167| 187| 214| 263|     |
| 10                   | 0                                          | 51 | 97 | 141| 183| 201| 225| 265|     |
| 15                   | NA                                         | NA | NA | NA | NA | 233| 253| 274| 305 |
| 20                   | NA                                         | NA | NA | NA | NA | 307| 330| 362|     |
| 30                   | NA                                         | NA | NA | NA | NA | 419| 445| 485|     |
| 50                   | NA                                         | NA | NA | NA | NA | NA | NA | 763|     |

|                      | Local 99% winter design temperature: 17°F to 26°F |    |    |    |    |    |    |    |     |
| 6                    | NA                                         | NA | NA | NA | NA | 215| 259| 349|     |
| 8                    | NA                                         | NA | NA | NA | NA | 197| 226| 264| 352 |
| 10                   | NA                                         | NA | NA | NA | NA | 214| 245| 278| 358 |
| 15                   | NA                                         | NA | NA | NA | NA | 296| 331| 398|     |
| 20                   | NA                                         | NA | NA | NA | NA | 352| 387| 457|     |
| 30                   | NA                                         | NA | NA | NA | NA | 507| 581|     |     |
| 50                   | NA                                         | NA | NA | NA | NA | NA | NA |     |     |

|                      | Local 99% winter design temperature: 5°F to 16°F |    |    |    |    |    |    |    |     |
| 6                    | NA                                         | NA | NA | NA | NA | NA | NA | 416|     |
| 8                    | NA                                         | NA | NA | NA | NA | NA | NA | 312| 423 |
| 10                   | NA                                         | NA | NA | NA | NA | NA | NA | 331| 430 |
| 15                   | NA                                         | NA | NA | NA | NA | NA | NA | 393| 485 |
| 20                   | NA                                         | NA | NA | NA | NA | NA | NA | 450| 547 |
| 30                   | NA                                         | NA | NA | NA | NA | NA | NA | 682|     |
| 50                   | NA                                         | NA | NA | NA | NA | NA | NA | 972|     |

|                      | Local 99% winter design temperature: -10°F to 4°F |    |    |    |    |    |    |    |     |
| 6                    | NA                                         | NA | NA | NA | NA | NA | NA | 484|     |
| 8                    | NA                                         | NA | NA | NA | NA | NA | NA | 494|     |
| 10                   | NA                                         | NA | NA | NA | NA | NA | NA | 513|     |
| 15                   | NA                                         | NA | NA | NA | NA | NA | NA | 586|     |
| 20                   | NA                                         | NA | NA | NA | NA | NA | NA | 650|     |
| 30                   | NA                                         | NA | NA | NA | NA | NA | NA | 805|     |
| 50                   | NA                                         | NA | NA | NA | NA | NA | NA | 1003|    |

|                      | Local 99% winter design temperature: -11°F or lower | Not recommended for any vent configurations |

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m², °C = (°F - 32)/1.8

**Notes:**
1 See Figure 510.1.10 for a map showing local 99 percent winter design temperatures in the United States.
2 NA: Not applicable.
### Type B Double-Wall Vent [NFPA 54: Table 13.2(a)]

#### Number of Appliances: Two or More

<table>
<thead>
<tr>
<th>Appliance Type</th>
<th>Category I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliance Vent Connection</td>
<td>Type B Double-Wall Connector</td>
</tr>
</tbody>
</table>

#### Vent Connector Capacity

**Type B Double-Wall Vent and Connector Diameter – D (inch)**

| VENT HEIGHT H (feet) | CONNECTOR RISE R (feet) | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT |
|----------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                      |                         | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| 3                    |                         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 4                    |                         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 5                    |                         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 6                    |                         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 7                    |                         |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

**Appliance Input Rating Limits in Thousands of BTU per Hour**

<table>
<thead>
<tr>
<th>VENT HEIGHT H (feet)</th>
<th>CONNECTOR RISE R (feet)</th>
<th>Fan</th>
<th>NAT</th>
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</table>

#### Common Vent Capacity

**Type B Double-Wall Common Vent Diameter – D (inch)**

<table>
<thead>
<tr>
<th>VENT HEIGHT H (feet)</th>
<th>Fan</th>
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<th>Fan</th>
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</tbody>
</table>

**Combined Appliance Input Rating in Thousands of BTU per Hour**

| VENT HEIGHT H (feet) | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT | Fan | NAT |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 6                    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 8                    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 10                   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 15                   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 20                   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 30                   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 50                   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 100                  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

*NA: Not applicable.
## WATER HEATERS

### TABLE 510.2(1)
TYPE B DOUBLE-WALL VENT (NFPA 54: TABLE 13.2(a)) (continued)

<table>
<thead>
<tr>
<th>VENT HEIGHT ( H ) (feet)</th>
<th>CONNECTOR RISE ( R ) (feet)</th>
<th>APPLIANCE VENT CONNECTION: TYPE B DOUBLE-WALL CONNECTOR</th>
<th>VENT CONNECTOR CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>NUMBER OF APPLIANCES:</strong></td>
<td><strong>TWO OR MORE</strong></td>
</tr>
<tr>
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<td><strong>APPLIANCE TYPE:</strong></td>
<td><strong>CATEGORY I</strong></td>
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<td><strong>APPLIANCE VENT CONNECTION:</strong></td>
<td><strong>TYPE B DOUBLE-WALL CONNECTOR</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>VENT CONNECTOR CAPACITY</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VENT HEIGHT ( H ) (feet)</th>
<th>CONNECTOR RISE ( R ) (feet)</th>
<th>FAN</th>
<th>NAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Min</td>
<td>Max</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>APPLIANCE INPUT RATING LIMITS IN THOUSANDS OF BTU PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FAN</strong></td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMON VENT CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TYPE B DOUBLE-WALL COMMON VENT DIAMETER – ( D ) (inch)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VENT HEIGHT ( H ) (feet)</th>
<th>FAN</th>
<th>NAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
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<table>
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</table>

<table>
<thead>
<tr>
<th>COMBINED APPLIANCE INPUT RATING IN THOUSANDS OF BTU PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²
### TABLE 510.2(1)
TYPE B DOUBLE-WALL VENT [NFPA 54: TABLE 13.2(a)] (continued)*

<table>
<thead>
<tr>
<th>VENT HEIGHT $H$ (feet)</th>
<th>CONNECTOR RISE $R$ (feet)</th>
<th>NUMBER OF APPLIANCES: TWO OR MORE</th>
<th>APPLIANCE TYPE: CATEGORY I</th>
<th>APPLIANCE VENT CONNECTION: TYPE B DOUBLE-WALL CONNECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>FAN Min</td>
<td>FAN Max</td>
<td>NAT Min</td>
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### COMMON VENT CAPACITY

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<th>NUMBER OF APPLIANCES: TWO OR MORE</th>
<th>APPLIANCE TYPE: CATEGORY I</th>
<th>APPLIANCE VENT CONNECTION: TYPE B DOUBLE-WALL CONNECTOR</th>
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**Notes:**
- For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²
- *NA: Not applicable.
TABLE 510.2(1)
TYPE B DOUBLE-WALL VENT [NFPA 54: TABLE 13.2(a)] (continued)*

NUMBER OF APPLIANCES: TWO OR MORE

| APPLIANCE TYPE: CATEGORY I |
| APPLIANCE VENT CONNECTION: TYPE B DOUBLE-WALL CONNECTOR |

VENT CONNECTOR CAPACITY

<table>
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<th>CONNECTOR RISE ( R ) (feet)</th>
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20 22 24

APPLIANCE INPUT RATING LIMITS IN THOUSANDS OF BTU PER HOUR

<table>
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<tr>
<th>VENT HEIGHT ( H ) (feet)</th>
<th>CONNECTOR RISE ( R ) (feet)</th>
<th>FAN</th>
<th>NAT</th>
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<tbody>
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<td>Min</td>
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20 22 24

COMMON VENT CAPACITY

<table>
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<th>NAT +NAT</th>
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<td>FAN +FAN</td>
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20 22 24

COMBINED APPLIANCE INPUT RATING IN THOUSANDS OF BTU PER HOUR

<table>
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<th>FAN +NAT</th>
<th>NAT +NAT</th>
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<tbody>
<tr>
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20 22 24

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
### TABLE 510.2(2)
**TYPE B DOUBLE-WALL VENT [NFPA 54: TABLE 13.2(b)]**

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<th>CONNECTOR RISE R (feet)</th>
<th>CONNECTOR CAPACITY</th>
<th>APPLIANCE INPUT RATING LIMITS IN THOUSANDS OF BTU PER HOUR</th>
<th>APPLIANCE TYPE: TWO OR MORE</th>
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### COMMON VENT CAPACITY

| VENT HEIGHT H (feet) | FAN +FAN | FAN +NAT | FAN +FAN | FAN +NAT | FAN +FAN | FAN +NAT | FAN +FAN | FAN +NAT | FAN +FAN | FAN +NAT | FAN +FAN | FAN +NAT | FAN +FAN | FAN +NAT |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 6                    | NA        | 78        | 64        | NA        | 113       | 99        | 200       | 158       | 144       | 304       | 244       | 196       | 269       | 218       | 292       |
| 8                    | NA        | 87        | 71        | NA        | 126       | 111       | 218       | 173       | 159       | 331       | 269       | 218       | 343       | 274       | 383       |
| 10                   | NA        | 94        | 76        | 163       | 137       | 120       | 237       | 189       | 174       | 357       | 292       | 236       | 343       | 274       | 383       |
| 15                   | 121       | 108       | 88        | 189       | 159       | 140       | 275       | 221       | 200       | 416       | 343       | 274       | 383       | 302       | 446       |
| 20                   | 131       | 118       | 98        | 208       | 177       | 156       | 305       | 247       | 223       | 463       | 383       | 302       | 446       | 349       | 529       |
| 30                   | 145       | 132       | 113       | 236       | 202       | 180       | 350       | 286       | 257       | 533       | 446       | 349       | 529       | 410       | 633       |
| 50                   | 159       | 145       | 128       | 268       | 233       | 208       | 406       | 337       | 296       | 622       | 529       | 410       | 633       | 464       | 899       |
| 100                  | 166       | 153       | NA        | 297       | 263       | NA        | 469       | 398       | NA        | 726       | 633       | 464       | 899       | 464       | 899       | 464       |

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²
* NA: Not applicable.
### WATER HEATERS

#### TABLE 510.2(2)

**TYPE B DOUBLE-WALL VENT (NFPA 54: TABLE 13.2(b))** (continued)

| VENT HEIGHT \(H\) (feet) | CONNECTOR RISE \(R\) (feet) | FAN | NAT | FAN | NAT | FAN | NAT | FAN | NAT | FAN | NAT |
|--------------------------|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                          |                             | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| 6                        | 1                           | 262 | 293 | 183 | 325 | 373 | 234 | 447 | 463 | 286 |
|                          | 2                           | 271 | 331 | 219 | 334 | 422 | 281 | 458 | 524 | 344 |
|                          | 3                           | 279 | 361 | 247 | 344 | 462 | 316 | 468 | 574 | 385 |
| 8                        | 1                           | 285 | 316 | 191 | 352 | 403 | 244 | 481 | 502 | 299 |
|                          | 2                           | 293 | 353 | 228 | 360 | 450 | 292 | 492 | 560 | 355 |
|                          | 3                           | 302 | 381 | 256 | 370 | 489 | 328 | 501 | 609 | 400 |
| 10                       | 1                           | 302 | 335 | 196 | 372 | 429 | 252 | 506 | 534 | 308 |
|                          | 2                           | 311 | 369 | 235 | 381 | 473 | 302 | 517 | 589 | 368 |
|                          | 3                           | 320 | 398 | 265 | 391 | 511 | 339 | 528 | 637 | 413 |
| 15                       | 1                           | 312 | 380 | 208 | 397 | 482 | 266 | 556 | 596 | 324 |
|                          | 2                           | 321 | 411 | 248 | 407 | 522 | 317 | 568 | 646 | 387 |
|                          | 3                           | 331 | 438 | 281 | 418 | 557 | 360 | 579 | 690 | 437 |
| 20                       | 1                           | 306 | 425 | 217 | 390 | 538 | 276 | 546 | 664 | 336 |
|                          | 2                           | 317 | 453 | 259 | 400 | 574 | 331 | 558 | 709 | 403 |
|                          | 3                           | 326 | 476 | 294 | 412 | 607 | 375 | 570 | 750 | 457 |
| 30                       | 1                           | 296 | 497 | 230 | 378 | 630 | 294 | 528 | 779 | 358 |
|                          | 2                           | 307 | 521 | 274 | 389 | 662 | 349 | 541 | 819 | 425 |
|                          | 3                           | 316 | 542 | 309 | 400 | 690 | 394 | 555 | 855 | 482 |
| 50                       | 1                           | 284 | 604 | 245 | 364 | 768 | 314 | 507 | 951 | 384 |
|                          | 2                           | 294 | 623 | 293 | 376 | 793 | 375 | 520 | 983 | 458 |
|                          | 3                           | 304 | 640 | 331 | 387 | 816 | 423 | 535 | 1013 | 518 |
| 100                      | 1                           | 259 | 774 | 249 | 345 | 993 | 321 | 476 | 1236 | 393 |
|                          | 2                           | 279 | 788 | 299 | 358 | 1011 | 383 | 490 | 1259 | 469 |
|                          | 3                           | 289 | 801 | 339 | 368 | 1027 | 431 | 506 | 1280 | 527 |

#### COMMON VENT CAPACITY

<table>
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<th>TYPE B DOUBLE-WALL COMMON VENT DIAMETER – (D) (inch)</th>
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<th>FAN +NAT</th>
<th>NAT +FAN</th>
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For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²
### TABLE 510.2(3)
MASONRY CHIMNEY [NFPA 54: TABLE 13.2(c)]

| VENT HEIGHT H (feet) | CONNECTOR RISE R (feet) | FAN | NAT | FAN | NAT | FAN | NAT | FAN | NAT | FAN | NAT |
|----------------------|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                      |                        | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| 6                    | 1                      | 24  | 33  | 21  | 52  | 40  | 52  | 67  | 67  | 65  | 94  | 52  | 52  |
| 2                    | 26                     | 43  | 79  | 52  | 53  | 133 | 55  | 85  | 85  | 67  | 230 | 124 | 124 |
| 3                    | 27                     | 49  | 92  | 61  | 63  | 55  | 97  | 69  | 69  | 69  | 262 | 143 | 143 |
| 8                    | 1                      | 24  | 39  | 22  | 55  | 41  | 55  | 71  | 71  | 71  | 213 | 105 | 105 |
| 2                    | 26                     | 47  | 87  | 53  | 57  | 140 | 86  | 86  | 86  | 73  | 246 | 127 | 127 |
| 3                    | 27                     | 52  | 97  | 62  | 63  | 159 | 98  | 98  | 98  | 75  | 269 | 145 | 145 |
| 10                   | 1                      | 24  | 42  | 22  | 55  | 42  | 55  | 71  | 71  | 71  | 233 | 108 | 108 |
| 2                    | 26                     | 50  | 93  | 54  | 57  | 153 | 87  | 87  | 87  | 76  | 261 | 129 | 129 |
| 3                    | 27                     | 55  | 105 | 63  | 65  | 170 | 100 | 100 | 100 | 78  | 284 | 148 | 148 |
| 15                   | 1                      | 24  | 48  | 23  | 54  | 44  | 54  | 74  | 74  | 74  | 277 | 114 | 114 |
| 2                    | 25                     | 55  | 105 | 55  | 56  | 174 | 89  | 89  | 89  | 74  | 299 | 134 | 134 |
| 3                    | 26                     | 59  | 115 | 64  | 66  | 189 | 102 | 102 | 102 | 76  | 319 | 153 | 153 |
| 20                   | 1                      | 24  | 52  | 24  | 53  | 46  | 53  | 77  | 77  | 77  | 313 | 119 | 119 |
| 2                    | 25                     | 58  | 114 | 56  | 55  | 190 | 91  | 91  | 91  | 73  | 335 | 138 | 138 |
| 3                    | 26                     | 63  | 135 | 65  | 65  | 204 | 104 | 104 | 104 | 75  | 353 | 157 | 157 |
| 30                   | 1                      | 24  | 54  | 25  | 51  | 48  | 51  | 82  | 82  | 82  | 357 | 127 | 127 |
| 2                    | 25                     | 60  | 122 | 58  | 57  | 208 | 95  | 95  | 95  | 72  | 376 | 145 | 145 |
| 3                    | 26                     | 64  | 131 | 66  | 66  | 221 | 107 | 107 | 107 | 74  | 392 | 163 | 163 |
| 50                   | 1                      | 23  | 51  | 25  | 51  | 48  | 51  | 89  | 89  | 89  | 405 | 143 | 143 |
| 2                    | 24                     | 59  | 127 | 61  | 63  | 225 | 102 | 102 | 102 | 70  | 421 | 161 | 161 |
| 3                    | 26                     | 64  | 135 | 69  | 69  | 237 | 115 | 115 | 115 | 72  | 435 | 180 | 180 |
| 100                  | 1                      | 23  | 53  | 24  | 108 | 50  | 49  | 92  | 92  | 92  | 428 | 155 | 155 |
| 2                    | 24                     | 59  | 120 | 60  | 51  | 224 | 105 | 105 | 105 | 67  | 444 | 174 | 174 |
| 3                    | 25                     | 59  | 130 | 68  | 53  | 237 | 118 | 118 | 118 | 69  | 458 | 193 | 193 |

### COMMON VENT CAPACITY

| VENT HEIGHT H (feet) | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN | FAN |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                      | Fan+Fan | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT | Fan+NAT |
| 6                    | NA     | 74  | 25  | NA   | 119 | 46  | NA   | 178 | 71  | NA   | 257 | 103 | NA   | 351 | 143 | NA     |
| 8                    | NA     | 80  | 28  | NA   | 130 | 53  | NA   | 193 | 82  | NA   | 279 | 119 | NA   | 384 | 163 | NA     |
| 10                   | NA     | 84  | 31  | NA   | 138 | 56  | NA   | 207 | 90  | NA   | 299 | 131 | NA   | 409 | 177 | NA     |
| 15                   | NA     | 88  | 36  | NA   | 152 | 67  | NA   | 233 | 106 | NA   | 334 | 152 | NA   | 523 | 212 | NA     |
| 20                   | NA     | 94  | 41  | NA   | 175 | 75  | NA   | 250 | 122 | NA   | 368 | 172 | NA   | 565 | 243 | NA     |
| 30                   | NA     | 99  | 46  | NA   | 198 | 83  | NA   | 270 | 137 | NA   | 404 | 198 | NA   | 615 | 278 | NA     |
| 50                   | NA     | 104 | 51  | NA   | 213 | 91  | NA   | 287 | 151 | NA   | 440 | 223 | NA   | 662 | 328 | NA     |
| 100                  | NA     | 110 | 56  | NA   | 231 | 99  | NA   | 307 | 169 | NA   | 476 | 249 | NA   | 710 | 384 | NA     |

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
WATER HEATERS

TABLE 510.2(3)
MASONRY CHIMNEY [NFPA 54: TABLE 13.2(c)] (continued)*

<table>
<thead>
<tr>
<th>NUMBER OF APPLIANCES: TWO OR MORE</th>
<th>APPLIANCE TYPE: CATEGORY I</th>
<th>APPLIANCE VENT CONNECTION: TYPE B DOUBLE-WALL CONNECTOR</th>
</tr>
</thead>
</table>

### VENT CONNECTOR CAPACITY

<table>
<thead>
<tr>
<th>VENT HEIGHT H (feet)</th>
<th>CONNECTOR RISE R (feet)</th>
<th>FAN</th>
<th>NAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
</tbody>
</table>

#### APPLIANCE INPUT RATING LIMITS IN THOUSANDS OF BTU PER HOUR

<table>
<thead>
<tr>
<th>VENT HEIGHT H (feet)</th>
<th>CONNECTOR RISE R (feet)</th>
<th>FAN +FAN</th>
<th>FAN +NAT</th>
<th>NAT +FAN</th>
<th>NAT +NAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
</tbody>
</table>

#### COMMON VENT CAPACITY

<table>
<thead>
<tr>
<th>VENT HEIGHT H (feet)</th>
<th>FAN +FAN</th>
<th>FAN +NAT</th>
<th>NAT +FAN</th>
<th>NAT +NAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
## TABLE 510.2(4)
### MASONRY CHIMNEY [NFPA 54: TABLE 13.2(d)]*

<table>
<thead>
<tr>
<th>NUMBER OF APPLIANCES:</th>
<th>TWO OR MORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPLIANCE TYPE:</td>
<td>CATEGORY I</td>
</tr>
<tr>
<td>APPLIANCE VENT CONNECTION:</td>
<td>SINGLE-WALL METAL CONNECTOR</td>
</tr>
</tbody>
</table>

### VENT CONNECTOR CAPACITY

<table>
<thead>
<tr>
<th>VENT CONNECTOR DIAMETER – D (inch)</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMBINED APPLIANCE INPUT RATING IN THOUSANDS OF BTU PER HOUR</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
</tbody>
</table>

### COMMON VENT CAPACITY

<table>
<thead>
<tr>
<th>VENT HEIGHT H (feet)</th>
<th>12</th>
<th>19</th>
<th>28</th>
<th>38</th>
<th>50</th>
</tr>
</thead>
</table>

---

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
### TABLE 510.2(4)
MASSONRY CHIMNEY [NFPA 54: TABLE 13.2(d)] (continued)*

<table>
<thead>
<tr>
<th>VENT HEIGHT</th>
<th>CONNECTOR RISE</th>
<th>FAN</th>
<th>NAT</th>
<th>FAN</th>
<th>NAT</th>
<th>FAN</th>
<th>NAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>H (feet)</td>
<td>R (feet)</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>292</td>
<td>366</td>
<td>200</td>
<td>231</td>
<td>373</td>
<td>557</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>301</td>
<td>432</td>
<td>231</td>
<td>373</td>
<td>557</td>
<td>299</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>309</td>
<td>491</td>
<td>269</td>
<td>381</td>
<td>634</td>
<td>348</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>313</td>
<td>407</td>
<td>207</td>
<td>387</td>
<td>530</td>
<td>263</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>323</td>
<td>465</td>
<td>238</td>
<td>397</td>
<td>607</td>
<td>309</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>332</td>
<td>509</td>
<td>274</td>
<td>407</td>
<td>663</td>
<td>356</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>333</td>
<td>434</td>
<td>213</td>
<td>410</td>
<td>571</td>
<td>273</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>343</td>
<td>489</td>
<td>244</td>
<td>420</td>
<td>640</td>
<td>317</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>352</td>
<td>530</td>
<td>279</td>
<td>430</td>
<td>694</td>
<td>363</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>349</td>
<td>502</td>
<td>225</td>
<td>445</td>
<td>646</td>
<td>291</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>359</td>
<td>548</td>
<td>256</td>
<td>456</td>
<td>706</td>
<td>334</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>368</td>
<td>586</td>
<td>289</td>
<td>466</td>
<td>755</td>
<td>378</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>345</td>
<td>569</td>
<td>235</td>
<td>439</td>
<td>734</td>
<td>306</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>355</td>
<td>610</td>
<td>266</td>
<td>450</td>
<td>787</td>
<td>348</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>365</td>
<td>644</td>
<td>298</td>
<td>461</td>
<td>831</td>
<td>391</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>338</td>
<td>665</td>
<td>250</td>
<td>430</td>
<td>864</td>
<td>330</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>348</td>
<td>699</td>
<td>282</td>
<td>442</td>
<td>908</td>
<td>372</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>358</td>
<td>729</td>
<td>312</td>
<td>452</td>
<td>946</td>
<td>412</td>
</tr>
<tr>
<td>50</td>
<td>1</td>
<td>328</td>
<td>778</td>
<td>287</td>
<td>417</td>
<td>1022</td>
<td>383</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>339</td>
<td>806</td>
<td>320</td>
<td>429</td>
<td>1058</td>
<td>425</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>349</td>
<td>831</td>
<td>351</td>
<td>440</td>
<td>1090</td>
<td>466</td>
</tr>
<tr>
<td>100</td>
<td>1</td>
<td>315</td>
<td>875</td>
<td>328</td>
<td>402</td>
<td>1181</td>
<td>444</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>326</td>
<td>899</td>
<td>361</td>
<td>415</td>
<td>1210</td>
<td>488</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>337</td>
<td>921</td>
<td>392</td>
<td>427</td>
<td>1238</td>
<td>529</td>
</tr>
</tbody>
</table>

### COMMON VENT CAPACITY

<table>
<thead>
<tr>
<th>VENT HEIGHT</th>
<th>FAN +FAN</th>
<th>FAN +NAT</th>
<th>NAT +FAN</th>
<th>NAT +NAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>H (feet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NA</td>
<td>455</td>
<td>187</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NA</td>
<td>497</td>
<td>217</td>
<td>NA</td>
</tr>
<tr>
<td>10</td>
<td>NA</td>
<td>532</td>
<td>234</td>
<td>771</td>
</tr>
<tr>
<td>15</td>
<td>677</td>
<td>602</td>
<td>280</td>
<td>866</td>
</tr>
<tr>
<td>20</td>
<td>765</td>
<td>661</td>
<td>321</td>
<td>947</td>
</tr>
<tr>
<td>30</td>
<td>808</td>
<td>739</td>
<td>377</td>
<td>1052</td>
</tr>
<tr>
<td>50</td>
<td>821</td>
<td>456</td>
<td>1152</td>
<td>1076</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
<td>494</td>
<td>NA</td>
<td>663</td>
</tr>
</tbody>
</table>

### WATER HEATERS

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
### TABLE 510.2(5)
SINGLE-WALL METAL PIPE OR TYPE B ASBESTOS-CEMENT VENT [NFPA 54: TABLE 13.2(e)]*

<table>
<thead>
<tr>
<th>TOTAL VENT HEIGHT (H) (feet)</th>
<th>CONNECTOR RISE (R) (feet)</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-8</td>
<td></td>
<td>21</td>
<td>40</td>
<td>68</td>
<td>102</td>
<td>146</td>
<td>205</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>23</td>
<td>44</td>
<td>77</td>
<td>117</td>
<td>179</td>
<td>240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 and up</td>
<td></td>
<td>25</td>
<td>49</td>
<td>84</td>
<td>129</td>
<td>190</td>
<td>270</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>31</td>
<td>58</td>
<td>97</td>
<td>145</td>
<td>211</td>
<td>295</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>36</td>
<td>68</td>
<td>107</td>
<td>164</td>
<td>232</td>
<td>321</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COMMON VENT CAPACITY**

<table>
<thead>
<tr>
<th>TOTAL VENT HEIGHT (H) (feet)</th>
<th>COMMON VENT DIAMETER – (D) (inch)</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td></td>
<td>48</td>
<td>78</td>
<td>111</td>
<td>155</td>
<td>205</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>55</td>
<td>89</td>
<td>128</td>
<td>175</td>
<td>234</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>59</td>
<td>95</td>
<td>136</td>
<td>190</td>
<td>250</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>71</td>
<td>115</td>
<td>168</td>
<td>228</td>
<td>305</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>80</td>
<td>129</td>
<td>186</td>
<td>260</td>
<td>340</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>NA</td>
<td>147</td>
<td>215</td>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>360</td>
<td>490</td>
</tr>
</tbody>
</table>

* NA: Not applicable.

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

### TABLE 510.2(6)
EXTERIOR MASONRY CHIMNEY [NFPA 54: TABLE 13.2(f)]*

<table>
<thead>
<tr>
<th>VENT HEIGHT (H) (feet)</th>
<th>INTERNAL AREA OF CHIMNEY (square inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>25 46 71 103 143 188 246 NA</td>
</tr>
<tr>
<td>19</td>
<td>28 53 82 119 163 218 278 408</td>
</tr>
<tr>
<td>28</td>
<td>31 56 90 131 177 236 302 454</td>
</tr>
<tr>
<td>38</td>
<td>NA 67 106 152 212 283 365 546</td>
</tr>
<tr>
<td>50</td>
<td>NA NA NA NA NA NA NA NA</td>
</tr>
<tr>
<td>78</td>
<td>NA NA NA NA NA NA NA NA</td>
</tr>
<tr>
<td>113</td>
<td>NA NA NA NA NA NA NA NA</td>
</tr>
</tbody>
</table>

* NA: Not applicable.

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²
### TABLE 510.2(7)
EXTERIOR MASONRY CHIMNEY [NFPA 54: TABLE 13.2(g)]¹ ²

<table>
<thead>
<tr>
<th>NUMBER OF APPLIANCES</th>
<th>NUMBER OF APPLIANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWO OR MORE</td>
<td>NAT + NAT</td>
</tr>
<tr>
<td>APPLIANCE VENT CONNECTION</td>
<td>TYPE B DOUBLE-WALL CONNECTOR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VENT HEIGHT H (feet)</th>
<th>INTERNAL AREA OF CHIMNEY (square inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Local 99% winter design temperature: 37°F or greater</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
</tr>
<tr>
<td>Local 99% winter design temperature: 27°F to 36°F</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
</tr>
<tr>
<td>Local 99% winter design temperature: 17°F to 26°F</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>8</td>
<td>NA</td>
</tr>
<tr>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
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<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
</tr>
<tr>
<td>Local 99% winter design temperature: 5°F to 16°F</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>8</td>
<td>NA</td>
</tr>
<tr>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
</tr>
<tr>
<td>Local 99% winter design temperature: 4°F or lower</td>
<td></td>
</tr>
</tbody>
</table>

Not recommended for any vent configurations

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m², °C = (°F-32)/1.8

Notes:

¹ See Figure 510.1.10 for a map showing local 99 percent winter design temperatures in the United States.
² NA: Not applicable.
### TABLE 510.2(8)
**EXTERIOR MASONRY CHIMNEY [NFPA 54: TABLE 13.2(h)]**

<table>
<thead>
<tr>
<th>VENT HEIGHT $H$ (feet)</th>
<th>NUMBER OF APPLIANCES: TWO OR MORE</th>
<th>APPLIANCE TYPE: FAN + NAT</th>
<th>APPLIANCE VENT CONNECTION: TYPE B DOUBLE-WALL CONNECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
<td>19</td>
<td>28</td>
</tr>
<tr>
<td>6</td>
<td>74</td>
<td>119</td>
<td>178</td>
</tr>
<tr>
<td>8</td>
<td>80</td>
<td>130</td>
<td>193</td>
</tr>
<tr>
<td>10</td>
<td>84</td>
<td>138</td>
<td>207</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
<td>152</td>
<td>233</td>
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<td>20</td>
<td>NA</td>
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<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m²

* NA: Not applicable.
### TABLE 510.2(9)
**EXTERIOR MASONRY CHIMNEY [NFPA 54: TABLE 13.2(i)]\(^1,2\)**

<table>
<thead>
<tr>
<th>NUMBER OF APPLIANCES: TWO OR MORE</th>
<th>APPLIANCE TYPE: FAN + NAT</th>
<th>APPLIANCE VENT CONNECTION: TYPE B DOUBLE-WALL CONNECTOR</th>
</tr>
</thead>
</table>

#### MINIMUM ALLOWABLE INPUT RATING OF SPACE-HEATING APPLIANCE IN THOUSANDS OF BTU PER HOUR

<table>
<thead>
<tr>
<th>VENT HEIGHT (H) (feet)</th>
<th>INTERNAL AREA OF CHIMNEY (square inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Local 99% winter design temperature: 37°F or greater</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
</tr>
<tr>
<td>Local 99% winter design temperature: 27°F to 36°F</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
</tr>
<tr>
<td>Local 99% winter design temperature: 17°F to 26°F</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>52</td>
</tr>
<tr>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
</tr>
<tr>
<td>Local 99% winter design temperature: 5°F to 16°F</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>8</td>
<td>NA</td>
</tr>
<tr>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
</tr>
<tr>
<td>Local 99% winter design temperature: -10°F to 4°F</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>8</td>
<td>NA</td>
</tr>
<tr>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>50</td>
<td>NA</td>
</tr>
<tr>
<td>100</td>
<td>NA</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 square inch = 0.000645 m², °C = (°F-32)/1.8

**Notes:**

1. See Figure 510.1.10 for a map showing local 99 percent winter design temperatures in the United States.
2. NA: Not applicable.
CHAPTER 6
WATER SUPPLY AND DISTRIBUTION

601.0 General.
601.1 Applicability. This chapter shall govern the materials, design, and installation of water supply systems, including methods and devices used for backflow prevention.

601.2 Water Supply and Flushing. Each plumbing fixture shall be provided with an adequate supply of potable running water piped thereto in an approved manner, so arranged as to flush and keep it in a clean and sanitary condition without danger of backflow or cross-connection. Water closets and urinals shall be flushed using an approved flush tank or flushometer valve.

Exceptions:
(1) Listed fixtures that do not require water for their operation and are not connected to the water supply.
(2) Where not deemed necessary for safety and sanitation by the Authority Having Jurisdiction.

601.2.1 Hot and Cold Water Required. In occupancies where plumbing fixtures are installed for private use, hot water shall be required for bathing, washing, laundry, cooking purposes, dishwashing or maintenance. In occupancies where plumbing fixtures are installed for public use, hot water shall be required for bathing and washing purposes. This requirement shall not supersede the requirements for individual temperature control limitations for public lavatories and public and private bidets, bathtubs, whirlpool bathtubs, and shower control valves.

601.3 Identification of a Potable and Nonpotable Water System. In buildings where potable water and nonpotable water systems are installed, each system shall be clearly identified in accordance with Section 601.3.1 through Section 601.3.5.

601.3.1 Potable Water. Green background with white lettering.

601.3.2 Color and Information. Each system shall be identified with a colored pipe or band and coded with paints, wraps, and materials compatible with the piping.

Except as required by Section 601.3.3, nonpotable water systems shall have a yellow background with black uppercase lettering, with the words “CAUTION: NONPOTABLE WATER, DO NOT DRINK.” Each nonpotable system shall be identified to designate the liquid being conveyed, and the direction of normal flow shall be clearly shown. The minimum size of the letters and length of the color field shall comply with Table 601.3.2.

The background color and required information shall be indicated every 20 feet (6096 mm) but not less than once per room, and shall be visible from the floor level.

601.3.3 Alternate Water Sources. Alternate water source systems shall have a purple (Pantone color No. 512, 522C, or equivalent) background with uppercase lettering and shall be field or factory marked as follows:

(1) Gray water systems shall be marked in accordance with this section with the words “CAUTION: NONPOTABLE GRAY WATER, DO NOT DRINK” in black letters.
(2) Reclaimed (recycled) water systems shall be marked in accordance with this section with the words: “CAUTION: NONPOTABLE RECLAIMED (RECYCLED) WATER, DO NOT DRINK” in black letters.
(3) On-site treated water systems shall be marked in accordance with this section with the words: “CAUTION: NONPOTABLE TREATED WATER, DO NOT DRINK” in black letters.
(4) Rainwater catchment systems shall be marked in accordance with this section with the words: “CAUTION: NONPOTABLE RAINWATER, DO NOT DRINK” in black letters.

601.3.4 Fixtures. Where vacuum breakers or backflow preventers are installed with fixtures listed in Chapter 17, identification of the discharge side shall be permitted to be omitted.

601.3.5 Outlets. Each outlet on the nonpotable water line that is used for special purposes shall be posted with black uppercase lettering as follows: “CAUTION: NONPOTABLE WATER, DO NOT DRINK.”

602.0 Unlawful Connections.
602.1 Prohibited Installation. No installation of potable water supply piping, or part thereof, shall be made in such a manner that it will be possible for used, unclean, polluted, or contaminated water, mixtures, or substances to enter a portion of such piping from a tank, receptor, equipment, or plumbing fixture by reason of backspignonage, suction, or other cause, either during normal use and operation thereof, or where such tank, receptor, equipment, or plumbing fixture is flooded or subject to pressure exceeding the operating pressure in the hot or cold water piping.
602.2 Cross-Contamination. No person shall make a connection or allow one to exist between pipes or conduits carrying domestic water supplied by a public or private building supply system, and pipes, conduits, or fixtures containing or carrying water from any other source or containing or carrying water that has been used for any purpose whatsoever, or piping carrying chemicals, liquids, gases, or substances whatsoever, unless there is provided a backflow prevention device approved for the potential hazard and maintained in accordance with this code. Each point of use shall be separately protected where potential cross-contamination of individual units exists.

602.3 Backflow Prevention. No plumbing fixture, device, or construction shall be installed or maintained, or shall be connected to a domestic water supply, where such installation or connection provides a possibility of polluting such water supply or cross-connection between a distributing system of water for drinking and domestic purposes and water that becomes contaminated by such plumbing fixture, device, or construction unless there is provided a backflow prevention device approved for the potential hazard.

602.4 Approval by Authority. No water piping supplied by a private water supply system shall be connected to any other source of supply without the approval of the Authority Having Jurisdiction, Health Department, or other department having jurisdiction.

603.0 Cross-Connection Control.

603.1 General. Cross-connection control shall be provided in accordance with the provisions of this chapter.

No person shall install a water-operated equipment or mechanism, or use a water-treating chemical or substance, where it is found that such equipment, mechanism, chemical, or substance causes pollution or contamination of the domestic water supply. Such equipment or mechanism shall be permitted where equipped with an approved backflow prevention device or assembly.

603.2 Approval of Devices or Assemblies. Before a device or an assembly is installed for the prevention of backflow, it shall have first been approved by the Authority Having Jurisdiction. Devices or assemblies shall be tested in accordance with recognized standards or other standards acceptable to the Authority Having Jurisdiction. Backflow prevention devices and assemblies shall comply with Table 603.2, except for specific applications and provisions as stated in Section 603.5.1 through Section 603.5.21.

Devices or assemblies installed in a potable water supply system for protection against backflow shall be maintained in good working condition by the person or persons having control of such devices or assemblies. Such devices or assemblies shall be tested at the time of installation, repair, or relocation and not less than on an annual schedule thereafter, or more often where required by the Authority Having Jurisdiction. Where found to be defective or inoperative, the device or assembly shall be repaired or replaced. No device or assembly shall be removed from use or relocated or other device or assembly substituted, without the approval of the Authority Having Jurisdiction.

Testing or maintenance shall be performed by a certified backflow assembly tester or repairer certified in accordance with ASSE Series 5000 or otherwise any other additional certification approved by the Authority Having Jurisdiction.

603.3 Backflow Prevention Devices, Assemblies, and Methods. Backflow prevention devices, assemblies, and methods shall comply with Section 603.3.1 through Section 603.3.12.

603.3.1 Air Gap. The minimum air gap to afford backflow protection shall be in accordance with Table 603.3.1.

603.3.2 Atmospheric Vacuum Breaker (AVB). An atmospheric vacuum breaker consists of a body, a checking member, and an atmospheric port.

603.3.3 Hose Connection Backflow Preventer. A hose connection backflow preventer consists of two independent check valves with an independent atmospheric vent between and a means of field testing and draining.

603.3.4 Double Check Valve Backflow Prevention Assembly (DC). A double check valve backflow prevention assembly consists of two independently acting internally loaded check valves, four properly located test cocks, and two isolation valves.

603.3.5 Pressure Vacuum Breaker Backflow Prevention Assembly (PVB). A pressure vacuum breaker backflow prevention assembly consists of a loaded air inlet valve, an internally loaded check valve, two properly located test cocks, and two isolation valves. This device shall be permitted to be installed indoors where provisions for spillage are provided.

603.3.6 Spill-Resistant Pressure Vacuum Breaker (SVB). A pressure-type vacuum breaker backflow prevention assembly consists of one check valve force loaded closed and an air inlet vent valve force loaded open to atmosphere, positioned downstream of the check valve and located between and including two tightly closing shutoff valves and test cocks.

603.3.7 Reduced-Pressure Principle Backflow Prevention Assembly (RP). A reduced-pressure principle backflow prevention assembly consists of two independently acting internally loaded check valves, a differential pressure relief valve, four properly located test cocks, and two isolation valves.

603.3.8 Double Check Detector Fire Protection Backflow Prevention Assembly. A double check valve backflow prevention assembly with a parallel detector assembly consisting of a water meter and a double check valve backflow prevention assembly (DC).

603.3.9 Reduced Pressure Detector Fire Protection Backflow Prevention Assembly. A reduced-pressure principle backflow prevention assembly with a parallel detector assembly consisting of a water meter and a reduced-pressure principle backflow prevention assembly (RP).

603.3.10 Dual Check Backflow Preventer. A dual check backflow preventer consists of two independently acting check valves, force loaded to a normally closed position.
## TABLE 603.2
BACKFLOW PREVENTION DEVICES, ASSEMBLIES, AND METHODS

<table>
<thead>
<tr>
<th>DEVICE, ASSEMBLY, OR METHOD</th>
<th>DEGREE OF HAZARD</th>
<th>POLLUTION (LOW HAZARD)</th>
<th>CONTAMINATION (HIGH HAZARD)</th>
<th>INSTALLATION²,³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>BACK-SIPHONAGE</td>
<td>BACK-PRESSURE</td>
<td>BACK-SIPHONAGE</td>
</tr>
<tr>
<td>Air gap</td>
<td>ASME A112.1.2</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td>Air gap fittings for use with plumbing fixtures, appliances, and appurtenances</td>
<td>ASME A112.1.3</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td>Antisiphon fill valve (ballcocks) for gravity water closet flush tanks and urinal tanks</td>
<td>ASSE 1002/ASME A112.1002/CSA B125.12</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td>Atmospheric vacuum breaker (consists of a body, checking member and atmospheric port)</td>
<td>ASSE 1001 or CSA B64.1.1</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td>Backflow preventer for Carbonated Beverage Dispensers (two independent check valves with a vent to the atmosphere)</td>
<td>ASSE 1022</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td>Backflow preventer with intermediate atmospheric vent</td>
<td>ASSE 1012</td>
<td>X</td>
<td>X</td>
<td>—</td>
</tr>
<tr>
<td>Backflow preventer with intermediate atmospheric vent and pressure reducing valve</td>
<td>ASSE 1081</td>
<td>X</td>
<td>X</td>
<td>—</td>
</tr>
<tr>
<td>Chemical dispenser with integral backflow protection</td>
<td>ASSE/IPAMO 1055</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td>Dual check backflow preventer</td>
<td>ASSE 1024</td>
<td>X</td>
<td>X</td>
<td>—</td>
</tr>
<tr>
<td>Dual check backflow preventer wall hydrants, freeze resistant</td>
<td>ASSE 1053</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td>Double Check Detector Fire Protection Backflow Prevention Assembly (two independent check valves with a parallel detector assembly consisting of a water meter and a double check valve backflow prevention assembly and means for field testing)</td>
<td>ASSE 1048</td>
<td>X</td>
<td>X</td>
<td>—</td>
</tr>
</tbody>
</table>
### TABLE 603.2
**BACKFLOW PREVENTION DEVICES, ASSEMBLIES, AND METHODS (continued)**

<table>
<thead>
<tr>
<th>DEGREE OF HAZARD</th>
<th>DEVICE, ASSEMBLY, OR METHOD</th>
<th>APPLICABLE STANDARDS</th>
<th>POLLUTION (LOW HAZARD)</th>
<th>CONTAMINATION (HIGH HAZARD)</th>
<th>INSTALLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>BACK-SIPHONAGE</td>
<td>BACK-PRESSURE</td>
<td>BACK-SIPHONAGE</td>
</tr>
<tr>
<td></td>
<td>Double Check Valve Backflow Prevention Assembly (two independent check valves and means of field testing)</td>
<td>ASSE 1015; AWWA C510; CSA B64.5 or CSA B64.5.1</td>
<td>X</td>
<td>X</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Freez resistant sanitary yard hydrants</td>
<td>ASSE 1057</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Hose connection backflow preventers</td>
<td>ASSE 1052</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Hose connection vacuum breakers</td>
<td>ASSE 1011</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Laboratory faucet backflow preventer</td>
<td>ASSE 1035</td>
<td>—X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Pressure Vacuum Breaker Backflow Prevention Assembly (loaded air inlet valve, internally loaded check valve and means for field testing)</td>
<td>ASSE 1020 or CSA B64.1.2</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Reduced Pressure Detector Fire Protection Backflow Prevention Assembly (two independently acting loaded check valves, a differential pressure relief valve, with a parallel detector assembly consisting of a water meter and a reduced-pressure principle backflow prevention assembly, and means for field testing)</td>
<td>ASSE 1047</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Reduced Pressure Principle Backflow Prevention Assembly (two independently acting loaded check valves, a differential pressure relief valve and means for field testing)</td>
<td>ASSE 1013; AWWA C511; CSA B64.4 or CSA B64.4.1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Spill-Resistant Pressure Vacuum Breaker (single check valve with air inlet vent and means of field testing)</td>
<td>ASSE 1056</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Vacuum breaker wall hydrants, hose bibbs, freeze resistant, automatic draining type</td>
<td>ASSE 1019 or CSA B64.2.1.1</td>
<td>X</td>
<td>—</td>
<td>X</td>
</tr>
</tbody>
</table>

Horizontal unless otherwise listed. Access and clearance shall be in accordance with the manufacturer’s instructions, and not less than a 12 inch clearance at the bottom for maintenance. May need platform/ladder for test and repair. Does not discharge water.

Such devices are not for use under continuous pressure conditions.

Installation includes laboratory faucets. Such devices are not for use under continuous pressure conditions. No valve downstream.

Upright position. May have valves downstream. Minimum of 12 inches above all downstream piping and flood-level rim of the receptor. May discharge water.

Horizontal unless otherwise listed. Access and clearance shall be in accordance with the manufacturer’s instructions, and not less than a 12 inch clearance at the bottom for maintenance. May need platform/ladder for test and repair. May discharge water.

Installation includes a fire protection system and is designed to operate under continuous pressure conditions.

Horizontal unless otherwise listed. Access and clearance shall be in accordance with the manufacturer’s instructions, and not less than a 12 inch clearance at the bottom for maintenance. May need platform/ladder for test and repair. May discharge water.

Installation includes wall hydrants and hose bibbs. Such devices are not for use under continuous pressure conditions (means of shutoff downstream of device is prohibited).

For SI units: 1 inch = 25.4 mm

**Notes:**

1. See the description of devices and assemblies in this chapter.
2. Installation in pit or vault requires previous approval by the Authority Having Jurisdiction.
3. Refer to the general and specific requirement for installation.
4. Not to be subjected to operating pressure for more than 12 hours in a 24 hour period.
5. For deck-mounted and equipment-mounted vacuum breaker, see Section 603.5.13.
6. Shall be installed in accordance with Section 603.5.7.
### Table 603.3.1

<table>
<thead>
<tr>
<th>FIXTURES</th>
<th>WHERE NOT AFFECTED BY SIDEWALLS(^1) (inches)</th>
<th>WHERE AFFECTED BY SIDEWALLS(^2) (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective openings(^3) not greater than (\frac{1}{2}) of an inch in diameter</td>
<td>1</td>
<td>1(\frac{1}{2})</td>
</tr>
<tr>
<td>Effective openings(^3) not greater than (\frac{3}{4}) of an inch in diameter</td>
<td>1(\frac{1}{2})</td>
<td>2(\frac{1}{4})</td>
</tr>
<tr>
<td>Effective openings(^3) not greater than 1 inch in diameter</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Effective openings(^3) greater than 1 inch in diameter</td>
<td>Two times the diameter of effective opening</td>
<td>Three times the diameter of effective opening</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

**Notes:**

1. Sidewalls, ribs, or similar obstructions do not affect air gaps where spaced from the inside edge of the spout opening a distance exceeding three times the diameter of the effective opening for a single wall, or a distance exceeding four times the effective opening for two intersecting walls.

2. Vertical walls, ribs, or similar obstructions extending from the water surface to or above the horizontal plane of the spout opening other than specified in Footnote 1 above. The effect of three or more such vertical walls or ribs has not been determined. In such cases, the air gap shall be measured from the top of the wall.

3. The effective opening shall be the minimum cross-sectional area at the seat of the control valve or the supply pipe or tubing that feeds the device or outlet. Where two or more lines supply one outlet, the effective opening shall be the sum of the cross-sectional areas of the individual supply lines or the area of the single outlet, whichever is smaller.

4. Air gaps less than 1 inch (25.4 mm) shall be approved as a permanent part of a listed assembly that has been tested under actual backflow conditions with vacuums of 0 to 25 inches of mercury (85 kPa).

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**603.3.11 Laboratory Faucet Backflow Preventers.** Laboratory faucet backflow preventers shall comply with ASSE 1035.

**603.3.12 Backflow Preventer with Intermediate Atmospheric Vent.** A backflow preventer with intermediate atmospheric vent consists of two independently acting check valves, force loaded to a normally closed position, and an intermediate chamber with a means for automatically venting to atmosphere, force loaded to a normally open position.

**603.4 General Requirements.** Assemblies shall comply with listed standards and be acceptable to the Authority Having Jurisdiction, with jurisdiction over the selection and installation of backflow prevention assemblies.

**603.4.1 Backflow Prevention Valve.** Where more than one backflow prevention valve is installed on a single premise, and the valves are installed in one location, each separate valve shall be permanently identified by the permittee in a manner satisfactory to the Authority Having Jurisdiction.

**603.4.2 Testing.** The premise owner or responsible person shall have the backflow prevention assembly tested by a certified backflow assembly tester at the time of installation, repair, or relocation and not less than on an annual schedule thereafter, or more often where required by the Authority Having Jurisdiction. The periodic testing shall be performed in accordance with the procedures referenced in ASSE Series 5000 by a tester qualified in accordance with those standards. The field test kit used shall comply with ASSE 1064.

**603.4.3 Access and Clearance.** Access and clearance shall be provided for the required testing, maintenance, and repair. Access and clearance shall be in accordance with the manufacturer’s instructions, and not less than 12 inches (305 mm) between the lowest portion of the assembly and grade, floor, or platform. Installations elevated that exceed 5 feet (1524 mm) above the floor or grade shall be provided with a platform capable of supporting a tester or maintenance person.

**603.4.4 Connections.** Direct connections between potable water piping and sewer-connected wastes shall not be permitted to exist under any condition with or without backflow protection. Where potable water is discharged to the drainage system, it shall be by means of an approved air gap of two pipe diameters of the supply inlet, but in no case shall the gap be less than 1 inch (25.4 mm). Connection shall be permitted to be made to the inlet side of a trap provided that an approved vacuum breaker is installed not less than 6 inches (152 mm), or the distance according to the device’s listing, above the flood-level rim of such trapped fixture, so that at no time will such device be subjected to backpressure.

**603.4.5 Hot Water Backflow Preventers.** Backflow preventers for hot water exceeding 110°F (43°C) shall be a type designed to operate at temperatures exceeding 110°F (43°C) without rendering a portion of the assembly inoperative.

**603.4.6 Integral Backflow Preventers.** Fixtures, appliances, or appurtenances with integral backflow preventers or integral air gaps manufactured as a unit shall be installed in accordance with their listing requirements and the manufacturer’s installation instructions.

**603.4.7 Freeze Protection.** In cold climate areas, backflow assemblies and devices shall be protected from freezing with an outdoor enclosure that complies with ASSE 1060 or by a method acceptable to the Authority Having Jurisdiction.
603.4.8 Drain Lines. Drain lines serving backflow devices or assemblies shall be sized in accordance with the discharge rates of the manufacturer’s flow charts of such devices or assemblies.

603.4.9 Prohibited Locations. Backflow prevention devices with atmospheric vents or ports shall not be installed in pits, underground, or submerged locations. Backflow preventers shall not be located in an area containing fumes that are toxic, poisonous, or corrosive.

603.5 Specific Requirements. Specific requirements for backflow prevention shall comply with Section 603.5.1 through Section 603.5.21.

603.5.1 Atmospheric Vacuum Breaker. Water closet and urinal flushometer valves shall be protected against backflow by an approved backflow prevention assembly, device, or method. Where the valves are equipped with an atmospheric vacuum breaker, the vacuum breaker shall be installed on the discharge side of the flushometer valve with the critical level not less than 6 inches (152 mm), or the distance according to its listing, above the overflow rim of a water closet bowl or the highest part of a urinal.

603.5.2 Ballcock. Water closet and urinal tanks shall be equipped with a ballcock. The ballcock shall be installed with the critical level not less than 1 inch (25.4 mm) above the full opening of the overflow pipe. In cases where the ballcock has no hush tube, the bottom of the water supply inlet shall be installed 1 inch (25.4 mm) above the full opening of the overflow pipe.

603.5.3 Backflow Prevention. Water closet flushometer tanks shall be protected against backflow by an approved backflow prevention assembly, device, or method.

603.5.4 Heat Exchangers. Heat exchangers used for heat transfer, heat recovery, or solar heating shall protect the potable water system from being contaminated by the heat-transfer medium. Single-wall heat exchangers used in indirect-fired water heaters shall meet the requirements of Section 505.4.1. Double-wall heat exchangers shall separate the potable water from the heat-transfer medium by providing a space between the two walls that are vented to the atmosphere.

603.5.5 Water Supply Inlets. Water supply inlets to tanks, vats, sumps, swimming pools, and other receptors shall be protected by one of the following means:

1. An approved air gap.
2. A listed vacuum breaker installed on the discharge side of the last valve with the critical level not less than 6 inches (152 mm) or in accordance with its listing.
3. A backflow preventer suitable for the degree of hazard, installed in accordance with the requirements for that type of device or assembly as set forth in this chapter.

603.5.6 Protection from Lawn Sprinklers and Irrigation Systems. Potable water supplies to systems having no pumps or connections for pumping equipment, and no chemical injection or provisions for chemical injection, shall be protected from backflow by one of the following devices:

1. Atmospheric vacuum breaker (AVB)
2. Pressure vacuum breaker backflow prevention assembly (PVB)
3. Spill-resistant pressure vacuum breaker (SVB)
4. Reduced-pressure principle backflow prevention assembly (RP)
5. A valve complying with IAPMO PS 72

603.5.6.1 Systems with Pumps. Where sprinkler and irrigation systems have pumps, connections for pumping equipment, or auxiliary air tanks, or are otherwise capable of creating backpressure, the potable water supply shall be protected by the following type of device where the backflow device is located upstream from the source of backpressure:

1. Reduced-pressure principle backflow prevention assembly (RP)

603.5.6.2 Systems with Backflow Devices. Where systems have a backflow device installed downstream from a potable water supply pump or a potable water supply pump connection, the device shall be one of the following:

1. Atmospheric vacuum breaker (AVB)
2. Pressure vacuum breaker backflow prevention assembly (PVB)
3. Spill-resistant pressure vacuum breaker (SVB)
4. Reduced-pressure principle backflow prevention assembly (RP)

603.5.6.3 Systems with Chemical Injectors. Where systems include a chemical injector or provisions for chemical injection, the potable water supply shall be protected by a reduced-pressure principle backflow prevention assembly (RP).

603.5.7 Outlets with Hose Attachments. Potable water outlets with hose attachments, other than water heater drains, boiler drains, and clothes washer connections, shall be protected by a nonremovable hose bibb-type backflow preventer, a nonremovable hose bibb-type vacuum breaker, or by an atmospheric vacuum breaker installed not less than 6 inches (152 mm) above the highest point of usage located on the discharge side of the last valve. In climates where freezing temperatures occur, a listed self-draining frost-proof hose bibb with an integral backflow preventer or vacuum breaker shall be used.

603.5.8 Water-Cooled Equipment. Water-cooled compressors, degreasers, or other water-cooled equipment shall be protected by a backflow preventer installed in accordance with the requirements of this chapter. Water-cooled equipment that produces backpressure shall be equipped with the appropriate protection.

603.5.9 Aspirators. Water inlets to water-supplied aspirators shall be equipped with a vacuum breaker installed in accordance with its listing requirements and
this chapter. The discharge shall drain through an air gap. Where the tailpiece of a fixture to receive the discharge of an aspirator is used, the air gap shall be located above the flood-level rim of the fixture.

603.5.10 Steam or Hot Water Boilers. Potable water connections to steam or hot water boilers shall be protected from backflow by a double check valve backflow prevention assembly, backflow preventer with intermediate atmospheric vent and pressure reducing valve, or reduced pressure principle backflow prevention assembly in accordance with Table 603.2. Where chemicals are introduced into the system a reduced pressure principle backflow prevention assembly shall be provided in accordance with Table 603.2.

603.5.11 Nonpotable Water Piping. In cases where it is impractical to correct individual cross-connections on the domestic waterline, the line supplying such outlets shall be considered a nonpotable water line. No drinking or domestic water outlets shall be connected to the nonpotable waterline. Where possible, portions of the nonpotable waterline shall be exposed, and exposed portions shall be properly identified in a manner satisfactory to the Authority Having Jurisdiction. Each outlet on the nonpotable waterline that is permitted to be used for drinking or domestic purposes shall be posted: “CAUTION: NONPOTABLE WATER, DO NOT DRINK.”

603.5.12 Beverage Dispensers. Potable water supply to beverage dispensers, carbonated beverage dispensers, or coffee machines shall be protected by an air gap or a vented backflow preventer that complies with ASSE 1022. For carbonated beverage dispensers, piping material installed downstream of the backflow preventer shall not be affected by carbon dioxide gas.

603.5.13 Deck-Mounted and Equipment-Mounted Vacuum Breakers. Deck-mounted or equipment-mounted vacuum breakers shall be installed in accordance with their listing and the manufacturer’s installation instructions, with the critical level not less than 1 inch (25.4 mm) above the flood-level rim.

603.5.14 Protection from Fire Systems. Except as provided in Section 603.5.14.1 and Section 603.5.14.2, potable water supplies to fire protection systems that are normally under pressure, including but not limited to standpipes and automatic sprinkler systems, except in one- or two-family or townhouse residential sprinkler systems, piped in materials approved for potable water distribution systems shall be protected from backpressure and backsiphonage by one of the following testable devices:

(1) Double check valve backflow prevention assembly (DC)
(2) Double check detector fire protection backflow prevention assembly
(3) Reduced pressure principle backflow prevention assembly (RP)
(4) Reduced pressure detector fire protection backflow prevention assembly

Potable water supplies to fire protection systems that are not normally under pressure shall be protected from backflow and shall be in accordance with the requirements of the appropriate standards referenced in Chapter 17.

603.5.14.1 Fire Department Connection. Where fire protection systems supplied from a potable water system include a fire department (siamese) connection that is located less than 1700 feet (518.2 m) from a nonpotable water source that is capable of being used by the fire department as a secondary water supply, the potable water supply shall be protected by one of the following:

(1) Reduced pressure principle backflow prevention assembly (RP)
(2) Reduced pressure detector fire protection backflow prevention assembly

Nonpotable water sources include fire department vehicles carrying water of questionable quality or water that is treated with antifreeze, corrosion inhibitors, or extinguishing agents.

603.5.14.2 Chemicals. Where antifreeze, corrosion inhibitors, or other chemicals are added to a fire protection system supplied from a potable water supply, the potable water system shall be protected by one of the following:

(1) Reduced pressure principle backflow prevention assembly (RP)
(2) Reduced pressure detector fire protection backflow prevention assembly

603.5.14.3 Hydraulic Design. Where a backflow device is installed in the potable water supply to a fire protection system, the hydraulic design of the system shall account for the pressure drop through the backflow device. Where such devices are retrofitted for an existing fire protection system, the hydraulics of the sprinkler system design shall be checked to verify that there will be sufficient water pressure available for satisfactory operation of the fire sprinklers.

603.5.15 Health Care or Laboratory Areas. Vacuum breakers for washer-hose bedpans shall be located not less than 5 feet (1524 mm) above the floor. Hose connections in health care or laboratory areas shall be not less than 6 feet (1829 mm) above the floor.

603.5.16 Special Equipment. Portable cleaning equipment and dental vacuum pumps shall be protected from backflow by an air gap, an atmospheric vacuum breaker, a spill-resistant vacuum breaker, or a reduced pressure principle backflow preventer.

603.5.17 Potable Water Outlets and Valves. Potable water outlets, freeze-proof yard hydrants, combination stop-and-waste valves, or other fixtures that incorporate a stop and waste feature that drains into the ground shall not be installed underground.
603.5.18 Pure Water Process Systems. The water supply to a pure water process system, such as dialysis water systems, semiconductor washing systems, and similar process piping systems, shall be protected from backpressure and backspihonage by a reduced-pressure principle backflow preventer.

603.5.18.1 Dialysis Water Systems. The individual connections of the dialysis related equipment to the dialysis pure water system shall not require additional backflow protection.

603.5.19 Plumbing Fixture Fittings. Plumbing fixture fittings with integral backflow protection shall comply with ASME A112.18.1/CSA B125.1.

603.5.20 Swimming Pools, Spas, and Hot Tubs. Potable water supply to swimming pools, spas, and hot tubs shall be protected by an air gap or a reduced pressure principle backflow preventer in accordance with the following:

1. The unit is equipped with a submerged fill line.
2. The potable water supply is directly connected to the unit circulation system.

603.5.21 Chemical Dispensers. The water supply to chemical dispensers shall be protected from backflow. The chemical dispenser shall comply with ASSE/IAPMO 1055 or the water supply shall be protected by one of the following methods:

1. Air gap
2. Atmospheric vacuum breaker (AVB)
3. Pressure vacuum breaker backflow prevention assembly (PVB)
4. Spill-resistant pressure vacuum breaker (SVB)
5. Reduced-pressure principle backflow prevention assembly (RP)

604.0 Materials.

604.1 Pipe, Tube, and Fittings. Pipe, tube, fittings, solvent cement, thread sealants, solders, and flux used in potable water systems intended to supply drinking water shall comply with NSF/ANSI/CAN 61. Where pipe fittings and valves are made from copper alloys containing more than 15 percent zinc by weight and are used in plastic piping systems, they shall be resistant to dezincification and stress corrosion cracking in compliance with NSF/ANSI 14.

Materials used in the water supply system, except valves and similar devices, shall be of a like material, except where otherwise approved by the Authority Having Jurisdiction.

Materials for building water piping and building supply piping shall comply with the applicable standards referenced in Table 604.1.

604.2 Lead Content. The maximum allowable lead content in pipes, pipe fittings, plumbing fittings, and fixtures intended to convey or dispense water for human consumption shall be not more than a weighted average of 0.25 percent with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures. For solder and flux, the lead content shall be not more than 0.2 percent where used in piping systems that convey or dispense water for human consumption.

Exceptions:

1. Pipes, pipe fittings, plumbing fittings, fixtures, or backflow preventers used for nonpotable services such as manufacturing, industrial processing, irrigation, outdoor watering, or any other uses where the water is not used for human consumption.
2. Flush valves, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are 2 inches (50 mm) in diameter or larger.

604.2.1 Lead Content of Water Supply Pipe and Fittings. Pipes, pipe fittings, valves, and faucets utilized in the water supply system for non-drinking water applications shall have a maximum of 8 percent lead content.

604.3 Copper or Copper Alloy Tube. Copper or copper alloy tubing for water piping shall have a weight of not less than Type L.

Exception: Type M copper or copper alloy tubing shall be permitted to be used for water piping where piping is aboveground in, or on, a building or underground outside of structures.

604.4 Hard-Drawn Copper or Copper Alloy Tubing. Hard-drawn copper or copper alloy tubing for water supply and distribution in addition to the required incised marking shall be marked in accordance with ASTM B88. The colors shall be: Type K, green; Type L, blue; and Type M, red.

604.5 Flexible Connectors. Flexible water connectors shall be installed in readily accessible locations, and where under continuous pressure shall comply with ASME A112.18.6/CSA B125.6. Flexible water connectors with an excess flow shutoff device shall comply with CSA B125.5/IAPMO Z600.

604.6 Cast-Iron Fittings. Cast-iron fittings up to and including 2 inches (50 mm) in size, where used in connection with potable water piping, shall be galvanized.

604.7 Malleable Iron Fittings. Malleable iron water fittings shall be galvanized.

604.8 Previously Used Piping and Tubing. Piping and tubing that has previously been used for a purpose other than for potable water systems shall not be used.

604.9 Epoxy Coating. The epoxy coating used on existing, underground steel building supply piping shall comply with NSF/ANSI/CAN 61 and AWWA C210.

604.10 Plastic Materials. Approved plastic materials shall be permitted to be used in building supply piping, provided that where metal building supply piping is used for electrical grounding purposes, replacement piping, therefore, shall be of like materials.
<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>BUILDING SUPPLY PIPE AND FITTINGS</th>
<th>WATER DISTRIBUTION PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
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Notes:
¹ For building supply or exterior cold-water applications, not for water distribution piping.
² For brazed fittings only.
Exception: Where a grounding system acceptable to the Authority Having Jurisdiction is installed, inspected, and approved, the metallic pipe shall be permitted to be replaced with nonmetallic pipe.

604.10.1 Tracer Wire. Plastic materials for building supply piping outside underground shall have an electrically continuous corrosion-resistant blue insulated copper tracer wire, or other approved conductor installed adjacent to the piping. Access shall be provided to the tracer wire, or the tracer wire shall terminate aboveground at each end of the nonmetallic piping. The tracer wire size shall be not less than 14 AWG, and the insulation type shall be suitable for direct burial.

604.11 Solder. Solder shall comply with the requirements of Section 604.2.

604.12 Flexible Corrugated Connectors. Flexible corrugated connectors of copper, copper alloy, or stainless steel shall be limited to the following connector lengths:

1. Fixture Connectors – 30 inches (762 mm)
2. Washing Machine Connectors – 72 inches (1829 mm)
3. Dishwasher and Icemaker Connectors – 120 inches (3048 mm)

604.13 Water Heater Connectors. Flexible metallic (copper and stainless steel), reinforced flexible, braided stainless steel, or polymer braided with EPDM core connectors that connect a water heater to the piping system shall comply with ASME A112.18.6/CSA B125.6. Copper, copper alloy, or stainless steel flexible connectors shall not exceed 24 inches (610 mm). PEX, PEX-AL-PEX, PE-AL-PE, or PE-RT tubing shall not be installed within the first 18 inches (457 mm) of piping connected to a water heater.

605.0 Joints and Connections.

605.1 Copper or Copper Alloy Pipe, Tubing, and Joints. Joining methods for copper or copper alloy pipe, tubing, and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.1.1 through Section 605.1.5.

605.1.1 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 shall conform to AWS A5.8 and shall be applied at the point where the pipe or tubing enters the socket of the fitting.

605.1.2 Flared Joints. Flared joints for soft copper or copper alloy water tubing shall be made with fittings that comply with the applicable standards referenced in Table 604.1. 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.

605.1.3 Mechanical Joints. Mechanical joints shall include, but are not limited to, compression, flanged, grooved, pressed, and push fit fittings.

605.1.3.1 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 ¼ 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.

605.1.3.2 Press-Connect Fittings. 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.

605.1.3.3 Push Fit Fittings. Removable and non-removable push fit fittings for copper or copper alloy tubing or pipe that employ quick assembly push fit connectors shall 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.

605.1.4 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 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 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.

605.1.5 Threaded Joints. Threaded joints for copper or copper alloy pipe shall be made with pipe threads 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.

605.2 CPVC Plastic Pipe and Joints. CPVC plastic pipe and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.2.1 through Section 605.2.3.

605.2.1 Mechanical Joints. Mechanical joints shall include compression, flanged, grooved and push fit fittings.

605.2.1.1 Push Fit Fittings. Removable and non-removable push fit fittings that employ a quick assembly push fit connector shall comply with ASSE 1061.

605.2.2 Solvent Cement Joints. Solvent cement joints for CPVC pipe and fittings shall be clean from dirt and moisture. Solvent cements shall comply with ASTM F493, requiring the use of a primer shall be orange in color. The primer shall be colored and shall comply with ASTM F656. Listed solvent cement that complies with ASTM F493 and that does not require the use of primers, yellow in color, shall be permitted to join pipe that comply with ASTM F2855 and fittings that comply with ASTM D2846, 1⁄2 of an inch (15 mm) through 2 inches (50 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.

605.2.3 Threaded Joints. Threads shall comply with ASME B1.20.1. A minimum of Schedule 80 shall be permitted to be threaded; 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.

605.3 CPVC/AL/CPVC Plastic Pipe and Joints. Chlorinated polyvinyl chloride/aluminum/chlorinated polyvinyl chloride (CPVC/AL/CPVC) plastic pipe and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.3.1 or Section 605.3.2.

605.3.1 Solvent Cement Joints. Solvent cement joints for CPVC/AL/CPVC pipe and fittings shall be clean from dirt and moisture. Solvent cements that comply with ASTM F493, requiring the use of a primer shall be orange in color. The primer shall be colored and shall comply with ASTM F656. Listed solvent cement that complies with ASTM F493 and that does not require the use of primers, yellow in color, shall be permitted to join pipe that comply with ASTM F2855 and fittings that comply with ASTM D2846, 1⁄2 of an inch (15 mm) through 2 inches (50 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.

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

605.3.2.1 Push Fit Fittings. Removable and non-removable push fit fittings that employ a quick assembly push fit connector shall comply with ASSE 1061.

605.4 Ductile Iron Pipe and Joints. Ductile iron pipe and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.4.1 or Section 605.4.2.

605.4.1 Mechanical Joints. Mechanical joints for ductile iron pipe and fittings shall consist of a bell that is cast integrally with the pipe or fitting and provided with an exterior flange having bolt holes and a socket with annular recesses for the sealing gasket and the plain end of the pipe or fitting. The elastomeric gasket shall comply with AWWA C111. Lubricant recommended for potable water application by the pipe manufacturer shall be applied to the gasket and plain end of the pipe.

605.4.2 Push-On Joints. Push-on joints for ductile iron pipe and fittings shall consist of a single elastomeric gasket that shall be assembled by positioning the elastomeric gasket in an annular recess in the pipe or fitting socket and forcing the plain end of the pipe or fitting into the socket. The plain end shall compress the elastomeric gasket to form a positive seal and shall be designed so that the elastomeric gasket shall be locked in place against displacement. The elastomeric gasket shall comply with AWWA C111. Lubricant recommended for potable water application by the pipe manufacturer shall be applied to the gasket and plain end of the pipe.
605.5 Galvanized Steel Pipe and Joints. Galvanized steel pipe and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.5.1 or Section 605.5.2.

605.5.1 Mechanical Joints. Mechanical joints shall be made with an approved and listed elastomeric gasket.

605.5.2 Threaded Joints. Threaded joints shall be made with pipe threads 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.

605.6 PE Plastic Pipe/Tubing and Joints. PE plastic pipe or tubing and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.6.1 or Section 605.6.2.

605.6.1 Heat-Fusion Joints. Heat-fusion joints between PE pipe or tubing and fittings shall be assembled in accordance with Section 605.6.1.1 through Section 605.6.1.3 using butt, socket, or electro-fusion heat methods.

605.6.1.1 Butt-Fusion Joints. Butt-fusion joints shall be made in accordance with ASTM F2620. 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.

605.6.1.2 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.

605.6.1.3 Socket-Fusion Joints. Socket-fusion joints shall be made in accordance with ASTM F2620. 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.

605.6.2 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.

605.7 PE-AL-PE Plastic Pipe/Tubing and Joints. PE-AL-PE plastic pipe or tubing and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.7.1 and Section 605.7.1.1.

605.7.1 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 1/8 of an inch (3.2 mm) to 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 cramped more than once.

605.7.1.1 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 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.

605.8 PE-RT. Polyethylene of raised temperature (PE-RT) tubing and fitting joining methods and shall comply with Section 605.8.1.

605.8.1 Mechanical Joints. Fittings for PE-RT tubing shall comply with the applicable standards listed in Table 604.1. Mechanical joints for PE-RT tubing shall be installed in accordance with the manufacturer’s installation instructions.

605.9 PEX Plastic Tubing and Joints. PEX plastic tubing and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.9.1 through Section 605.9.3.

605.9.1 Fittings. Fittings for PEX tubing shall comply with the applicable standards referenced in Table 604.1. 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.

605.9.2 Mechanical Joints. Mechanical joints shall be installed in accordance with the manufacturer’s installation instructions.
605.9.3 Push Fit Fittings. Removable and nonremovable push fit fittings that employ a quick assembly push fit connector shall comply with ASSE 1061.

605.10 PEX-AL-PEX Plastic Tubing and Joints. PEX-AL-PEX plastic pipe or tubing and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.10.1 and Section 605.10.1.1.

605.10.1 Mechanical Joints. Mechanical joints between PEX-AL-PEX tubing and fittings shall include mechanical and compression type fittings and insert fittings with a crimping ring. Insert fittings utilizing a crimping ring shall comply 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 the annular space formed by ribs on the fitting.

605.10.1.1 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.

605.11 Polypropylene (PP) Piping and Joints. PP pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.11.1 through Section 605.11.3.

605.11.1 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.

605.11.2 Mechanical and Compression Sleeve Joints. Mechanical and compression sleeve joints shall be installed in accordance with the manufacturer’s installation instructions.

605.11.3 Threaded Joints. PP pipe shall not be threaded. 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.

605.12 PVC Plastic Pipe and Joints. PVC plastic pipe and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.12.1 through Section 605.12.3.

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.

605.12.1 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 socket after assembly to provide a positive seal.

605.12.2 Solvent Cement Joints. Solvent cement joints for PVC pipe and fittings shall be clean from dirt and moisture. Pipe shall be cut square and pipe shall be deburred. Where surfaces to be joined are cleaned and free of dirt, moisture, oil, and other foreign material, apply primer purple in color that complies with ASTM F656. Primer shall be applied to the surface of the pipe and fitting is softened. Solvent cement that complies with ASTM D2564 shall be applied to all joint surfaces. Joints shall be made while both the inside socket surface and outside surface of pipe are wet with solvent cement. Hold joint in place and undisturbed for 1 minute after assembly.

605.12.3 Threaded Joints. Threads shall comply with ASME B1.20.1. A minimum of Schedule 80 shall be permitted to be threaded; 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 PVC components once the thread sealant has been applied. Female PVC threaded fittings shall be used with plastic male threads only.

605.13 Stainless Steel Pipe and Joints. Joining methods for stainless steel pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.13.1 or Section 605.13.2.

605.13.1 Mechanical Joints. Mechanical joints shall be designed for their intended use. Such joints shall include compression, flanged, grooved, press-connect, and threaded.

605.13.2 Welded Joints. Welded joints shall be either fusion or resistance welded based on the selection of the base metal. The chemical composition of the filler metal shall comply with AWS A5.9 based on the alloy content of the piping material.

605.14 Slip Joints. In water piping, slip joints shall be permitted to be used only on the exposed fixture supply.

605.15 Dielectric Unions. Dielectric unions where installed at points of connection where there is a dissimilarity of metals shall be in accordance with ASSE 1079 or IAPMO PS 66.

605.16 Joints Between Various Materials. Joints between various materials shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 605.16.1 through Section 605.16.3.

605.16.1 Copper or Copper Alloy Pipe or Tubing to Threaded Pipe Joints. Joints from copper or copper alloy pipe or tubing to threaded pipe shall be made
using copper alloy adapter, copper alloy nipple [minimum 6 inches (152 mm)], dielectric fitting, or dielectric union in accordance with ASSE 1079 or IAPMO PS 66. The joint between the copper or copper alloy pipe or tubing and the fitting shall be a soldered, brazed, flared, or press-connect joint and the connection between the threaded pipe and the fitting shall be made with a standard pipe size threaded joint.

605.16.2 Plastic Pipe to Other Materials. Where connecting plastic pipe to other types of piping, approved types of adapter or transition fittings designed for the specific transition intended shall be used.

605.16.3 Stainless Steel to Other Materials. Where connecting stainless steel pipe to other types of piping, mechanical joints of the compression type, dielectric fitting, or dielectric union in accordance with ASSE 1079 or IAPMO PS 66 and designed for the specific transition intended shall be used.

606.0 Valves.

606.1 General. Valves up to and including 2 inches (50 mm) in size shall be copper alloy or other approved material. Sizes exceeding 2 inches (50 mm) shall be permitted to have cast iron or copper alloy bodies. Each gate or ball valve shall be a fullway or full-port type with working parts of the non-corrosive material. Valves carrying water used in potable water systems intended to supply drinking water shall comply with the requirements of NSF 61 and ASME A112.4.14, ASME B16.34, ASTM F1970, ASTM F2389, AWWA C500, AWWA C504, AWWA C507, IAPMO Z1157, MSS SP-67, MSS SP-70, MSS SP-71, MSS SP-72, MSS SP-78, MSS SP-80, MSS SP-110, MSS SP-122, or NSF 359. Valves intended to supply drinking water shall comply with the requirements of NSF/ANSI/CAN 61.

606.2 Fullway Valve. A fullway valve controlling outlets shall be installed on the discharge side of each water meter and each unmetered water supply. Water piping supplying more than one building on one premise shall be equipped with a separate fullway valve to each building; so arranged that the water supply can be turned on or off to an individual or separate building provided; however, that supply piping to a single-family residence and building accessory thereto shall be permitted to be controlled by one valve. Such shutoff valves shall be accessible. A fullway valve shall be installed on the discharge piping from water supply tanks at or near the tank. A fullway valve shall be installed on the cold water supply pipe to each water heater at or near the water heater.

606.3 Multidwelling Units. In multidwelling units, one or more shutoff valves shall be provided in each dwelling unit so that the water supply to a plumbing fixture or group of fixtures in that dwelling unit can be shut off without stopping water supply to fixtures in other dwelling units. These valves shall be accessible in the dwelling unit that they control.

606.4 Multiple Openings. Valves used to control two or more openings shall be fullway gate valves, ball valves, or other approved valves designed and approved for the service intended.

606.5 Control Valve. A control valve shall be installed immediately ahead of each water-supplied appliance and immediately ahead of each slip joint or appliance supply.

Parallel water distribution systems shall provide a control valve either immediately ahead of each fixture being supplied or installed at the manifold, and shall be identified with the fixture being supplied. Where parallel water distribution system manifolds are located in attics, crawl spaces, or other locations not readily accessible, a separate shutoff valve shall be required immediately ahead of each individual fixture or appliance served.

606.5.1 Manifolds. Field installed manifolds for water distribution shall conform with the applicable requirements for valves, pipes, and fittings as referenced in this code. Manufactured water distribution manifolds shall be in accordance with IAPMO IGC 109.

606.6 Accessible. Required shutoff or control valves shall be accessible.

606.7 Multiple Fixtures. A single control valve shall be installed on a water supply line ahead of an automatic metering valve that supplies a battery of fixtures.

606.8 Check Valve Required. All systems that circulate water by means of a pump or other mechanical device or method shall have a check valve(s) or equal device(s) installed so as to ensure the direction of flow.

606.9 Leak Detection Devices. Where leak detection devices for water supply and distribution are installed, they shall comply with IAPMO IGC-115 or IAPMO IGC-349 IAPMO Z1349.

607.0 Potable Water Supply Tanks.

607.1 General. Potable water supply tanks shall be installed in accordance with the manufacturer’s installation instructions and supported in accordance with the building code.

607.2 Potable Water Tanks. Potable water supply tanks, interior tank coatings, or tank liners intended to supply drinking water shall comply with NSF/ANSI/CAN 61.

607.3 Venting. Tanks used for potable water shall be tightly covered and vented in accordance with the manufacturer’s installation instructions. Such vent shall be screened with a corrosion-resistant material of not less than number 24 mesh.

607.4 Overflow. Tanks shall have not less than a 16 square inch (0.01 m²) overflow that is screened with a corrosion-resistant material of not less than number 24 mesh.

607.5 Valves. Pressurized tanks shall be provided with a listed pressure-relief valve installed in accordance with the manufacturer’s installation instructions. The relief valve shall be discharged in accordance with Section 608.5. Where a potable water supply tank is located above the fixtures, appliances, or system components it serves, it shall be equipped with a vacuum relief valve that complies with CSA Z21.22.

608.0 Water Pressure, Pressure Regulators, Pressure Relief Valves, and Vacuum Relief Valves.

608.1 Inadequate Water Pressure. Where the water pressure in the main or other source of supply will not provide a
residual water pressure of not less than 15 pounds force per square inch (psi) (103 kPa), after allowing for friction and other pressure losses, a tank and a pump or other means that will provide said 15 psi (103 kPa) pressure shall be installed. Where fixtures, fixture fittings, or both are installed, that require residual pressure exceeding 15 psi (103 kPa), that minimum residual pressure shall be provided.

**608.2 Excessive Water Pressure.** Where static water pressure in the water supply piping is exceeding 80 psi (552 kPa), an approved-type pressure regulator preceded by an adequate strainer shall be installed and the static pressure reduced to 80 psi (552 kPa) or less. Pressure regulators for potable water distribution systems shall comply with ASSE 1003. Pressure regulator(s) equal to or exceeding 1½ inches (40 mm) shall not require a strainer. Such regulator(s) shall control the pressure to water outlets in the building unless otherwise approved by the Authority Having Jurisdiction. Each such regulator and strainer shall be accessibly located aboveground or in a vault equipped with a properly sized and sloped bored sighted drain to daylight, shall be protected from freezing, and shall have the strainer readily accessible for cleaning without removing the regulator or strainer body or disconnecting the supply piping.

Pipe size determinations shall be based on 80 percent of the reduced pressure where using Table 610.4.

An approved expansion tank shall be installed in the cold water distribution piping downstream of each such regulator to prevent excessive pressure from developing due to thermal expansion and to maintain the pressure setting of the regulator. Expansion tanks used in potable water systems intended to supply drinking water shall comply with NSF/ANSI/CAN 61. The expansion tank shall be properly sized, securely fastened to the structure, and installed in accordance with the manufacturer’s installation instructions and listing. Systems designed by registered design professionals shall be permitted to use approved pressure relief valves in lieu of expansion tanks provided such relief valves have a maximum pressure relief setting of 100 psi (689 kPa) or less.

**608.3 Expansion Tanks, and Combination Temperature and Pressure-Relief Valves.** A water system provided with a check valve, backflow preventer, or other normally closed device that prevents dissipation of building pressure back into the water main, independent of the type of water heater used, shall be provided with an approved, listed, and adequately sized expansion tank or other approved device having a similar function to control thermal expansion. Pressure-rated water expansion tanks shall comply with IAPMO Z1088. Such expansion tank or other approved device shall be installed on the building side of the check valve, backflow preventer, or other device and shall be sized, securely fastened to the structure, and installed in accordance with the manufacturer’s installation instructions.

A water system containing storage water heating equipment shall be provided with an approved, listed, adequately sized combination temperature and pressure-relief valve, except for listed nonstorage instantaneous heaters having an inside diameter of not more than 3 inches (80 mm). Each such approved combination temperature and pressure-relief valve shall be installed on the water-heating device in an approved location based on its listing requirements and the manufacturer’s installation instructions. Each such combination temperature and pressure-relief valve shall be provided with a drain in accordance with Section 608.5.

**Exception:** An expansion tank shall not be required for an instantaneous non-storage water heater.

**608.4 Pressure Relief Valves.** Each pressure relief valve shall be an approved automatic type with drain, and each such relief valve shall be set at a pressure of not more than 150 psi (1034 kPa). No shutoff valve shall be installed between the relief valve and the system.

**608.5 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. 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.

**608.6 Water-Heating Devices.** A water-heating device connected to a separate storage tank and having valves between said heater and tank shall be provided with an approved water pressure relief valve.

**608.7 Vacuum Relief Valves.** Where a hot-water storage tank or an indirect water heater is located at an elevation above the fixture outlets in the hot-water system, a vacuum relief valve that complies with CSA Z21.22 shall be installed on the storage tank or heater.

**609.0 Installation, Testing, Unions, and Location.**

**609.1 Installation.** Water piping shall be adequately supported in accordance with Table 313.3. Burred ends shall be reamed to the full bore of the pipe or tube. Changes in direction shall be made by the appropriate use of fittings, except that changes in direction in copper or copper alloy 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. Changes in direction are allowed with flexible pipe and tubing without fittings in accordance with the manufacturer’s
instructions. Provisions shall be made for expansion in hot-water piping. Piping, equipment, appurtenances, and devices shall be installed in a workmanlike manner in accordance with the provisions and intent of the code. Building supply yard piping shall be not less than 12 inches (305 mm) below the average local frost depth. The cover shall be not less than 12 inches (305 mm) below finish grade.

609.2 Trenches. 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 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.

609.3 Under Concrete Slab. Water piping installed within a building and in or under a concrete floor slab resting on the ground shall be installed in accordance with the following requirements:

(1) Ferrous piping shall have a protective coating of an approved type; machine applied and in accordance with recognized standards. Field wrapping shall provide equivalent protection and shall be restricted to those short sections and fittings necessarily stripped for threading. Zinc coating (galvanizing) shall not be deemed adequate protection for piping or fittings. Approved nonferrous piping shall not be required to be wrapped.

(2) Copper or copper alloy tubing shall be installed without joints where possible. Where joints are permitted, they shall be brazed, and fittings shall be wrought copper.

For the purpose of this section, “within a building” shall mean within the fixed limits of the building foundation.

609.4 Testing. Upon completion of a section or of the entire hot and cold water supply system, the system shall be tested with water or air. The potable water test pressure shall be greater than or equal to the working pressure under which the system is to be used. The air pressure shall be a minimum of 114 psi (790 kPa) and shall be set for not less than 10 psi (69 kPa). A pressure gauge shall be installed not more than 5 feet (1524 mm) of the inlet. The cutoff switch on the inlet side of the pump shall be installed not more than 5 feet (1524 mm) from the inlet side of the pump.

Pumps for Water Distribution Systems.

609.9 Low-Pressure Cutoff Required on Booster Pumps for Water Distribution Systems. Where a booster pump (excluding a fire pump) is connected to a building supply or underground water pipe, a low-pressure cutoff switch on the inlet side of the pump shall be installed not more than 5 feet (1524 mm) of the inlet. The cutoff switch shall be set for not less than 10 psi (69 kPa). A pressure gauge shall be installed between the shutoff valve and the pump.

609.10 Disinfection of Potable Water System. New or repaired potable water systems shall be disinfected prior to use where required by the Authority Having Jurisdiction. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by it, the following:

(1) The pipe system shall be flushed with clean, potable water until potable water appears at the points of the outlet.

(2) The system or parts thereof shall be filled with a water-chlorine solution containing not less than 50 parts per million of chlorine, and the system or part thereof shall be valved-off and allowed to stand for 24 hours; or, the system or part thereof shall be filled with a water-chlorine solution containing not less than 200 parts per million of chlorine and allowed to stand for 3 hours.

(3) Following the allowed standing time, the system shall be flushed with clean, potable water until the chlorine residual in the water coming from the system does not exceed the chlorine residual in the flushing water.
610.0 Size of Potable Water Piping.

610.1 Size. The size of each water meter and each potable water supply pipe from the meter or other source of supply to the fixture supply branches, risers, fixtures, connections, outlets, or other uses shall be based on the total demand and shall be determined according to the methods and procedures outlined in this section. Water piping systems shall be designed to ensure that the maximum velocities allowed by the code and the applicable standard are not exceeded.

610.2 Pressure Loss. Where a water filter, water softener, backflow prevention device, tankless water heater, or similar device is installed in a water supply line, the pressure loss through such devices shall be included in the pressure loss calculations of the system, and the water supply pipe and meter shall be adequately sized to provide for such a pressure loss.

No water filter, water softener, backflow prevention device, or similar device regulated by this code shall be installed in a potable water supply piping where the installation of such device produces an excessive pressure drop in such water supply piping. In the absence of specific pressure drop information, the diameter of the inlet or outlet of such device or its connecting piping shall be not less than the diameter of such water distribution piping to the fixtures served by the device.

Such devices shall be of a type approved by the Authority Having Jurisdiction and shall be tested for flow rating and pressure loss by an approved laboratory or recognized testing agency to standards consistent with the intent of this chapter.

610.3 Quantity of Water. The quantity of water required to be supplied to every plumbing fixture shall be represented by fixture units, as shown in Table 610.3. Equivalent fixture values shown in Table 610.3 include both hot and cold water demand.

610.4 Sizing Water Supply and Distribution Systems. Systems within the range of Table 610.4 shall be permitted to be sized from that table or by the method in accordance with Section 610.5.

Listed parallel water distribution systems shall be installed in accordance with their listing, but at no time shall a portion of the system exceed the maximum velocities allowed by the code.

610.5 Sizing per Appendices A and C. Except as provided in Section 610.4, the size of each water piping system shall be determined in accordance with the procedure set forth in Appendix A. For alternate methods of sizing water supply systems, see Appendix C.

610.6 Friction and Pressure Loss. Except where the type of pipe used and the water characteristics are such that no decrease in capacity due to the length of service (age of system) is expected, friction-loss data shall be obtained from the “Fairly Rough” or “Rough” charts in Appendix A of this code. Friction or pressure losses in a water meter, valve, and fittings shall be obtained from the same sources. Pressure losses through water-treating equipment, backflow prevention devices, or other flow-restricting devices shall be computed in accordance with Section 610.2.

610.7 Conditions for Using Table 610.4. On a proposed water piping installation sized using Table 610.4, the following conditions shall be determined:

1. Total number of fixture units as determined from Table 610.3, Equivalent Fixture Units, for the fixtures to be installed.
2. Developed length of supply pipe from meter to the most remote outlet.
3. Difference in elevation between the meter or other source of supply and the highest fixture or outlet.
4. Pressure in the street main or another source of supply at the locality where the installation is to be made.
5. In localities where there is a fluctuation of pressure in the main throughout the day, the water piping system shall be designed on the basis of the minimum pressure available.

610.8 Size of Meter and Building Supply Pipe Using Table 610.4. The size of the meter and the building supply pipe shall be determined as follows:

1. Determine the available pressure at the meter or other source of supply.
2. Add or subtract depending on positive or negative elevation change, \( \frac{1}{2} \) psi (3.4 kPa) for each foot (305 mm) of difference in elevation between such source of supply and the highest water supply outlet in the building or on the premises.
(3) Use the “pressure range” group within which this pressure will fall using Table 610.4.
(4) Select the “length” column that is equal to or longer than the required length.
(5) Follow down the column to a fixture unit value equal to or exceeding the total number of fixture units required by the installation.
(6) Having located the proper fixture unit value for the required length, sizes of meter and building supply pipe as found in the two left-hand columns shall be applied.

No building supply pipe shall be less than \( \frac{3}{4} \) of an inch (20 mm) in diameter.

610.9 Size of Branches. Where Table 610.4 is used, the minimum size of each branch shall be determined by the total fixture units served by that branch and then following the steps in Section 610.8. No branch piping shall exceed the total demand in fixture units for the system computed from Table 610.3.

610.10 Sizing for Flushometer Valves. Where using Table 610.4 to size water supply systems serving flushometer valves, the number of flushometer fixture units assigned to every section of pipe, whether branch or main, shall be determined by the number and category of flushometer valves served by that section of pipe, in accordance with Table 610.10. Piping supplying a flushometer valve shall be not less in size than the valve inlet.

Where using Table 610.10 to size water piping, care shall be exercised to assign flushometer fixture units based on the number and category of fixtures served.

**TABLE 610.10**
FLUSHOMETER FIXTURE UNITS FOR WATER SIZING USING TABLE 610.3

<table>
<thead>
<tr>
<th>NUMBER OF FLUSHOMETER VALVES</th>
<th>INDIVIDUAL FIXTURE UNITS ASSIGNED IN DECREASING VALUE</th>
<th>FIXTURE UNITS ASSIGNED FOR WATER CLOSETS AND SIMILAR 5-UNIT FIXTURES IN ACCUMULATIVE VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>105</td>
</tr>
<tr>
<td>5 or more</td>
<td>10 each</td>
<td>115 plus 10 for each additional fixture in excess of 5</td>
</tr>
</tbody>
</table>

**FIXTURE CATEGORY: URINALS WITH FLUSHOMETER VALVES**

<table>
<thead>
<tr>
<th>NUMBER OF FLUSHOMETER VALVES</th>
<th>INDIVIDUAL FIXTURE UNITS ASSIGNED IN DECREASING VALUE</th>
<th>FIXTURE UNITS ASSIGNED FOR URINALS AND SIMILAR 5-UNIT FIXTURES IN ACCUMULATIVE VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>45</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>53</td>
</tr>
<tr>
<td>5 or more</td>
<td>5 each</td>
<td>58 plus 5 for each additional fixture in excess of 5</td>
</tr>
</tbody>
</table>

Example 610.10
SIZING METHOD FOR PUBLIC USE FIXTURES USING TABLE 610.10

In the example below, fixture units assigned to each section of pipe are computed. Each capital letter refers to the section of pipe above it unless otherwise shown.

610.11 Sizing Systems for Flushometer Tanks. The size of branches and mains serving flushometer tanks shall be consistent with the sizing procedures for flush tank water closets.

610.12 Sizing for Velocity. Water piping systems shall not exceed the maximum velocities listed in this section or Appendix A.
TABLE 610.3
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES

<table>
<thead>
<tr>
<th>APPLIANCES, APPURtenANCES OR FIXTURES²</th>
<th>MINIMUM FIXTURE BRANCH PIPE SIZE¹,4 (inches)</th>
<th>PRIVATE</th>
<th>PUBLIC</th>
<th>ASSEMBLY⁶</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathtub or Combination Bath/Shower (fill)</td>
<td>½</td>
<td>4.0</td>
<td>4.0</td>
<td>—</td>
</tr>
<tr>
<td>¼ inch Bathtub Fill Valve</td>
<td>¾</td>
<td>10.0</td>
<td>10.0</td>
<td>—</td>
</tr>
<tr>
<td>Bidet</td>
<td>½</td>
<td>1.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Clothes Washer</td>
<td>½</td>
<td>4.0</td>
<td>4.0</td>
<td>—</td>
</tr>
<tr>
<td>Dental Unit, cuspidor</td>
<td>½</td>
<td>—</td>
<td>1.0</td>
<td>—</td>
</tr>
<tr>
<td>Dishwasher, domestic</td>
<td>½</td>
<td>1.5</td>
<td>1.5</td>
<td>—</td>
</tr>
<tr>
<td>Drinking Fountain or Water Cooler</td>
<td>½</td>
<td>0.5</td>
<td>0.5</td>
<td>0.75</td>
</tr>
<tr>
<td>Hose Bibb</td>
<td>½</td>
<td>2.5</td>
<td>2.5</td>
<td>—</td>
</tr>
<tr>
<td>Hose Bibb, each additional³</td>
<td>½</td>
<td>1.0</td>
<td>1.0</td>
<td>—</td>
</tr>
<tr>
<td>Lavatory</td>
<td>½</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Lawn Sprinkler, each head⁶</td>
<td>—</td>
<td>1.0</td>
<td>1.0</td>
<td>—</td>
</tr>
<tr>
<td>Mobile Home, each (minimum)</td>
<td>—</td>
<td>12.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Sinks</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Bar</td>
<td>½</td>
<td>1.0</td>
<td>2.0</td>
<td>—</td>
</tr>
<tr>
<td>Clinical Faucet</td>
<td>½</td>
<td>—</td>
<td>3.0</td>
<td>—</td>
</tr>
<tr>
<td>Clinical Flushometer Valve with or without faucet</td>
<td>³⁄₄</td>
<td>—</td>
<td>8.0</td>
<td>—</td>
</tr>
<tr>
<td>Kitchen, domestic with or without dishwasher</td>
<td>½</td>
<td>1.5</td>
<td>1.5</td>
<td>—</td>
</tr>
<tr>
<td>Laundry</td>
<td>½</td>
<td>1.5</td>
<td>1.5</td>
<td>—</td>
</tr>
<tr>
<td>Service or Mop Basin</td>
<td>½</td>
<td>1.5</td>
<td>3.0</td>
<td>—</td>
</tr>
<tr>
<td>Washup, each set of faucets</td>
<td>½</td>
<td>—</td>
<td>2.0</td>
<td>—</td>
</tr>
<tr>
<td>Shower, per head</td>
<td>½</td>
<td>2.0</td>
<td>2.0</td>
<td>—</td>
</tr>
<tr>
<td>Urinal, 1.0 GPF Flushometer Valve</td>
<td>¾</td>
<td>See Footnote⁷</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Urinal, greater than 1.0 GPF Flushometer Valve</td>
<td>¾</td>
<td>See Footnote⁷</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Urinal, flush tank</td>
<td>½</td>
<td>2.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Wash Fountain, circular spray</td>
<td>¾</td>
<td>—</td>
<td>4.0</td>
<td>—</td>
</tr>
<tr>
<td>Water Closet, 1.6 GPF Gravity Tank</td>
<td>½</td>
<td>2.5</td>
<td>2.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Water Closet, 1.6 GPF Flushometer Tank</td>
<td>½</td>
<td>2.5</td>
<td>2.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Water Closet, 1.6 GPF Flushometer Valve</td>
<td>1</td>
<td>See Footnote⁷</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Water Closet, greater than 1.6 GPF Gravity Tank</td>
<td>½</td>
<td>3.0</td>
<td>5.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Water Closet, greater than 1.6 GPF Flushometer Valve</td>
<td>1</td>
<td>See Footnote⁷</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm

Notes:
1. Size of the cold branch pipe, or both the hot and cold branch pipes.
2. Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.
3. The listed fixture unit values represent their load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as three-quarter of the listed total value of the fixture.
4. The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.
5. For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s), and add it separately to the demand in gpm (L/s) for the distribution system or portions thereof.
6. Assembly [Public Use (See Table 422.1)].
7. Where sizing flushometer systems, see Section 610.10.
8. Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.
WATER SUPPLY AND DISTRIBUTION

### TABLE 610.4
FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES

<table>
<thead>
<tr>
<th>METER AND STREET SERVICE (inches)</th>
<th>BUILDING SUPPLY AND BRANCHES (inches)</th>
<th>MAXIMUM ALLOWABLE LENGTH (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>½</td>
<td>6 5 4 3 2 1 1 1 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>½</td>
<td>¼</td>
<td>16 16 14 12 9 6 5 5 4 3 2 2 2 1 1</td>
</tr>
<tr>
<td>½</td>
<td>⅛</td>
<td>29 25 23 21 17 15 13 12 10 8 6 6 6 6 6</td>
</tr>
<tr>
<td>1</td>
<td>½</td>
<td>36 31 27 25 20 17 15 13 12 10 8 6 6 6 6</td>
</tr>
<tr>
<td>⅛</td>
<td>½</td>
<td>36 33 31 28 24 22 21 19 17 16 13 12 11 11 11</td>
</tr>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>54 47 42 38 32 28 25 23 19 17 14 12 12 11 11</td>
</tr>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>78 68 57 48 38 32 28 25 21 18 15 12 12 11 11</td>
</tr>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>85 84 79 65 56 48 43 38 32 28 26 22 21 20 20</td>
</tr>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>150 124 105 91 70 57 49 45 43 36 31 26 23 21 20 20</td>
</tr>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>151 129 129 110 80 64 53 46 38 32 27 23 21 20 20</td>
</tr>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>85 85 85 85 85 82 80 66 61 57 52 49 46 43</td>
</tr>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>220 205 190 176 155 138 127 120 104 85 70 61 57 54 51</td>
</tr>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>370 327 292 265 217 185 164 147 124 96 70 61 57 54 51</td>
</tr>
<tr>
<td>⅛</td>
<td>⅛</td>
<td>445 418 390 370 330 300 280 265 240 220 198 175 158 143 133</td>
</tr>
</tbody>
</table>

#### PRESSURE RANGE – 46 to 60 psi

| ¼                                | ½                                     | 20 20 19 17 14 11 9 6 5 4 3 3 3 3 3 3 3 |
| ½                                | ⅛                                     | 39 39 36 33 28 23 21 19 17 14 12 10 9 8 8 |
| ⅛                                | ⅛                                     | 39 39 39 36 30 25 23 20 18 15 12 10 9 8 8 |
| ⅛                                | ⅛                                     | 39 39 39 39 39 39 39 38 34 32 27 25 22 19 19 17 16 |
| ⅛                                | ⅛                                     | 78 78 76 67 52 44 39 36 30 27 24 20 19 17 16 |
| ⅛                                | ⅛                                     | 78 78 78 78 66 52 44 39 33 29 24 20 19 17 16 |
| ⅛                                | ⅛                                     | 85 85 85 85 85 85 80 67 55 49 41 37 34 32 30 |
| ⅛                                | ⅛                                     | 151 151 151 151 126 105 90 78 62 52 42 38 35 32 30 |
| ⅛                                | ⅛                                     | 151 151 151 151 150 117 98 84 67 55 42 38 35 32 30 |
| ⅛                                | ⅛                                     | 85 85 85 85 85 85 85 85 85 85 85 85 83 80 |
| ⅛                                | ⅛                                     | 370 370 370 370 368 318 280 250 205 165 142 123 110 102 94 |
| ⅛                                | ⅛                                     | 370 370 370 370 370 368 318 280 250 205 165 142 123 110 102 94 |
| ⅛                                | ⅛                                     | 654 640 610 580 535 500 470 440 400 365 335 315 285 267 250 |

#### PRESSURE RANGE – Over 60 psi

| ¼                                | ½                                     | 20 20 20 17 13 11 10 8 7 6 6 5 4 4 4 4 4 |
| ½                                | ¼                                     | 39 39 39 39 38 32 29 26 22 18 14 13 12 12 11 |
| ⅛                                | ⅛                                     | 39 39 39 39 39 38 32 29 26 22 18 14 13 12 12 11 |
| ⅛                                | ⅛                                     | 78 78 78 78 78 78 74 62 53 47 39 31 26 23 22 21 |
| ⅛                                | ⅛                                     | 78 78 78 78 78 78 74 65 54 43 34 26 25 23 22 21 |
| ⅛                                | ⅛                                     | 85 85 85 85 85 85 85 85 85 85 85 85 83 80 |
| ⅛                                | ⅛                                     | 151 151 151 151 151 151 130 113 88 73 51 46 43 40 |
| ⅛                                | ⅛                                     | 151 151 151 151 151 151 142 122 98 82 64 51 46 43 40 |
| ⅛                                | ⅛                                     | 85 85 85 85 85 85 85 85 85 85 85 85 85 85 |
| ⅛                                | ⅛                                     | 370 370 370 370 360 335 305 282 244 212 187 172 153 141 129 |
| ⅛                                | ⅛                                     | 370 370 370 370 370 360 335 305 282 244 212 187 172 153 141 129 |
| ⅛                                | ⅛                                     | 654 654 654 654 654 650 610 570 510 460 430 404 380 356 329 |

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 pound-force per square inch = 6.8947 kPa

**Notes:**

1. Available static pressure after head loss.
2. Building supply, not less than ¼ in [mm] nominal size.
610.12.1 Copper Tube Systems. Maximum velocities in copper and copper alloy tube and fitting systems shall not exceed 8 feet per second (ft/s) (2.4 m/s) in cold water and 5 ft/s (1.5 m/s) in hot water.

610.12.2 Tubing Systems Using Copper Fittings. Maximum velocities through copper fittings in tubing other than copper shall not exceed 8 ft/s (2.4 m/s) in cold water and 5 ft/s (1.5 m/s) in hot water.

610.13 Exceptions. The provisions of this section relative to the size of water piping shall not apply to the following:

1. Water supply piping systems designed in accordance with recognized engineering procedures acceptable to the Authority Having Jurisdiction.
2. Alteration of or minor additions to existing installations provided the Authority Having Jurisdiction finds that there will be an adequate supply of water to operate fixtures.
3. Replacement of existing fixtures or appliances.
4. Piping that is part of fixture equipment.
5. Unusual conditions where, in the judgment of the Authority Having Jurisdiction, an adequate supply of water is provided to operate fixtures and equipment.
6. The size and material of irrigation water piping installed outside of a building or structure and separated from the potable water supply by means of an approved air gap or backflow prevention device are not regulated by this code. The potable water piping system supplying each such irrigation system shall be adequately sized as required elsewhere in this chapter to deliver the full connected demand of both the domestic use and the irrigation systems.

611.0 Drinking Water Treatment Units.

611.1 Application. Drinking water treatment units shall comply with the applicable referenced standards in Table 611.1.

611.1.1 Alkaline Water Treatment. Alkaline water treatment devices shall comply with IAPMO IGC 322.

611.1.2 Scale Reduction Devices. Scale reduction devices shall comply with IAPMO Z601.

611.2 Air Gap Discharge. Discharge from drinking water treatment units shall enter the drainage system through an air gap in accordance with Table 603.3.1 or an air gap device that complies with Table 603.2, NSF/ANSI 58, or IAPMO PS 65.

611.3 Connection Tubing. The tubing to and from drinking water treatment units shall be of a size and material as recommended by the manufacturer.

611.4 Sizing of Residential Softeners. Residential-use water softeners shall be sized in accordance with Table 611.4.

<table>
<thead>
<tr>
<th>REQUIRED SIZE OF SOFTENER CONNECTION</th>
<th>NUMBER OF BATHROOM GROUPS SERVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4</td>
<td>up to 2²</td>
</tr>
<tr>
<td>1</td>
<td>up to 4³</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm

Notes:
1. Installation of a kitchen sink and dishwasher, laundry tray, and automatic clothes washer permitted without additional size increase.
2. An additional water closet and lavatory permitted.
3. Over four bathroom groups, the softener size shall be engineered for the specific installation.
4. See also Appendix A, Recommended Rules for Sizing the Water Supply System, and Appendix C, Alternate Plumbing Systems, for alternate methods of sizing water supply systems.

612.0 Residential Fire Sprinkler Systems.

612.1 Where Required. Where residential sprinkler systems are required in one and two-family dwellings or townhouses, the systems shall be installed by personnel, installer, or both, certified in accordance with ASSE Series 7000 in accordance with this section or NFPA 13D. This section shall be considered equivalent to NFPA 13D. Partial residential sprinkler systems shall be permitted to be installed in buildings not required to be equipped with a residential sprinkler system.

612.2 Types of Systems. This section shall apply to stand-alone and multipurpose wet-pipe sprinkler systems that do not include the use of antifreeze. A multipurpose fire sprinkler system shall provide potable water to both fire sprinklers and plumbing fixtures. A stand-alone sprinkler system shall be separate and independent from the potable water distribution system. A backflow preventer shall not be required to separate a stand-alone sprinkler system from the water distribution system where the sprinkler system material is in accordance with the requirements of Section 604.0.

**TABLE 611.1**

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>POINT OF USE</th>
<th>POINT OF ENTRY</th>
<th>COMMERCIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic Contaminant Reduction (filters)</td>
<td>NSF/ANSI 42</td>
<td>NSF/ANSI 42</td>
<td>ASSE 1087 and NSF/ANSI 42*</td>
</tr>
<tr>
<td>Health Related Contaminant Reduction (filters)</td>
<td>NSF/ANSI 53</td>
<td>NSF/ANSI 53</td>
<td>ASSE 1087 and NSF/ANSI 53*</td>
</tr>
<tr>
<td>Water Softener</td>
<td>–</td>
<td>NSF/ANSI 44</td>
<td>ASSE 1087</td>
</tr>
<tr>
<td>Ultraviolet Water Treatment</td>
<td>NSF/ANSI 55</td>
<td>NSF/ANSI 55</td>
<td>ASSE 1087</td>
</tr>
<tr>
<td>Reverse Osmosis</td>
<td>NSF/ANSI 58</td>
<td>NSF/ANSI/CAN 61</td>
<td>ASSE 1087</td>
</tr>
<tr>
<td>Distillation</td>
<td>NSF/ANSI 62</td>
<td>NSF/ANSI 62</td>
<td>ASSE 1087</td>
</tr>
</tbody>
</table>

* Required for commercial modular systems only.
612.3 Sprinklers. Sprinklers shall be installed in accordance with Section 612.3.1 through Section 612.3.7.

612.3.1 Required Sprinkler Locations. Sprinklers shall be installed to protect all floor areas of a dwelling unit in one and two-family dwellings or townhouses.

Exceptions:
(1) Attics, crawl spaces, and normally unoccupied concealed spaces that do not contain fuel-fired appliances do not require sprinklers. In attics, crawl spaces, and normally unoccupied concealed spaces that contain fuel-fired equipment, a sprinkler shall be provided to protect the equipment; however, sprinklers shall not be required in the remainder of the space.
(2) Clothes closets, linen closets, and pantries that do not exceed 100 cubic feet (2.83 m³) and having wall and ceiling surfaces of gypsum board.
(3) Garages; carports; exterior porches; unheated entry areas, such as mud rooms, that extend from an exterior door; and similar areas.
(4) Covered unheated projections of the building at entrances/exit provided it is the only means of egress from the dwelling unit.
(5) Ceiling pockets that meet the following requirements:
(a) The total volume of an unprotected ceiling pocket does not exceed 100 cubic feet (2.83 m³).
(b) The entire floor under the unprotected ceiling pocket is protected by the sprinklers at the lower ceiling elevation.
(c) Each unprotected ceiling pocket is separated from an adjacent unprotected ceiling pocket by not less than a 10 feet (3048 mm) horizontal distance.
(d) The interior finish of the unprotected ceiling pocket is noncombustible material.
(e) Skylights not exceeding 32 square feet (2.97 m²).

612.3.2 Sprinkler Installation. Sprinklers shall be listed residential sprinklers and shall be installed in accordance with the sprinkler manufacturer’s installation instructions.

612.3.3 Temperature Rating and Separation from Heat Sources. Sprinklers shall have a temperature rating of not less than 135°F (57°C) and not more than 170°F (77°C). Sprinklers shall be separated from heat sources in accordance with the sprinkler manufacturer’s installation instructions.

Exception: Sprinklers located close to a heat source in accordance with Section 612.3.3.1 shall be intermediate temperature sprinklers.

612.3.3.1 Intermediate Temperature Sprinklers. Sprinklers shall have an intermediate temperature rating of not less than 175°F (79°C) and not more than 225°F (107°C) where installed in the following locations:
(1) Directly under skylights, where the sprinkler is exposed to direct sunlight.
(2) In attics and concealed spaces located directly beneath a roof.
(3) Within the distance to a heat source in accordance with Table 612.3.3.1.

612.3.4 Freezing Areas. The piping system shall be protected in accordance with the requirements of Chapter 3. Where sprinklers are required in areas that are subject to freezing, dry-sidewall or dry-pendent sprinklers extending from a non-freezing area into a freezing area shall be installed.

612.3.5 Coverage Area Limit. The area of coverage of a single sprinkler shall be based on the sprinkler listing and the sprinkler manufacturer’s installation instructions. The area of coverage of a single sprinkler shall not exceed 400 square feet (37.16 m²).

612.3.6 Obstructions to Sprinkler Coverage. The water discharge from a sprinkler shall not be blocked by obstructions unless additional sprinklers are installed to protect the obstructed area. Additional sprinklers shall not be required where sprinkler separation from obstructions is in accordance with the requirements of Table 612.3.6, or the minimum distances specified in the sprinkler manufacturer’s installation instructions.

### Table 612.3.3.1
#### LOCATIONS WHERE INTERMEDIATE TEMPERATURE SPRINKLERS ARE REQUIRED

<table>
<thead>
<tr>
<th>HEAT SOURCE</th>
<th>DISTANCE FROM HEAT SOURCE¹</th>
<th>MINIMUM DISTANCE²</th>
<th>MAXIMUM DISTANCE²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fireplace, Side of Open or Recessed Fireplace</td>
<td>12</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>Fireplace, Front of Recessed Fireplace</td>
<td>36</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Coal and Wood Burning Stove</td>
<td>12</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Kitchen Range Top</td>
<td>9</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Oven</td>
<td>9</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Vent Connector or Chimney Connector</td>
<td>9</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Heating Duct, Not Insulated</td>
<td>9</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Hot Water Pipe, Not Insulated</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Side of Ceiling or Wall Warm Air Register</td>
<td>12</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Front of Wall Mounted Warm Air Register</td>
<td>18</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Water Heater, Furnace, or Boiler</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Luminaire up to 250 Watts</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Luminaire 250 Watts up to 499 Watts</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

Notes:
¹ Distances shall be measured in a straight line from the nearest edge of the heat source to the nearest edge of the sprinkler.
² Sprinklers shall not be located at distances less than the minimum table distance unless the sprinkler listing allows a lesser distance.
## TABLE 612.3.6
MINIMUM SEPARATION FROM OBSTRUCTION

### PENDENT SPRINKLERS

<table>
<thead>
<tr>
<th>DISTANCE FROM DEFLECTOR TO PLANE AT BOTTOM OF OBSTRUCTION (A) (inches)</th>
<th>MINIMUM DISTANCE TO OBSTRUCTION (B) (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1½</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>4½</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>6½</td>
</tr>
<tr>
<td>14</td>
<td>7</td>
</tr>
</tbody>
</table>

### SIDEWALL SPRINKLER SIDE OBSTRUCTION

<table>
<thead>
<tr>
<th>DISTANCE FROM DEFLECTOR TO PLANE AT BOTTOM OF OBSTRUCTION (A) (inches)</th>
<th>MINIMUM DISTANCE TO OBSTRUCTION (B) (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1½</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>4½</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>6½</td>
</tr>
<tr>
<td>14</td>
<td>7</td>
</tr>
</tbody>
</table>

### SIDEWALL SPRINKLER FORWARD OBSTRUCTION

<table>
<thead>
<tr>
<th>DISTANCE FROM DEFLECTOR TO PLANE AT BOTTOM OF OBSTRUCTION (A) (inches)</th>
<th>MINIMUM DISTANCE TO OBSTRUCTION (B) (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>14</td>
<td>17</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm
612.3.6.1 Additional Requirements for Pendant Sprinklers. Pendant sprinklers located within 3 feet (914 mm) of the center of a ceiling fan, surface-mounted ceiling luminaire, or similar object shall be considered to be obstructed, and additional sprinklers shall be provided.

612.3.6.2 Additional Requirements for Sidewall Sprinklers. Sidewall sprinklers located within 5 feet (1524 mm) of the center of a ceiling fan, surface-mounted ceiling luminaire, or similar object shall be considered to be obstructed, and additional sprinklers shall be provided.

612.3.7 Sprinkler Modifications Prohibited. Sprinklers shall not be painted, caulked, or modified. A sprinkler that has been painted, caulked, modified, or damaged shall be replaced with a new sprinkler.

612.4 Sprinkler Piping System. Sprinkler piping systems shall be installed in accordance with Section 612.4.1 through Section 612.4.5.

612.4.1 General. Sprinkler piping shall be installed in accordance with the requirements for water distribution piping. Sprinkler piping shall comply with the material requirements for cold water distribution piping. For multipurpose piping systems, the sprinkler piping shall connect to and be a part of the cold water distribution piping system.

612.4.2 Nonmetallic Pipe and Tubing. Nonmetallic pipe and tubing, such as CPVC, PEX-AL-PEX, PE-RT, and PEX, shall be certified for residential sprinkler installations and shall have a pressure rating of not less than 130 psi (896 kPa) at 120°F (49°C).

612.4.2.1 Nonmetallic Pipe Protection. Nonmetallic pipe and tubing systems shall be protected from exposure to the occupied space by a layer of not less than ¾ of an inch (9.5 mm) thick gypsum wallboard, ½ of an inch (12.7 mm) thick plywood, or other material having a 15-minute fire rating.

Exceptions:

(1) Pipe protection shall not be required in areas that are not required to be protected with sprinklers in accordance with Section 612.3.1.

(2) Pipe protection shall not be required where exposed piping is permitted by the pipe third party listing.

612.4.2.2 Sprinkler Installation on Systems Assembled with Solvent Cement. The solvent cementing of fittings shall be completed, and threaded adapters for sprinklers shall be verified as being clear of excess cement before the installation of sprinklers on systems assembled with solvent cement.

612.4.3 Shutoff Valves Prohibited. Shutoff valves shall not be installed in a location where the valve would isolate piping serving one or more sprinklers. Shutoff valves shall only be permitted for the entire water distribution system.

612.4.4 Single Dwelling Limit. The sprinkler piping beyond the service valve located at the beginning of the water distribution system shall serve only one dwelling unit.

612.4.5 Drain. A ½ inch (15 mm) drain for the sprinkler system shall be provided on the system side of the water distribution shutoff valve.

612.5 Sprinkler Piping Design. Sprinkler piping systems shall be sized in accordance with Section 612.5.1 through Section 612.5.3.2.2.

612.5.1 Determining System Design Flow. The sizing of the sprinkler piping system shall be based on the flow rate and pressure of each sprinkler in accordance with Section 612.5.1.1 and the number of sprinklers in accordance with Section 612.5.1.2.

612.5.1.1 Determining Required Flow Rate for Each Sprinkler. The minimum flow rate and pressure for each residential sprinkler shall be in accordance with the manufacturer’s published data for the specific sprinkler model based on the following:

(1) The area of coverage.

(2) The ceiling configuration.

(3) The temperature rating.

(4) Additional conditions specified by the sprinkler manufacturer.

612.5.1.2 System Flow Rate. The flow rate used for sizing the sprinkler piping system shall be based on the following:

(1) The flow rate for a room having only one sprinkler shall be the flow rate required for the sprinkler in accordance with Section 612.5.1.1.

(2) The flow rate for a room having two or more sprinklers shall be determined by identifying the sprinkler in the room with the highest required flow rate in accordance with Section 612.5.1.1 and multiplying that flow rate by 2.

(3) Where the sprinkler manufacturer specifies different criteria for ceiling configurations that are not smooth, flat, and horizontal the required flow rate for that room shall be in accordance with the sprinkler manufacturer’s instructions.

(4) The flow rate used for sizing the sprinkler system shall be the flow required by the room with the largest flow rate in accordance with Section 612.5.1.2(1), Section 612.5.1.2(2), and Section 612.5.1.2(3).

(5) For the purpose of this section, it shall be permissible to reduce the flow rate for a room by subdividing the space into two or more rooms, where each room is evaluated separately on the required design flow rate. Each room shall be
bounded by walls and a ceiling. Openings in walls shall have a lintel not less than 8 inches (203 mm) in depth, and each lintel shall form a solid barrier between the ceiling and the top of the opening.

612.5.2 Sprinkler Pipe Water Supply. The water supply for a multipurpose or stand-alone sprinkler system shall be provided by the public water main, private water main, private well system, or storage tank. The water supply required shall be determined in accordance with Section 612.5.1.2 at a pressure not less than that used in accordance with Section 612.5.3.

612.5.2.1 Water Pressure from Individual Sources. Where a dwelling unit water supply is from a tank system, a private well system, or a combination of these, the available water pressure shall be based on the minimum pressure control setting of the pump.

612.5.2.2 Required Capacity. The water supply shall have the capacity to provide the required flow rate to the sprinklers for a period of time as follows:

(1) Seven minutes for one story dwelling units less than 2000 square feet (185.8 m²) in area.

(2) Ten minutes for multi-level dwelling units and one story dwelling units not less than 2000 square feet (185.8 m²) in the area.

Where a well system, a water supply tank system, or a combination thereof is used a combination of well capacity and tank storage shall be permitted to meet the capacity requirement.

612.5.3 Sprinkler Pipe Sizing. The sprinkler piping shall be sized for the flow rate in accordance with Section 612.5.1. The flow rate required to supply the plumbing fixtures shall not be required to be added to the sprinkler design flow for multipurpose or stand alone piping systems. The sizing of the water supply to the plumbing fixtures shall be determined in accordance with this chapter. For multipurpose piping systems, the largest pipe size required based on either the sprinkler piping calculations or the water distribution piping calculations shall be installed.

612.5.3.1 Sprinkler Pipe Sizing Method. The sprinkler pipe shall be sized using the prescriptive method in Section 612.5.3.2 or by hydraulic calculation in accordance with NFPA 13D. The sprinkler pipe size from the water supply source to a sprinkler shall be not less than ¾ of an inch (20 mm) in diameter. Threaded adapter fittings at the point where sprinklers are attached to the piping shall be not less than ½ of an inch (15 mm) in diameter.

612.5.3.2 Prescriptive Pipe Sizing Method. The sprinkler pipe shall be sized by determining the available pressure to offset friction loss in piping and based on the piping material, diameter and length using the equation in Section 612.5.3.2.1 and the procedure in Section 612.5.3.2.2.

612.5.3.2.1 Available Pressure Equation. The available system pressure (P_s) for sizing the sprinkler piping shall be determined in accordance with the Equation 612.5.3.2.1.

### TABLE 612.5.3.2(1)

<table>
<thead>
<tr>
<th>FLOW RATE (gpm)</th>
<th>3/4 INCH WATER SERVICE PRESSURE LOSS (psi)</th>
<th>1 INCH WATER SERVICE PRESSURE LOSS (psi)</th>
<th>1 1/4 INCH WATER SERVICE PRESSURE LOSS (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40 FEET OR LESS</td>
<td>41 FEET TO 75 FEET</td>
<td>76 FEET TO 100 FEET</td>
</tr>
<tr>
<td>8</td>
<td>5.1</td>
<td>8.7</td>
<td>11.8</td>
</tr>
<tr>
<td>10</td>
<td>7.7</td>
<td>13.1</td>
<td>17.8</td>
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<tr>
<td>12</td>
<td>10.8</td>
<td>18.4</td>
<td>24.9</td>
</tr>
<tr>
<td>14</td>
<td>14.4</td>
<td>24.5</td>
<td>NP</td>
</tr>
<tr>
<td>16</td>
<td>18.4</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>18</td>
<td>22.9</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>20</td>
<td>27.8</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>22</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>24</td>
<td>NP</td>
<td>NP</td>
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<td>34</td>
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<td>NP</td>
</tr>
<tr>
<td>36</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 inch = 25 mm, 1 foot = 304.8 mm

Notes:
1 Values are applicable for underground piping materials and are based on polyethylene pipe having an SDR of 11 and a Hazen Williams C Factor of 150.
2 Values include the following length allowances for fittings: 25 percent length increase for actual lengths up to 100 feet (30 480 mm) and 15 percent length increase for actual lengths over 100 feet (30 480 mm).
3 NP – Means not permitted.
\[ P_t = P_{sup} - PL_{ws} - PL_m - PL_d - P_{Le} - P_{sp} \]

Where:
- \( P_t \) = Pressure used for sizing the system in Table 612.5.3.2(4) through Table 612.5.3.2(9)
- \( P_{sup} \) = Pressure available from the water supply source
- \( PL_{ws} \) = Pressure loss in the water service pipe
- \( PL_m \) = Pressure loss through the water meter
- \( PL_d \) = Pressure loss from devices other than the water meter
- \( PL_{Le} \) = Pressure loss associated with changes in elevation
- \( P_{sp} \) = Maximum pressure required by a sprinkler

### Step 2 – Determine \( PL_{ws} \)
Use Table 612.5.3.2(1) to determine the pressure loss in the water service pipe based on the size of the water service. Where the water service supplies more than one dwelling unit, 5 gpm (0.3 L/s) shall be added to the sprinkler flow rate.

### Step 3 – Determine \( PL_m \)
Use Table 612.5.3.2(2) to determine the pressure loss from the water meter based on the water meter size.

### Step 4 – Determine \( PL_d \)
Determine the pressure loss from devices, other than the water meter, installed in the piping system supplying sprinklers such as pressure-reducing valves, backflow preventers, water softeners, or water filters. Device pressure losses shall be based on the device manufacturer’s specifications. The flow rate used to determine pressure loss shall be the sprinkler flow rate from Section 612.5.1.2. As an alternative to deducting pressure loss for a device, an automatic bypass valve shall be installed to divert flow around the device when a sprinkler activates.

### Step 5 – Determine \( PL_{Le} \)
Use Table 612.5.3.2(3) to determine the pressure loss associated with changes in elevation. The elevation used in applying the table shall be the difference between the elevation where the water source pressure was measured and the elevation of the highest sprinkler.

### Step 6 – Determine \( P_{sp} \)
Determine the maximum pressure required by an individual sprinkler based on the flow rate from Section 612.5.1.1. The minimum pressure required is specified in the sprinkler manufacturer’s published data for the specific sprinkler model based on the selected flow rate.

### Step 7 – Calculate \( P_t \)
Using Equation 612.5.3.2.1, calculate the available system pressure for sizing the sprinkler piping.

---

### TABLE 612.5.3.2(2)

<table>
<thead>
<tr>
<th>FLOW RATE (gpm)</th>
<th>3/4 INCH METER PRESSURE LOSS (psi)</th>
<th>1 INCH METER PRESSURE LOSS (psi)</th>
<th>1 INCH METER PRESSURE LOSS (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>5</td>
<td>2</td>
<td>1</td>
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<tr>
<td>16</td>
<td>7</td>
<td>3</td>
<td>1</td>
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<tr>
<td>18</td>
<td>9</td>
<td>4</td>
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<tr>
<td>20</td>
<td>11</td>
<td>4</td>
<td>2</td>
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<tr>
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</tr>
<tr>
<td>24</td>
<td>NP</td>
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<td>2</td>
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<tr>
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<tr>
<td>28</td>
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<td>8</td>
<td>3</td>
</tr>
<tr>
<td>36</td>
<td>NP</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 inch = 25 mm

**Notes:**
1. Table 612.5.3.2(2) establishes conservative values for water meter pressure loss for installations where the water meter loss is unknown. Where the actual water meter pressure loss is known, \( PL_m \) shall be the pressure loss as specified by the meter manufacturer.
2. NP – Means not permitted.

### TABLE 612.5.3.2(3)

<table>
<thead>
<tr>
<th>ELEVATION (feet)</th>
<th>PRESSURE LOSS (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2.2</td>
</tr>
<tr>
<td>10</td>
<td>4.4</td>
</tr>
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<td>15</td>
<td>6.5</td>
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<td>20</td>
<td>8.7</td>
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<tr>
<td>25</td>
<td>10.9</td>
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<tr>
<td>30</td>
<td>13.0</td>
</tr>
<tr>
<td>35</td>
<td>15.2</td>
</tr>
<tr>
<td>40</td>
<td>17.4</td>
</tr>
</tbody>
</table>

For SI units: 1 foot = 304.8 mm, 1 pound-force per square inch = 6.8947 kPa
Step 8 – Determine the maximum allowable pipe length

Use Table 612.5.3.2(4) through Table 612.5.3.2(9) to select a material and size for the residential sprinkler piping. The piping material and size shall be acceptable where the developed length of pipe between the inside water service valve and the most remote sprinkler does not exceed the maximum allowable length specified by the applicable table. Interpolation of $P_t$ between the tabular values shall be permitted.

The maximum allowable length of piping in Table 612.5.3.2(4) through Table 612.5.3.2(9) incorporates an adjustment for pipe fittings, and no additional consideration of friction losses associated with pipe fittings shall be required.

612.6 Instructions and Signs. An owner’s manual for the fire sprinkler system shall be provided to the owner. A sign or valve tag shall be installed at the main shutoff valve to the water distribution system stating the following: “Warning, the water system for this home supplies fire sprinklers that require certain flow and pressure to fight a fire. Devices that restrict the flow decrease the pressure, or automatically shut-off the water to the fire sprinkler system, such as water softeners, filtration systems, and automatic shutoff valves shall not be added to this system without a review of the fire sprinkler system by a fire protection specialist. Do not remove this sign.”

612.7 Inspection and Testing. The inspection and testing of sprinkler systems shall be in accordance with Section 612.7.1 and Section 612.7.2.

612.7.1 Pre-Concealment Inspection. The following shall be verified prior to the concealment of any sprinkler system piping:

1. Sprinklers are installed in all areas in accordance with Section 612.3.1.
2. Where sprinkler water spray patterns are obstructed by construction features, luminaires or ceiling fans, additional sprinklers are installed in accordance with Section 612.3.6.
3. Sprinklers are the correct temperature rating and are installed at or beyond the required separation distances from heat sources in accordance with Section 612.3.3 and Section 612.3.3.1.
4. The minimum pipe size in accordance with the requirements of Table 612.5.3.2(4) through Table 612.5.3.2(9) or, where the piping system was hydraulically calculated in accordance with Section 612.5.3.1, the size used in the hydraulic calculation.
5. The pipe length does not exceed the length permitted by Table 612.5.3.2(4) through Table 612.5.3.2(9) or, where the piping system was hydraulically calculated in accordance with Section 612.5.3.1, pipe lengths and fittings shall not exceed those used in the hydraulic calculation.
6. Nonmetallic piping that conveys water to sprinklers is certified as having a pressure rating of not less than 130 psi (896 kPa) at 120°F (49°C).
7. Piping is properly supported.
8. The piping system is tested in accordance with Section 609.4.

612.7.2 Final Inspection. Upon completion of the residential sprinkler system, the system shall be inspected. The following shall be verified during the final inspection:

1. Sprinklers are not painted, damaged, or otherwise hindered from the operation.
2. Where a pump is required to provide water to the system, the pump starts automatically upon system water demand.
3. Pressure reducing valves, water softeners, water filters, or other impairments to water flow that were not part of the original design has not been installed.
4. The sign or valve tag in accordance with Section 612.6 is installed, and the owner’s manual for the system is present.
TABLE 612.5.3.2(4)  
ALLOWABLE PIPE LENGTH FOR ¾ INCH TYPE M COPPER WATER TUBING*

<table>
<thead>
<tr>
<th>SPRINKLER FLOW RATE (gpm)</th>
<th>WATER DISTRIBUTION SIZE (inch)</th>
<th>AVAILABLE PRESSURE - P&lt;sub&gt;t&lt;/sub&gt; (psi)</th>
<th>ALLOWABLE LENGTH OF PIPE FROM SERVICE VALVE TO FARTHEST SPRINKLER (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>¼</td>
<td>217</td>
<td>289</td>
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<tr>
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<tr>
<td>40</td>
<td>¼</td>
<td>NP</td>
<td>18</td>
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</tbody>
</table>

For SI units: 1 pound-force per square inch = 6.8947 kPa, 1 gallon per minute = 0.06 L/s, 1 inch = 25 mm, 1 foot = 304.8 mm
* NP – Means not permitted.
## TABLE 612.5.3.2(5)
### ALLOWABLE PIPE LENGTH FOR 1 INCH TYPE M COPPER WATER TUBING

<table>
<thead>
<tr>
<th>SPRINKLER FLOW RATE (gpm)</th>
<th>WATER DISTRIBUTION SIZE (inch)</th>
<th>AVAILABLE PRESSURE - $P_t$ (psi)</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ALLOWABLE LENGTH OF PIPE FROM SERVICE VALVE TO FARTHEST SPRINKLER (feet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>1075</td>
<td>1343</td>
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<td>1881</td>
<td>2149</td>
<td>2418</td>
<td>2687</td>
<td>2955</td>
<td>3224</td>
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For SI units: 1 pound-force per square inch = 6.8947 kPa, 1 gallon per minute = 0.06 L/s, 1 inch = 25 mm, 1 foot = 304.8 mm
## TABLE 612.5.3.2(6)
### ALLOWABLE PIPE LENGTH FOR 3⁄4 INCH IPS CPVC PIPE

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For SI units: 1 pound-force per square inch = 6.8947 kPa, 1 gallon per minute = 0.06 L/s, 1 inch = 25 mm, 1 foot = 304.8 mm
### Table 612.5.3.2(7)

**Allowable Pipe Length for 1 Inch IPS CPVC Pipe**

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For SI units: 1 pound-force per square inch = 6.8947 kPa, 1 gallon per minute = 0.06 L/s, 1 inch = 25 mm, 1 foot = 304.8 mm
### TABLE 612.5.3.2(8)

**ALLOWABLE PIPE LENGTH FOR ¾ INCH PEX TUBING**

<table>
<thead>
<tr>
<th>SPRINKLER FLOW RATE (gpm)</th>
<th>WATER DISTRIBUTION SIZE (inch)</th>
<th>AVAILABLE PRESSURE - ( P_t ) (psi)</th>
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<tbody>
<tr>
<td></td>
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<td>15</td>
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<tr>
<td></td>
<td></td>
<td>ALLOWABLE LENGTH OF PIPE FROM SERVICE VALVE TO FARDEST SPRINKLER (feet)</td>
</tr>
<tr>
<td>8</td>
<td>¾</td>
<td>93</td>
</tr>
<tr>
<td>9</td>
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<tr>
<td>40</td>
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</table>

For SI units: 1 pound-force per square inch = 6.8947 kPa, 1 gallon per minute = 0.06 L/s, 1 inch = 25 mm, 1 foot = 304.8 mm

* NP – Means not permitted.
## TABLE 612.5.3.2(9)
### ALLOWABLE PIPE LENGTH FOR 1 INCH PEX TUBING

<table>
<thead>
<tr>
<th>Sprinkler Flow Rate (gpm)</th>
<th>Water Distribution Size (inch)</th>
<th>Available Pressure - $P_t$ (psi)</th>
<th>Allowable Length of Pipe from Service Valve to Farthest Sprinkler (feet)</th>
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For SI units: 1 pound-force per square inch = 6.8947 kPa, 1 gallon per minute = 0.06 L/s, 1 inch = 25 mm, 1 foot = 304.8 mm
CHAPTER 7
SANITARY DRAINAGE

Part I – Drainage Systems.

701.0 General.
701.1 Applicability. This chapter shall govern the materials, design, and installation of sanitary drainage systems and building sewers.

701.2 Drainage Piping. Materials for drainage piping shall be in accordance with one of the referenced standards in Table 701.2 except that:

1) No galvanized wrought-iron or galvanized steel pipe shall be used underground and shall be kept not less than 6 inches (152 mm) aboveground.

2) ABS and PVC DWV piping installations shall be installed in accordance with applicable standards referenced in Table 701.2 and Chapter 14 “Firestop Protection.” Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a flame-spread index of not more than 25 and a smoke-developed index of not more than 50, where tested in accordance with ASTM E84 or UL 723. Plastic piping installed in plenums shall be tested in accordance with all requirements of ASTM E84 or UL 723. Mounting methods, supports and sample sizes of materials for testing that are not specified in ASTM E84 or UL 723 shall be prohibited.

3) No vitrified clay pipe or fittings shall be used aboveground or where pressurized by a pump or ejector. They shall be kept not less than 12 inches (305 mm) below ground.

4) Copper or copper alloy tube for drainage and vent piping shall have a weight of not less than that of copper or copper alloy drainage tube type DWV.

5) Stainless steel 304 pipe and fittings shall not be installed underground and shall be kept not less than 6 inches (152 mm) aboveground.

6) Cast-iron soil pipe and fittings and the stainless steel couplings used to join these products shall be listed and tested in accordance with standards referenced in Table 701.2. Such pipe and fittings shall be marked with the country of origin, manufacturer’s name or registered trademark as defined in the product standards, the third party certifier’s mark, and the class of the pipe or fitting.

701.3 Drainage Fittings. Materials for drainage fittings shall comply with the applicable standards referenced in Table 701.2 of the same diameter as the piping served, and such fittings shall be compatible with the type of pipe used.

701.3.1 Screwed Pipe. Fittings on screwed pipe shall be of the recessed drainage type. Buried ends shall be reamed to the full bore of the pipe.

701.3.2 Threads. The threads of drainage fittings shall be tapped to allow ¼ inch per foot (20.8 mm/m) grade.

701.3.3 Type. Fittings used for drainage shall be of the drainage type, have a smooth interior water-way, and be constructed to allow ¼ inch per foot (20.8 mm/m) grade.

701.4 Continuous Wastes. Continuous wastes and fixture tailpieces shall be constructed from the materials specified in Section 701.2 for drainage piping, provided, however, that such connections where exposed or accessible shall be permitted to be of seamless drawn brass not less than No. 20 B & S Gauge (0.032 inches) (0.8 mm).

701.5 Lead. (See Chapter 17) Sheet lead shall comply with the following:

1) For safe pans – not less than 4 pounds per square foot (lb/ft²) (19 kg/m²) or ½ of an inch (1.6 mm) thick.

2) For flashings or vent terminals – not less than 3 lb/ft² (15 kg/m²) or 0.0472 of an inch (1.2 mm) thick.

3) Lead bends and lead traps shall be not less than ½ of an inch (3.2 mm) in wall thickness.

701.6 Caulking Ferrules. Caulking ferrules shall be manufactured from copper or copper alloy and shall be in accordance with Table 701.6.

701.7 Soldering Bushings. Soldering bushings shall be of copper or copper alloy and shall be in accordance with Table 701.7.

### TABLE 701.6
**CAULKING FERRULES**

<table>
<thead>
<tr>
<th>PIPE SIZE (inches)</th>
<th>INSIDE DIAMETER (inches)</th>
<th>LENGTH (inches)</th>
<th>MINIMUM WEIGHT EACH</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>pounds</td>
</tr>
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</tr>
<tr>
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<td>4½</td>
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For SI units: 1 inch = 25 mm, 1 pound = 0.453 kg, 1 ounce = 0.02834 kg

### TABLE 701.7
**SOLDERING BUSHINGS**

<table>
<thead>
<tr>
<th>PIPE SIZE (inches)</th>
<th>MINIMUM WEIGHT EACH</th>
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<tbody>
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<td></td>
<td>pounds</td>
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<tr>
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For SI units: 1 inch = 25 mm, 1 pound = 0.453 kg, 1 ounce = 0.02834 kg

702.0 Fixture Unit Equivalents.

702.1 Trap Size. The unit equivalent of plumbing fixtures shown in Table 702.1 shall be based on the size of the trap required, and the unit equivalent of fixtures and devices not shown in Table 702.1 shall be based on the size of trap or trap arm.

Maximum drainage fixture units for a fixture trap and trap arm loadings for sizes up to 4 inches (100 mm) shall be in accordance with Table 702.1(1).
### Table 701.2
Materials for Drain, Waste, Vent Pipe and Fittings

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS</th>
<th>BUILDING SEWER PIPE AND FITTINGS</th>
<th>REFERENCED STANDARD(S) PIPE</th>
<th>REFERENCED STANDARD(S) FITTINGS</th>
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<tr>
<td>ABS (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASTM D2661, ASTM D2680*</td>
<td>ASME A112.4.4, ASTM D2661, ASTM D2680*</td>
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<td>Cast-Iron</td>
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<td>X</td>
<td>X</td>
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<td>ASME B16.12, ASTM A74, ASTM A888, CISPI 301</td>
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<td>Co-Extruded ABS (Schedule 40)</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<td>X</td>
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<td>ASTM D2729</td>
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<tr>
<td>Stainless Steel 316L</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>ASME A112.3.1</td>
<td>ASME A112.3.1</td>
</tr>
<tr>
<td>Vitrified Clay (Extra strength)</td>
<td>--</td>
<td>--</td>
<td>X</td>
<td>ASTM C700</td>
<td>ASTM C700</td>
</tr>
</tbody>
</table>

* For building sewer applications.
### Table 702.1

**DRAINAGE FIXTURE UNIT VALUES (DFU)**

<table>
<thead>
<tr>
<th>PLUMBING APPLIANCES, APPURTENCES, OR FIXTURES</th>
<th>MINIMUM SIZE TRAP AND TRAP ARM(^7)</th>
<th>PRIVATE</th>
<th>PUBLIC</th>
<th>ASSEMBLY(^8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathtub or Combination Bath/Shower</td>
<td>1 1/2</td>
<td>2.0</td>
<td>2.0</td>
<td>—</td>
</tr>
<tr>
<td>Bidet</td>
<td>1 1/4</td>
<td>1.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Bidet</td>
<td>1 1/2</td>
<td>2.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Clothes Washer, domestic, standpipe(^5)</td>
<td>2</td>
<td>3.0</td>
<td>3.0</td>
<td>—</td>
</tr>
<tr>
<td>Dental Unit, cuspidor</td>
<td>1 1/4</td>
<td>—</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Dishwasher, domestic, with independent drain(^2)</td>
<td>1 1/2</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Drinking Fountain or Water Cooler</td>
<td>1 1/4</td>
<td>0.5</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Food Waste Disposer</td>
<td>2</td>
<td>—</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Floor Drain, emergency</td>
<td>2</td>
<td>—</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Floor Drain (for additional sizes see Section 702.0)</td>
<td>2</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Shower, single-head trap</td>
<td>2(^9)</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Multi-head, each additional</td>
<td>2</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Lavatory</td>
<td>1 1/4</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Lavatories in sets</td>
<td>1 1/2</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Washfountain</td>
<td>1 1/2</td>
<td>—</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Washfountain</td>
<td>2</td>
<td>—</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Mobile Home, trap</td>
<td>3</td>
<td>12.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Receptor, indirect waste(^1,3)</td>
<td>1 1/2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Receptor, indirect waste(^1,4)</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Receptor, indirect waste(^1)</td>
<td>3</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Sinks</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Bar</td>
<td>1 1/4</td>
<td>1.0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Bar(^2)</td>
<td>1 1/2</td>
<td>—</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Clinical</td>
<td>3</td>
<td>—</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Commercial with food waste(^2)</td>
<td>1 1/2</td>
<td>—</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Exam Room</td>
<td>1 1/2</td>
<td>—</td>
<td>1.0</td>
<td>—</td>
</tr>
<tr>
<td>Special Purpose(^4)</td>
<td>1 1/2</td>
<td>2.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Special Purpose(^2)</td>
<td>2</td>
<td>3.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Special Purpose(^3)</td>
<td>3</td>
<td>—</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Kitchen, domestic(^2)</td>
<td>1 1/2</td>
<td>2.0</td>
<td>2.0</td>
<td>—</td>
</tr>
<tr>
<td>Laundry(^2) (with or without discharge from a clothes washer)</td>
<td>1 1/2</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Service or Mop Basin</td>
<td>2</td>
<td>—</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Service or Mop Basin(^2)</td>
<td>3</td>
<td>—</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Service, flushing rim</td>
<td>3</td>
<td>—</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Wash, each set of faucets</td>
<td>—</td>
<td>—</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Nonwater Urinal with Drain Cleansing Action</td>
<td>2</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Urinal, integral trap 1.0 GPF(^2)</td>
<td>2</td>
<td>2.0</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Urinal, integral trap greater than 1.0 GPF</td>
<td>2</td>
<td>2.0</td>
<td>2.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Urinal, exposed trap(^4)</td>
<td>1 1/2</td>
<td>2.0</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Water Closet, 1.6 GPF Gravity Tank(^6)</td>
<td>3</td>
<td>3.0</td>
<td>4.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Water Closet, 1.6 GPF Flushometer Tank(^6)</td>
<td>3</td>
<td>3.0</td>
<td>4.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Water Closet, 1.6 GPF Flushometer Valve(^6)</td>
<td>3</td>
<td>3.0</td>
<td>4.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Water Closet, greater than 1.6 GPF Gravity Tank(^6)</td>
<td>3</td>
<td>4.0</td>
<td>6.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Water Closet, greater than 1.6 GPF Flushometer Valve(^6)</td>
<td>3</td>
<td>4.0</td>
<td>6.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm

**Notes:**

1. Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain thereinto, in accordance with Table 702.2.
2. Provide a 2 inch (50 mm) minimum drain.
3. For refrigerators, coffee urns, water stations, and similar low demands.
4. For commercial sinks, dishwashers, and similar moderate or heavy demands.
5. Buildings having a clothes-washing area with clothes washers in a battery of three or more clothes washers shall be rated at 6 fixture units each for purposes of sizing common horizontal and vertical drainage piping.
6. Water closets shall be computed as 6 fixture units where determining septic tank sizes based on Appendix H of this code.
7. Trap sizes shall not be increased to the point where the fixture discharge is capable of being inadequate to maintain their self-scouring properties.
8. Assembly [Public Use (see Table 422.1)].
9. For a bathtub to shower retrofit, a 1 1/2 inch (40 mm) trap and trap arm shall be permitted with a maximum shower size of 36 inches (914 mm) in width and 60 inches (1524 mm) in length. See Section 408.5-408.6 and Section 408.6-408.7.
702.2 Intermittent Flow. Drainage fixture units for intermittent flow into the drainage system shall be computed on the rated discharge capacity in gallons per minute (gpm) (L/s) in accordance with Table 702.2.

<table>
<thead>
<tr>
<th>GPM</th>
<th>DISCHARGE CAPACITY IN GALLONS PER MINUTE FOR INTERMITTENT FLOW ONLY*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 7½</td>
<td>Equals 1 Fixture Unit</td>
</tr>
<tr>
<td>Greater than 7½ to 15</td>
<td>Equals 2 Fixture Units</td>
</tr>
<tr>
<td>Greater than 15 to 30</td>
<td>Equals 4 Fixture Units</td>
</tr>
<tr>
<td>Greater than 30 to 50</td>
<td>Equals 6 Fixture Units</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s
* Discharge capacity exceeding 50 gallons per minute (3.15 L/s) shall be determined by the Authority Having Jurisdiction.

702.3 Continuous Flow. For a continuous flow into a drainage system, such as from a pump, sump ejector, air conditioning equipment, or similar device, 2 fixture units shall be equal to each gallon per minute (gpm) (L/s) of flow.

703.0 Size of Drainage Piping.

703.1 Minimum Size. The minimum sizes of vertical, horizontal, or both drainage piping shall be determined from the total of fixture units connected thereto, and additionally, in the case of vertical drainage pipes, in accordance with their length.

703.2 Maximum Number of Fixture Units. Table 703.2 shows the maximum number of fixture units allowed on a vertical or horizontal drainage pipe, building drain, or building sewer of a given size; the maximum number of fixture units allowed on a branch interval of a given size; and the maximum length (in feet and meters) of a vertical drainage pipe of a given size.

703.3 Sizing per Appendix C. For alternate method of sizing drainage piping, see Appendix C.

704.0 Fixture Connections (Drainage).

704.1 Inlet Fittings. Drainage piping shall be provided with approved inlet fittings for fixture connections, correctly located according to the size and type of fixture proposed to be connected.

704.2 Single Vertical Drainage Pipe. Two fixtures set back-to-back, or side-by-side, within the distance allowed between a trap and its vent, shall be permitted to be served by a single vertical drainage pipe provided that each fixture wastes separately into an approved double-fixture fitting having inlet openings at the same level.

704.3 Commercial Sinks. Pot sinks, scullery sinks, dishwashing sinks, silverware sinks, and other similar fixtures shall be connected directly to the drainage system. A floor drain shall be provided adjacent to the fixture and shall be connected on the sewer side of the sink. No other drainage line shall be connected between the floor drain waste connection and the fixture drain. The fixture and floor drain shall be trapped and vented in accordance with this code.

705.0 Joints and Connections.

705.1 ABS and ABS Co-Extruded Plastic Pipe and Joints. Joining methods for ABS plastic pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.1.1 through Section 705.1.3.

705.1.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint. The push-on joint shall include an elastomeric gasket that complies with ASTM D3212 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.1.2 Solvent Cement Joints. Solvent cement joints for ABS pipe and fittings shall be clean from dirt and moisture. Pipe shall be cut square and shall be deburred. Where surfaces to be joined are cleaned, and free of dirt, moisture, oil, and other foreign material, the solvent cement that complies with ASTM D2235 shall be applied to all joint surfaces. Joints shall be made while both the inside socket surface and outside surface of pipe are wet with solvent cement. Hold joint in place and undisturbed for 1 minute after assembly.

705.1.3 Threaded Joints. Threads shall comply with ASME B1.20.1. A minimum of Schedule 80 shall be permitted to be threaded. Molded threads on adapter fittings for the transition to threaded joints shall be permitted. Thread sealant compound shall be applied to male threads, insoluble in water, and nontoxic. The joint between the pipe and transition fitting shall be of the solvent cement type. Caution shall be used during assembly to prevent over tightening of the ABS components once the thread sealant compound has been applied.

705.2 Cast-Iron Pipe and Joints. Joining methods for cast-iron pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.2.1 or Section 705.2.2.

705.2.1 Caulked Joints. Caulked joints shall be firmly packed with oakum or hemp and filled with molten lead to a depth of not less than 1 inch (25.4 mm) in one continuous pour. The lead shall be caulked thoroughly at the inside and outside edges of the joint. After
Up to 8 public lavatories are permitted to be installed on a 11⁄4-size fixture unit.

The diameter of an individual vent shall be not less than 1 inch (25 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2. Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.3.

### Notes:

1. Excluding trap arm.
2. Except for sinks, urinals, and dishwashers – exceeding 1 fixture unit.
3. Except for six-unit traps or water closets.
4. Not to exceed five six-unit traps.
5. Based on ¼ inch per foot (20.8 mm/m) slope. For ½ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.
6. For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

### Table 703.2

<table>
<thead>
<tr>
<th>SIZE OF PIPE (inches)</th>
<th>1½</th>
<th>1½</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Units</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Drainage Piping</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical</td>
<td>1</td>
<td>2</td>
<td>16</td>
<td>48</td>
<td>256</td>
<td>600</td>
<td>1380</td>
<td>3600</td>
<td>5600</td>
<td>8400</td>
</tr>
<tr>
<td>Horizontal</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>35</td>
<td>216</td>
<td>428</td>
<td>720</td>
<td>2640</td>
<td>4680</td>
<td>8200</td>
</tr>
<tr>
<td><strong>Maximum Length</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>Drainage Piping</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical, (feet)</td>
<td>45</td>
<td>65</td>
<td>85</td>
<td>212</td>
<td>300</td>
<td>390</td>
<td>510</td>
<td>750</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Horizontal (unlimited)</td>
<td>60</td>
<td>120</td>
<td>212</td>
<td>300</td>
<td>390</td>
<td>510</td>
<td>750</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Vent Piping</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal and Vertical</td>
<td>45</td>
<td>60</td>
<td>120</td>
<td>212</td>
<td>300</td>
<td>390</td>
<td>510</td>
<td>750</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

**Notes:**

1. Excluding trap arm.
2. Except for sinks, urinals, and dishwashers – exceeding 1 fixture unit.
3. Except for six-unit traps or water closets.
4. Not to exceed five six-unit traps.
5. Based on ¼ inch per foot (20.8 mm/m) slope. For ½ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.
6. The diameter of an individual vent shall be not less than 1¼ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2. Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.3.
7. Up to 8 public lavatories are permitted to be installed on a 1½-size (40 mm) vertical branch or horizontal sanitary branch sloped at ¼ inch per foot (20.8 mm/m),

caulking, the finished joint shall not exceed ½ of an inch (3.2 mm) below the rim of the hub. No paint, varnish, or other coatings shall be permitted on the joining material until after the joint has been tested and approved.

#### 705.2.2 Mechanical Joints and Compression Joints

Mechanical joints for cast-iron pipe and fittings shall be of the elastomeric compression type or mechanical joint couplings. Compression type joints with an elastomeric gasket for cast-iron hub and spigot pipe shall comply with ASTM C1564 and be tested in accordance with ASTM C1563. Hub and spigot shall be clean and free of dirt, mud, sand, and foreign materials. Cut pipe shall be free from sharp edges. Fold and insert gasket into the hub. Lubricate the joint following manufacturer’s instructions. Insert spigot into hub until the spigot end of the other pipe or fitting. Pipe or fittings shall be seated against the center stop inside the elastomeric sleeve. Slide the stainless steel shield and clamp assembly into a position centered over the gasket and tighten. Bands shall be tightened using an approved calibrated torque wrench specifically set by the manufacturer of the couplings.

#### 705.3 Copper or Copper Alloy Pipe (DWV) and Joints

Joining methods for copper or copper alloy pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.3.1 through Section 705.3.4.

#### 705.3.1 Brazed Joints

Brazed joints between copper or copper alloy pipe 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. Piping 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 shall conform to AWS A5.8 and shall be applied at the point where the pipe or tubing enters the socket of the fitting.

#### 705.3.2 Mechanical Joints

Mechanical joints in copper or copper alloy piping shall be made with a mechanical coupling with grooved end piping or approved joint designed for the specific application.

#### 705.3.3 Soldered Joints

Soldered joints between copper or copper alloy pipe 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, cool-
ing, and cleaning. Pipe shall be cut square and reamed to the full inside diameter including the removal of burrs on the outside of the pipe. Surfaces to be joined shall be cleaned bright by manual or mechanical means. Flux shall be applied to pipe and fittings and shall conform to ASTM B813, and shall become noncorrosive and non-toxic after soldering. Insert pipe into the base of the fitting and remove excess flux. Pipe and fitting shall be supported to ensure a uniform capillary space around the joint. Heat shall be applied using air or fuel torch with the flame perpendicular to the pipe 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 and fitting. Solder conforming to ASTM B32 shall be applied to the joint surfaces until capillary action draws the molten solder into the cup. Joint surfaces shall not be disturbed until cool, and any remaining flux residue shall be cleaned.

705.3.4 Threaded Joints. Threaded joints for copper or copper alloy pipe shall be made with pipe threads that comply with ASME B1.20.1. Thread sealant tape or compound shall be applied only to male threads, and such material shall be approved types, insoluble in water, and nontoxic.

705.4 Galvanized Steel Pipe and Joints. Joining methods for galvanized steel pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.4.1 or Section 705.4.2.

705.4.1 Mechanical Joints. Mechanical joints shall be made with an elastomeric gasket.

705.4.2 Threaded Joints. Threaded joints shall be made with pipe threads that comply with ASME B1.20.1. Thread sealant tape or compound shall be applied only to male threads, and such material shall be of approved types, insoluble in water, and non-toxic.

705.5 Polyethylene (PE) Sewer Pipe. Polyethylene (PE) sewer pipe or tubing and fitting joining methods shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.5.1 through Section 705.5.1.3.

705.5.1 Heat-Fusion Joints. Heat-fusion joints between PE sewer pipe or tubing and fittings shall be assembled in accordance with Section 705.5.1.1 through Section 705.5.1.3 using butt-fusion, electro-fusion, or socket-fusion heat methods. Do not disturb the joint until cooled to ambient temperature.

705.5.1.1 Butt-Fusion Joints. Butt-fusion joints for PE pipe shall be installed in accordance with ASTM F2620 and shall be made by heating the prepared ends of two pipes, pipe and fitting, or two fittings by holding ends against a heated element. The heated element shall be removed when the required melt or times are obtained and heated ends shall be placed together with applied force. Do not disturb the joint until cooled to ambient temperature.

705.5.1.2 Electro-Fusion Joints. Electro-fusion joints shall be heated internally by a conductor at the interface of the joint. Fittings shall comply with ASTM F1055 for the performance requirements of polyethylene electro-fusion fittings. The specified electro-fusion cycle used to form the joint requires consideration of the properties of the materials being joined, the design of the fitting being used, and the environmental conditions. Align and restrain fitting to pipe to prevent movement and apply electric current to the fitting. Turn off the current when the required time has elapsed to heat the joint. Do not disturb the joint until cooled to ambient temperature.

705.5.1.3 Socket-Fusion Joints. Socket fusion joints shall be installed in accordance with ASTM F2620 and shall be made by simultaneously heating the outside surface of a pipe end and the inside of a fitting socket. Where the required melt is obtained, the pipe and fitting shall be joined by inserting one into the other with applied force. Do not disturb the joint until cooled to ambient temperature.

705.6 PVC and PVC Co-Extruded Plastic Pipe and Joining Methods. Joining methods for PVC plastic pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.6.1 through Section 705.6.3.

705.6.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket that complies with ASTM D3212 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.6.2 Solvent Cement Joints. Solvent cement joints for PVC pipe and fittings shall be clean from dirt and moisture. Pipe shall be cut square, and pipe shall be deburred. Where surfaces to be joined are cleaned and free of dirt, moisture, oil, and other foreign material, apply primer purple in color that complies with ASTM F656. Primer shall be applied to the surface of the pipe and fitting is softened. Solvent cement that comply with ASTM D2564 shall be applied to all joint surfaces. Joints shall be made while both the inside socket surface and outside surface of pipe are wet with solvent cement. Hold joint in place and undisturbed for 1 minute after assembly.

705.6.3 Threaded Joints. Threads shall comply with ASME B1.20.1. A minimum of Schedule 80 shall be permitted to be threaded. Molded threads on adapter fittings for the transition to threaded joints shall be permitted. Thread sealant compound that is compatible with the pipe and fitting, insoluble in water and non-toxic shall be applied to male threads. The joint between the pipe and transition fitting shall be of the solvent cement type. Caution shall be used during assembly to prevent overtightening of the PVC components once the thread sealant has been applied. Female PVC threaded fittings shall be used with plastic male threads only.

705.7 Stainless Steel Pipe and Joints. Joining methods for stainless steel pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.7.1 or Section 705.7.2.
705.7.1 Mechanical Joints. Mechanical joints between stainless steel pipe and fittings shall be of the compression, grooved coupling, hydraulic press-connect fittings, or flanged.

705.7.2 Welded Joints. Welded joints between stainless steel pipe and fittings shall be made in accordance with ASME A112.3.1 and shall be welded autogenously. Pipe shall be cleaned, free of scale and contaminating particles. Pipe shall be cut with a combination cutting and beveling tool that provides a square cut, and free of burrs. Mineral oil lubricant shall be used during the cutting and beveling process.

705.8 Vitrified Clay Pipe and Joints. Joining methods for vitrified clay pipe and fittings shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 705.8.1.

705.8.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint type. The push-on joint shall include an elastomeric gasket that complies with ASTM C425 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.9 Special Joints. Special joints shall comply with Section 705.9.1 through Section 705.9.4.

705.9.1 Slip Joints. In fixture drains and traps, slip joints of approved materials shall be permitted to be used in accordance with their approvals.

705.9.2 Expansion Joints. Expansion joints shall be accessible, except where in vent piping or drainage stacks, and shall be permitted to be used where necessary to provide for expansion and contraction of the pipes.

705.9.3 Ground Joint, Flared, or Ferrule Connections. Copper or copper alloy ground joint flared, or ferrule-type connections that allow adjustment of tubing, but provide a rigid joint where made up, shall not be considered as slip joints.

705.9.4 Transition Joint. A solvent cement transition joint between ABS and PVC building drain and building sewer shall be made using listed transition solvent cement in accordance with ASTM D3138.

705.10 Joints Between Various Materials. Joints between various materials shall be installed in accordance with the manufacturer’s installation instructions and with Section 705.10.1 through Section 705.10.4. Mechanical couplings used to join different materials shall comply with ASTM C1173 for beloground use, ASTM C1460 for aboveround use, or ASTM C1461 for abovereound and beloground use.

705.10.1 Copper or Copper Alloy Pipe to Cast-Iron Pipe. Joints from copper or copper alloy pipe or tubing to cast-iron pipe shall be made with a listed compression-type joint or copper alloy ferrule. The copper or copper alloy pipe or tubing shall be soldered or brazed to the ferrule, and the ferrule shall be joined to the cast-iron hub by a compression or caulked joint.

705.10.2 Copper or Copper Alloy Pipe to Threaded Pipe Joints. Joints from copper or copper alloy pipe or tubing to threaded pipe shall be made by the use of a listed copper alloy adapter or dielectric fitting. The joint between the copper or copper alloy pipe and the fitting shall be a soldered or brazed, and the connection between the threaded and the fittings shall be made with a standard pipe size threaded joint.

705.10.3 Plastic Pipe to Other Materials. Where connecting plastic pipe to other types of plastic or other types of piping material; approved listed adapter or transition fittings and listed for the specific transition intended shall be used. Except as provided in Section 705.9.4, PVC and ABS pipe and fittings shall not be solvent welded to any other unlike material.

705.10.4 Stainless Steel Pipe to Other Materials. Where connecting stainless steel pipe to other types of piping, listed mechanical joints of the compression type and listed for the specific transition intended shall be used.

706.0 Changes in Direction of Drainage Flow.

706.1 Approved Fittings. Changes in the direction of drainage piping shall be made by the appropriate use of approved fittings and shall be of the angles presented by a one-sixteenth bend, one-eighth bend, or one-sixth bend, or other approved fittings of equivalent sweep.

706.2 Horizontal to Vertical. Horizontal drainage lines, connecting with a vertical stack, shall enter through 45 degree (0.79 rad) wye branches, 60 degree (1.05 rad) wye branches, combination wye and one-eighth bend branches, sanitary tee or sanitary tapped tee branches, or other approved fittings of equivalent sweep. No fitting having more than one inlet at the same level shall be used unless such fitting is constructed so that the discharge from one inlet cannot readily enter any other inlet. Double sanitary tees shall be permitted to be used where the barrel of the fitting is not less than two pipe sizes larger than the largest inlet, (pipe sizes recognized for this purpose are 2 inches, 2½ inches, 3 inches, 3½ inches, 4 inches, 4½ inches, 5 inches, 6 inches, etc.) (50 mm, 65 mm, 80 mm, 90 mm, 100 mm, 115 mm, 125 mm, 150 mm, etc.).

706.3 Horizontal to Horizontal. Horizontal drainage lines connecting with other horizontal drainage lines shall enter through 45 degree (0.79 rad) wye branches, combination wye and one-eighth bend branches, or other approved fittings of equivalent sweep.

706.4 Vertical to Horizontal. Vertical drainage lines connecting with horizontal drainage lines shall enter through 45 degree (0.79 rad) wye branches, combination wye and one-eighth bend branches, or other approved fittings of equivalent sweep. Branches or offsets of 60 degrees (1.05 rad) shall be permitted to be used where installed in a true vertical position.

707.0 Cleanouts.

707.1 Plug. Each cleanout fitting for cast-iron pipe shall consist of a cast-iron or copper alloy body and an approved plug. Each cleanout for galvanized wrought iron, galvanized steel, copper, or copper alloy pipe shall consist of a plug as specified in Table 707.1, or a standard weight copper alloy cap, or
an approved ABS or PVC plastic plug, or an approved stainless steel cleanout or plug. Plugs shall have raised square heads or approved countersunk rectangular slots.

### TABLE 707.1 CLEANOUTS

<table>
<thead>
<tr>
<th>SIZE OF PIPE (inches)</th>
<th>SIZE OF CLEANOUT (inches)</th>
<th>THREADS (per inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1½</td>
<td>1½</td>
<td>11½</td>
</tr>
<tr>
<td>2</td>
<td>1½</td>
<td>11½</td>
</tr>
<tr>
<td>2½</td>
<td>2½</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>2½</td>
<td>8</td>
</tr>
<tr>
<td>4 &amp; larger</td>
<td>3½</td>
<td>8</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm

### 707.2 Approved

Each cleanout fitting and each cleanout plug or cap shall be of an approved type. A list of approved standards for cleanouts are referenced in Table 707.2.

### TABLE 707.2 CLEANOUT MATERIALS FOR DRAIN, WASTE, AND VENT

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>ASTM D2661, CSA B79, IAPMO IGC 78, IAPMO IGC 224</td>
</tr>
<tr>
<td>Cast Iron</td>
<td>ASME A112.36.2M, ASTM A888, CISPI 301, CSA B79, IAPMO IGC 224</td>
</tr>
<tr>
<td>Copper or Copper Alloy</td>
<td>ASME A112.36.2M, CSA B79</td>
</tr>
<tr>
<td>Ductile Iron</td>
<td>CSA B79</td>
</tr>
<tr>
<td>Elastomers</td>
<td>CSA B79, IAPMO PS 90</td>
</tr>
<tr>
<td>Polyethylene (PE)</td>
<td>CSA B79</td>
</tr>
<tr>
<td>Polypropylene (PP)</td>
<td>CSA B79</td>
</tr>
<tr>
<td>PVC</td>
<td>ASTM D2665, CSA B79, IAPMO IGC 78, IAPMO IGC 224</td>
</tr>
<tr>
<td>Polyvinylidene Fluoride (PVDF)</td>
<td>CSA B79</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>CSA B79</td>
</tr>
</tbody>
</table>

### 707.3 Watertight and Gastight

Cleanouts shall be designed to be watertight and gastight.

### 707.4 Location

Each horizontal drainage pipe shall be provided with a cleanout at its upper terminal, and each run of piping, that is more than 100 feet (30 480 mm) in total developed length, shall be provided with a cleanout for each 100 feet (30 480 mm), or fraction thereof, in length of such piping. An additional cleanout shall be provided in a drainage line for each aggregate horizontal change in direction exceeding 135 degrees (2.36 rad). A cleanout shall be installed above the fixture connection fitting, serving each urinal, regardless of the location of the urinal in the building.

### Exceptions

1. Cleanouts shall be permitted to be omitted on a horizontal drain line less than 5 feet (1524 mm) in length unless such line is serving sinks or urinals.

2. Cleanouts shall be permitted to be omitted on a horizontal drainage pipe installed on a slope of 72 degrees (1.26 rad) or less from the vertical angle (one-fifth bend).

3. Excepting the building drain, its horizontal branches, kitchen sinks, and urinals, a cleanout shall not be required on a pipe or piping that is above the floor level of the lowest floor of the building.

4. An approved type of two-way cleanout fitting, installed inside the building wall near the connection between the building drain and the building sewer or installed outside of a building at the lower end of a building drain and extended to grade, shall be permitted to be substituted for an upper terminal cleanout.

### 707.4.1 Load Rated Cover

Cleanout floor covers and top rims meant to take loads shall be rated for the loading in accordance with ASME A112.36.2M.

### 707.5 Cleaning

Each cleanout shall be installed so that it opens to allow cleaning in the direction of flow of the soil or waste or at right angles thereto and, except in the case of wye branch and end-of-line cleanouts, shall be installed vertically above the flow line of the pipe.

### 707.6 Extension

Each cleanout extension shall be considered as drainage piping and each 90 degree (1.57 rad) cleanout extension shall be extended from a wye-type fitting or other approved fitting of equivalent sweep.

### 707.7 Interceptor

Each cleanout for an interceptor shall be outside of such interceptor.

### 707.8 Access

Each cleanout, unless installed under an approved cover plate, shall be above grade, readily accessible, and so located as to serve the purpose for which it is intended. Cleanouts located under cover plates shall be so installed as to provide the clearances and accessibility required by this section.

### 707.9 Clearance

Each cleanout in piping 2 inches (50 mm) or less in size shall be so installed that there is a clearance of not less than 18 inches (457 mm) by 18 inches (457 mm) in front of the cleanout. Cleanouts in piping, that is more than 2 inches (50 mm) shall have a clearance of not less than 24 inches (610 mm) by 24 inches (610 mm) in front of the cleanout. Cleanouts in under-floor piping shall be extended to or above the finished floor or shall be extended outside the building where there is less than 18 inches (457 mm) vertical overall, allowing for obstructions such as ducts, beams, and piping, and 30 inches of (762 mm) horizontal clearance from the means of access to such cleanout. No under-floor cleanout shall be located exceeding 5 feet (1524 mm) from an access door, trap door, or crawl hole.

### 707.10 Fittings

Cleanout fittings shall be not less in size than those given in Table 707.1.

### 707.11 Pressure Drainage Systems

Cleanouts shall be provided for pressure drainage systems as classified under Section 710.7.

### 707.12 Countersunk Cleanout Plugs

Countersunk cleanout plugs shall be installed where raised heads cause a hazard.
707.13 Hubless Blind Plugs. Where a hubless blind plug is used for a required cleanout, the complete coupling and plug shall be accessible for removal or replacement.

707.14 Trap Arms. Cleanouts for trap arms shall be installed in accordance with Section 1002.3.

708.0 Grade of Horizontal Drainage Piping.

708.1 General. Horizontal drainage piping shall be run in practical alignment and a uniform slope of not less than $\frac{1}{16}$ inch per foot (20.8 mm/m) or 2 percent toward the point of disposal provided that, where it is impractical due to the depth of the street sewer, to the structural features, or to the arrangement of a building or structure to obtain a slope of $\frac{1}{4}$ inch per foot (20.8 mm/m) or 2 percent, such pipe or piping 4 inches (100 mm) or larger in diameter shall be permitted to have a slope of not less than $\frac{1}{8}$ inch per foot (10.4 mm/m) or 1 percent, where first approved by the Authority Having Jurisdiction.

709.0 Gravity Drainage Required.

709.1 General. Where practicable, plumbing fixtures shall be drained to the public sewer or private sewage disposal system by gravity.

710.0 Drainage of Fixtures Located Below the Next Upstream Manhole or Below the Main Sewer Level.

710.1 Backflow Protection. Fixtures installed on a floor level that is lower than the next upstream manhole cover of the public, or private sewer shall be protected from backflow of sewage by installing an approved type of backwater valve. Fixtures on such floor level that are not below the next upstream manhole cover shall not be required to be protected by a backwater valve. Fixtures on floor levels above such elevation shall not discharge through the backwater valve. Cleanouts for drains that pass through a backwater valve shall be clearly identified with a permanent label stating “backwater valve downstream.”

710.2 Sewage Discharge. Drainage piping serving fixtures that are located below the crown level of the main sewer shall discharge into an approved watertight sump or receiving tank, so located as to receive the sewage or wastes by gravity. From such sump or receiving tank, the sewage or other liquid wastes shall be lifted and discharged into the building drain or building sewer by approved ejectors, pumps, or other equally efficient approved mechanical devices.

710.3 Sewage Ejector and Pumps. A sewage ejector or sewage pump receiving the discharge of water closets or urinals:

1. Shall have a discharge capacity of not less than 20 gpm (1.26 L/s).
2. In single dwelling units, the ejector or pump shall be capable of passing an 1 1/2 inch (38 mm) diameter solid ball, and the discharge piping of each ejector or pump shall have a backwater valve and gate valve, and be not less than 2 inches (50 mm) in diameter.
3. In other than single-dwelling units, the ejector or pump shall be capable of passing a 2 inch (51 mm) diameter solid ball, and the discharge piping of each ejector or pump shall have a backwater valve and gate valve, and be not less than 3 inches (80 mm) in diameter.

710.4 Discharge Line. The discharge line from such ejector, pump, or another mechanical device shall be of approved pressure rated material and be provided with an accessible backwater or swing check valve and gate or ball valve. Where the gravity drainage line to which such discharge line connects is horizontal, the method of connection shall be from the top through a wye branch fitting. The gate or ball valve shall be located on the discharge side of the backwater or check valve.

Gate or ball valves, where installed in drainage piping, shall be fullway type with working parts of corrosion-resistant metal. Sizes 4 inches (100 mm) or more in diameter shall have cast-iron bodies and sizes less than 4 inches (100 mm), cast-iron or copper alloy bodies.

710.5 Size of Building Drains and Sewers. Building drains or building sewers receiving a discharge from a pump or ejector shall be adequately sized to prevent overloading. Two fixture units shall be allowed for each gallon per minute (L/s) of flow.

710.6 Backwater Valves. Backwater valves, gate valves, fullway ball valves, unions, motors, compressors, air tanks, and other mechanical devices required by this section shall be located where they will be accessible for inspection and repair and, unless continuously exposed, shall be enclosed in a masonry pit fitted with an adequately sized removable cover.

Backwater valves shall comply with ASME A112.14.1 or IAPMO IGC 305, and have bodies of cast-iron, plastic, copper alloy, or other approved materials; shall have noncorrosive bearings, seats, and self-aligning discs; and shall be constructed to ensure a positive mechanical seal. Such backwater valves shall remain open during periods of low flows to avoid screening of solids and shall not restrict capacities or cause excessive turbulence during peak loads. Unless otherwise listed, valve access covers shall be bolted type with gasket, and each valve shall bear the manufacturer’s name cast into the body and the cover.

710.7 Drainage and Venting Systems. The drainage and venting systems, in connection with fixtures, sumps, receiving tanks, and mechanical waste-lifting devices shall be installed under the same requirements as provided for in this code for gravity systems.

710.8 Sump and Receiving Tank Construction. Sumps and receiving tanks shall be watertight and shall be constructed of concrete, metal, or other approved materials. Where constructed of poured concrete, the walls and bottom shall be adequately reinforced and designed to recognized acceptable standards. Metal sumps or tanks shall be of such thickness as to serve their intended purpose and shall be treated internally and externally to resist corrosion.

710.9 Alarm. Such sumps and receiving tanks shall be automatically discharged and, wherein a “public use” occupancy,
shall be provided with dual pumps or ejectors arranged to function alternately in normal use and independently. Such pumps shall be capable of running continuously in case of overload or mechanical failure of one of the pumps or ejectors. The pumps shall have an audio and visual alarm, readily accessible, that signals pump failure or an overload condition. The lowest inlet shall have a clearance of not less than 2 inches (51 mm) from the high-water or “starting” level of the sump.

710.10 Sump and Receiving Tank Covers and Vents. Sumps and receiving tanks shall be provided with substantial covers having a bolt-and-gasket-type manhole or equivalent opening to permit access for inspection, repairs, and cleaning. The top shall be provided with a vent pipe that shall extend separately through the roof or, where permitted, be combined with other vent pipes. Such vent shall be large enough to maintain atmospheric pressure within the sump under normal operating conditions and, in no case, shall be less in size than that required by Table 703.2 for the number and type of fixtures discharging into the sump, nor less than 1½ inches (40 mm) in diameter. Where the preceding requirements are met and the vent, after leaving the sump, is combined with vents from fixtures discharging into the sump, the size of the combined vent need not exceed that required for the total number of fixtures discharging into the sump. No vent from an air-operating sewage ejector shall combine with other vents.

710.11 Air Tanks. Air tanks shall be so proportioned as to be of equal cubical capacity to the ejectors connected in addition to that in which there shall be maintained an air pressure of not less than 2 pounds per foot (lb/ft) (3 kg/m) of height the sewage is to be raised. No water-operated ejectors shall be permitted.

710.12 Grinder Pump Ejector. Grinder pumps shall be permitted to be used.

710.12.1 Discharge Piping. The discharge piping shall be sized in accordance with the manufacturer’s installation instructions and shall be not less than 1½ inches (32 mm) in diameter. A check valve and fullway-type shutoff valve shall be located on the discharge line.

710.13 Macerating Toilet Systems and Pumped Waste Systems. Fixtures shall be permitted to discharge to a macerating toilet system, or pumped waste system shall be permitted as an alternate to a sewage pump system where approved by the Authority Having Jurisdiction. Such systems shall comply with ASME A112.3.4/CSA B45.9 and shall be installed in accordance with the manufacturer’s installation instructions.

710.13.1 Sumps. The sump shall be watertight and gastight.

710.13.2 Discharge Piping. The discharge piping shall be sized in accordance with manufacturer’s instructions and shall be not less than ¾ of an inch (20 mm) in diameter. The developed length of the discharge piping shall not exceed the manufacturer’s instructions. A check valve and fullway-type shutoff valve shall be located within the discharge line or internally within the device.

710.13.3 Venting. The plumbing fixtures that discharge into the macerating device shall be vented in accordance with this code. The sump shall be vented in accordance with the manufacturer’s instructions, and such vent shall be permitted to connect to the fixture venting.

711.0 Suds Relief.

711.1 General. Drainage connections shall not be made into a drainage piping system within 8 feet (2438 mm) of a vertical to horizontal change of direction of a stack containing suds-producing fixtures. Bathtubs, laundries, washing machine standpipes, kitchen sinks, and dishwashers shall be considered suds-producing fixtures. Where parallel vent stacks are required, they shall connect to the drainage stack at a point 8 feet (2438 mm) above the lowest point of the drainage stack.

Exceptions:
2. Stacks receiving the discharge from less than three stories of plumbing fixtures.

712.0 Testing.

712.1 Media. The piping of the plumbing, drainage, and venting systems shall be tested with water or air except that plastic pipe shall not be tested with air. The Authority Having Jurisdiction shall be permitted to require the removal of cleanouts, etc., to ascertain whether the pressure has reached all parts of the system. After the plumbing fixtures have been set and their traps filled with water, they shall be submitted to a final test.

712.2 Water Test. The water test shall be applied to the drainage and vent systems either in its entirety or in sections. Where the test is applied to the entire system, openings in the piping shall be tightly closed, except the highest opening, and the system filled with water to the point of overflow. Where the system is tested in sections, each opening shall be tightly plugged, except the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10 foot head of water (30 kPa). In testing successive sections, not less than the upper 10 feet (3048 mm) of the next preceding section shall be tested, so that no joint or pipe in the building (except the uppermost 10 feet (3048 mm) of the system) shall have been submitted to a test of less than a 10 foot head of water (30 kPa). The water shall be kept in the system, or in the portion under test, for not less than 15 minutes before inspection starts. The system shall then be tight at all points.

712.3 Air Test. The air test shall be made by attaching an air compressor testing apparatus to a suitable opening and, after closing all other inlets and outlets to the system, forcing air into the system until there is a uniform gauge pressure of 5 pounds-force per square inch (psi) (34 kPa) or sufficient to
Part II – Building Sewers.

713.0 Sewer Required.

713.1 Where Required. A building in which plumbing fixtures are installed and premises having drainage piping thereon shall have a connection to a public or private sewer, except as provided in Section 713.2, and Section 713.4.

713.2 Private Sewage Disposal System. Where no public sewer intended to serve a lot or premises is available in a thoroughfare or right of way abutting such lot or premises, drainage piping from a building or works shall be connected to an approved private sewage disposal system as approved by the Authority Having Jurisdiction. See Appendix H.

713.3 Public Sewer. Within the limits prescribed by Section 713.4 hereof, the rearrangement or subdivision into smaller parcels of a lot that abuts and is served by a public sewer shall not be deemed cause to permit the construction of a private sewage disposal system, and plumbing or drainage systems on a smaller parcel or parcels shall connect to the public sewer.

713.4 Public Sewer Availability. The public sewer shall be permitted to be considered as not being available where such public sewer or a building or an exterior drainage facility connected thereto is located more than 200 feet (60 960 mm) from a proposed building or exterior drainage facility on a lot or premises that abut and is served by such public sewer.

713.5 Permit. No permit shall be issued for the installation, alteration, or repair of a private sewage disposal system, or part thereof, on a lot for which a connection with a public sewer is available.

713.6 Lot. On every lot or premises hereafter connected to a public sewer, plumbing, and drainage systems or parts thereof on such lot or premises shall be connected with such public sewer.

713.7 Installation. In cities, counties, or both where the installation of building sewers is under the jurisdiction of a department other than the Authority Having Jurisdiction, the provisions of this code relating to building sewers need not apply.

Exception: Single-family dwellings and buildings or structures accessory thereto, existing and connected to an approved private sewage disposal system prior to the time of connecting the premises to the public sewer shall be permitted, where no hazard, nuisance, or insanitary condition is evidenced, and written permission has been obtained from the Authority Having Jurisdiction, remain connected to such properly maintained private sewage disposal system where there is insufficient grade or fall to permit drainage to the sewer by gravity.

714.0 Damage to Public Sewer or Private Sewage Disposal System.

714.1 Unlawful Practices. It shall be unlawful for a person to deposit, by means whatsoever, into a plumbing fixture, floor drain, interceptor, sump, receptor, or device which is connected to a drainage system, public sewer, private sewer, septic tank, or cesspool, ashes; cinders; solids; rags; flammable, poisonous, or explosive liquids or gases; oils; grease; and whatsoever that is capable of causing damage to the public sewer, private sewer, or private sewage disposal system.

714.2 Prohibited Water Discharge. No rain, surface, or subsurface water shall be connected to or discharged into a drainage system unless first approved by the Authority Having Jurisdiction.

714.3 Prohibited Sewer Connection. No cesspool, septic tank, seepage pit, or drain field shall be connected to a public sewer or to a building sewer leading to such public sewer.

714.4 Commercial Food Waste Disposer. The Authority Having Jurisdiction shall review before approval, the installation of a commercial food waste disposer connecting to a private sewage disposal system.

714.5 Tanks. An approved type, watertight sewage or wastewater holding tank, the contents of which, due to their character, shall be periodically removed and disposed of at some approved off-site location, shall be installed where required by the Authority Having Jurisdiction or the Health Officer to prevent anticipated surface or subsurface contamination or pollution, damage to the public sewer, or other hazardous or nuisance conditions.

715.0 Building Sewer Materials.

715.1 Materials. The building sewer, beginning 2 feet (610 mm) from a building or structure, shall be of such materials as prescribed in this code.

715.2 Joining Methods and Materials. Joining methods and materials shall be as prescribed in this code.

715.3 Existing Sewers. Where permitted by the Authority Having Jurisdiction, trenchless methods of rehabilitation of existing building sewer and building storm sewers using trenchless methodology and materials shall be installed in accordance with the ASTM F1216, ASTM F2561, ASTM F2599, or ASTM F3240, following:

715.3.1 Sewer Pipe Lining. For trenchless installation of resin-impregnated flexible tubing to line existing building sewers and building storm sewers see the applicable standards listed in Table 1701.2.

715.3.2 Sewer Pipe Replacement. For trenchless installation of polyethylene (PE) pipe using the pipe bursting method to replace existing building sewers and building storm sewers see the applicable standards listed in Table 1701.2.

716.0 Markings.

716.1 General. Pipe, brick, block, prefabricated septic tanks, prefabricated septic tank or seepage pit covers, or other parts
or appurtenances incidental to the installation of building sewers or private sewage disposal systems shall be in accordance with the approval requirements of Chapter 3 of this code.

**717.0 Size of Building Sewers.**

**717.1 General.** The minimum size of a building sewer shall be determined on the basis of the total number of fixture units drained by such sewer, in accordance with Table 717.1. No building sewer shall be smaller than the building drain.

For alternate methods of sizing building sewers, see Appendix C.

### TABLE 717.1

<table>
<thead>
<tr>
<th>SIZE OF PIPE (inches)</th>
<th>SLOPE (inches per foot)</th>
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</thead>
<tbody>
<tr>
<td>6 and smaller</td>
<td>(As specified in Table 703.2/No minimum loading)</td>
</tr>
<tr>
<td>8</td>
<td>1950/1500</td>
</tr>
<tr>
<td></td>
<td>2800/2625</td>
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<tr>
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<td>3900/275</td>
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<td>3400/1600</td>
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<td>6800/300</td>
</tr>
<tr>
<td>12</td>
<td>5600/1700</td>
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<tr>
<td></td>
<td>8000/275</td>
</tr>
<tr>
<td></td>
<td>11 200/325</td>
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</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 inch per foot = 83.3 mm/m

* See also Appendix H, Private Sewage Disposal Systems. For alternate methods of sizing drainage piping, see Appendix C.

**718.0 Grade, Support, and Protection of Building Sewers.**

**718.1 Slope.** Building sewers shall be run in practical alignment and at a uniform slope of not less than 1/8 inch per foot (20.8 mm/m) toward the point of disposal.

**Exception:** Where approved by the Authority Having Jurisdiction and where it is impractical, due to the depth of the street sewer, or to the structural features or the arrangement of a building or structure, to obtain a slope of 1/8 inch per foot (20.8 mm/m), such pipe or piping 4 inches (100 mm) through 6 inches (150 mm) shall be permitted to have a slope of not less than 1/16 inch per foot (10.4 mm/m) and such piping 8 inches (200 mm) and larger shall be permitted to have a slope of not less than 1/32 inch per foot (5.2 mm/m). The maximum and minimum fixture unit loading shall be in accordance with Table 717.1.

**718.2 Support.** Building sewer piping shall be laid on a firm bed throughout its entire length, and such piping laid in made or filled-in ground shall be laid on a bed of approved materials and shall be properly supported as required by the Authority Having Jurisdiction.

**718.3 Protection from Damage.** No building sewer or other drainage piping or part thereof, which is constructed of materials other than those approved for use under or within a building, shall be installed under or within 2 feet (610 mm) of a building or structure, or part thereof, nor less than 1 foot (305 mm) below the surface of the ground. The provisions of this subsection include structures such as porches and steps, whether covered or uncovered; breezeways; roofed porte cochere; roofed patios; carports; covered walks; covered driveways; and similar structures or appurtenances.

**719.0 Cleanouts.**

**719.1 Locations.** Cleanouts shall be placed inside the building near the connection between the building drain and the building sewer or installed outside the building at the lower end of the building drain and extended to grade.

Additional building sewer cleanouts shall be installed at intervals not to exceed 100 feet (30 480 mm) in straight runs and for each aggregate horizontal change in direction exceeding 135 degrees (2.36 rad).

**719.2 No Additional Cleanouts.** Where a building sewer or a branch thereof does not exceed 10 feet (3048 mm) in length and is a straight-line projection from a building drain that is provided with a cleanout, no cleanout will be required at its point of connection to the building drain.

**719.3 Building Sewer Cleanouts.** Required building sewer cleanouts shall be extended to grade and shall be in accordance with the appropriate sections of cleanouts, Section 707.0, for sizing, construction, and materials. Where building sewers are located under buildings, the cleanout requirements of Section 707.0 shall apply.

**719.4 Cleaning.** Each cleanout shall be installed so that it opens to allow cleaning in the direction of flow of the soil or waste or at right angles thereto and, except in the case of wye branch and end-of-line cleanouts, shall be installed vertically above the flow line of the pipe.

**719.5 Access.** Cleanouts installed under concrete or asphalt paving shall be made accessible by yard boxes or by extending flush with paving with approved materials and shall be adequately protected.

**719.6 Manholes.** Approved manholes shall be permitted to be installed in lieu of cleanouts, where first approved by the Authority Having Jurisdiction. The maximum distance between manholes shall not exceed 300 feet (91 440 mm).

The inlet and outlet connections shall be made by the use of a flexible compression joint not less than 12 inches (305 mm) and not exceeding 3 feet (914 mm) from the manhole. No flexible compression joints shall be embedded in the manhole base.

**720.0 Sewer and Water Pipes.**

**720.1 General.** Building sewers or drainage piping of clay or materials that are not approved for use within a building shall not be run or laid in the same trench as the water pipes unless the following requirements are met:

1. The bottom of the water pipe, at 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.
(3) 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.

For the purpose of this section, “within a building” shall mean within the fixed limits of the building foundation.

721.0 Location.
721.1 Building Sewer. Except as provided in Section 721.2, no building sewer shall be located in a lot other than the lot that is the site of the building or structure served by such sewer nor shall a building sewer be located at a point having less than the minimum distances referenced in Table 721.1.

<table>
<thead>
<tr>
<th>Buildings or structures¹</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property line adjoining private property</td>
<td>Clear²</td>
</tr>
<tr>
<td>Water supply wells</td>
<td>50³</td>
</tr>
<tr>
<td>Streams</td>
<td>50</td>
</tr>
<tr>
<td>On-site domestic water service line</td>
<td>1⁴</td>
</tr>
<tr>
<td>Public water main</td>
<td>10⁵,⁶</td>
</tr>
</tbody>
</table>

For SI units: 1 foot = 304.8 mm

Notes:
¹ Including porches and steps, whether covered or uncovered; breezeways; roofed porte-cochere; roofed patios; carports; covered walks; covered driveways; and similar structures or appurtenances.
² See also Section 312.3.
³ Drainage piping shall clear domestic water supply wells by not less than 50 feet (15 240 mm). This distance shall be permitted to be reduced to not less than 25 feet (7620 mm) where the drainage piping is constructed of materials approved for use within a building.
⁴ See Section 720.0.
⁵ For parallel construction.
⁶ For crossings, approval by the Health Department or the Authority Having Jurisdiction shall be required.

721.2 Abutting Lot. Nothing contained in this code shall be construed to prohibit the use of all or part of an abutting lot to:

1. Provide access to connect a building sewer to an available public sewer where proper cause and legal easement, not in violation of other requirements, has been first established to the satisfaction of the Authority Having Jurisdiction.

2. Provide additional space for a building sewer where the proper cause, transfer of ownership, or change of boundary, not in violation of other requirements, has been first established to the satisfaction of the Authority Having Jurisdiction. The instrument recording such action shall constitute an agreement with the Authority Having Jurisdiction and shall clearly state and show that the areas so joined or used shall be maintained as a unit during the time they are so used. Such an agreement shall be recorded in the office of the County Recorder as part of the conditions of ownership of said properties, and shall be binding on heirs, successors, and assigns to such properties. A copy of the instrument recording such proceedings shall be filed with the Authority Having Jurisdiction.

722.0 Abandoned Sewers and Sewage Disposal Facilities.
722.1 Building (House) Sewer. An abandoned building (house) sewer, or part thereof, shall be plugged or capped in an approved manner within 5 feet (1524 mm) of the property line.

722.2 Cesspools, Septic Tanks, and Seepage Pits. A cesspool, septic tank, and seepage pit that has been abandoned or has been discontinued otherwise from further use, or to which no waste or soil pipe from a plumbing fixture is connected, shall have the sewage removed therefrom and be completely filled with earth, sand, gravel, concrete, or other approved material.

722.3 Filling. The top cover or arch over the cesspool, septic tank, or seepage pit shall be removed before filling, and the filling shall not extend above the top of the vertical portions of the sidewalls or above the level of the outlet pipe until inspection has been called and the cesspool, septic tank, or seepage pit has been inspected. After such inspection, the cesspool, septic tank, or seepage pit shall be filled to the level of the top of the ground.

722.4 Ownership. No person owning or controlling a cesspool, septic tank, or seepage pit on the premises of such person or in that portion of a public street, alley, or other public property abutting such premises, shall fail, refuse, or neglect to comply with the provisions of this section or upon receipt of notice so to comply from the Authority Having Jurisdiction.

722.5 Disposal Facilities. Where disposal facilities are abandoned consequent to connecting premises with the public sewer, the permittee making the connection shall fill abandoned facilities in accordance with the Authority Having Jurisdiction within 30 days from the time of connecting to the public sewer.

723.0 Building Sewer Test.
723.1 General. Building sewers shall be tested by plugging the end of the building sewer at its points of connection to the public sewer or private sewage disposal system and completely filling the building sewer with water from the lowest to the highest point thereof, or by approved equivalent low-pressure air test. Plastic DWV piping systems shall not be tested by the air test method. The building sewer shall be watertight.
CHAPTER 8
INDIRECT WASTES

801.0 General.
801.1 Applicability. This chapter shall govern the materials, design, and installation of indirect waste piping, receptors, and connections; and provisions for discharge and disposal of condensate wastes, chemical wastes, industrial wastes, and clear water wastes.

801.2 Air Gap or Air Break Required. Indirect waste piping shall discharge into the building drainage system through an air gap or air break as set forth in this code. Where a drainage air gap is required by this code, the minimum vertical distance as measured from the lowest point of the indirect waste pipe or the fixture outlet to the flood-level rim of the receptor shall be not less than 1 inch (25.4 mm).

801.3 Food and Beverage Handling Establishments. Establishments engaged in the storage, preparation, selling, serving, processing, or other handling of food and beverage involving the following equipment that requires drainage shall provide indirect waste piping for refrigerators, refrigeration coils, freezers, walk-in coolers, iceboxes, ice-making machines, steam tables, egg boilers, coffee urns and burners, hot-and-cold drink dispensers, and similar equipment.

801.3.1 Size of Indirect Waste Pipes. Except for refrigeration coils and ice-making machines, the size of the indirect waste pipe shall be not smaller than the drain on the unit, but shall be not smaller than 1 inch (25 mm), and the maximum developed length shall not exceed 15 feet (4572 mm). Indirect waste pipe for ice-making machines shall be not less than the drain on the unit and in no case less than ½ of an inch (20 mm).

801.3.2 Walk-In Coolers. For walk-in coolers, floor drains shall be permitted to be connected to a separate drainage line discharging into an outside receptor. The flood-level rim of the receptor shall be not less than 6 inches (152 mm) lower than the lowest floor drain. Such floor drains shall be trapped and individually vented. Cleanouts shall be provided at 90 degree (1.57 rad) turns and shall be accessibly located. Such waste shall discharge through an air gap or air break into a trapped and vented receptor, except that a full-size air gap is required where the indirect waste pipe is under vacuum.

801.3.3 Food-Handling Fixtures. Food-preparation sinks, steam kettles, potato peelers, ice cream dipper wells, and similar equipment shall be indirectly connected to the drainage system by means of an air gap. Bins, sinks, and other equipment having drainage connections and used for the storage of unpackaged ice used for human ingestion, or used in direct contact with ready-to-eat food, shall be indirectly connected to the drainage system by means of an air gap. Each indirect waste pipe from food-handling fixtures or equipment shall be separately piped to the indirect waste receptor and shall not combine with other indirect waste pipes. The piping from the equipment to the receptor shall be not less than the drain on the unit and in no case less than ½ of an inch (15 mm).

801.4 Bar and Fountain Sink Traps. Where the sink in a bar, soda fountain, or counter is so located that the trap serving the sink cannot be vented, the sink drain shall discharge through an air gap or air break (see Section 801.3.3) into an approved receptor that is vented. The developed length from the fixture outlet to the receptor shall not exceed 5 feet (1524 mm).

801.5 Connections from Water Distribution System. Indirect waste connections shall be provided for drains, overflows, or relief pipes from potable water pressure tanks, water heaters, boilers, and similar equipment that is connected to the potable water distribution system. Such indirect waste connections shall be made using a water-distribution air gap constructed in accordance with Table 603.3.1.

801.6 Sterilizers. Lines, devices, or apparatus such as stills, sterilizers, and similar equipment requiring waste connections and used for sterile materials shall be indirectly connected using an air gap. Each such indirect waste pipe shall be separately piped to the receptor and shall not exceed 15 feet (4572 mm). Such receptors shall be located in the same room.

801.7 Drip or Drainage Outlets. Appliances, devices, or apparatus not regularly classified as plumbing fixtures, but which have a drip or drainage outlets, shall be permitted to be drained by indirect waste pipes discharging into an open receptor through either an air gap or air break (see Section 801.3.1).

802.0 Approvals.
802.1 General. No plumbing fixtures served by indirect waste pipes or receiving discharge therefrom shall be installed until first approved by the Authority Having Jurisdiction.

803.0 Indirect Waste Piping.
803.1 Materials. Pipe, tube, and fittings conveying indirect waste shall be of such materials and design as to perform their intended function to the satisfaction of the Authority Having Jurisdiction.

803.2 Copper and Copper Alloys. Joints and connections in copper and copper alloy pipe and tube shall be installed in accordance with Section 705.3.

803.3 Pipe Size and Length. Except as hereinafter provided, the size of indirect waste piping shall be in accordance with other sections of this code applicable to drainage and vent piping. No vent from indirect waste piping shall combine with a sewer-connected vent. Vents from indirect waste piping shall extend separately to the outside air. Indirect waste pipes exceeding 5 feet (1524 mm), but less than 15 feet (4572 mm) in length shall be directly trapped, but such traps need not be vented.

Indirect waste pipes less than 15 feet (4572 mm) in length shall be not less than the diameter of the drain outlet or
tailpiece of the fixture, appliance, or equipment served, and in no case less than ⅜ of an inch (15 mm). Angles and changes of direction in such indirect waste pipes shall be provided with cleanouts to permit flushing and cleaning.

804.0 Indirect Waste Receptors.

804.1 Standpipe Receptors. Plumbing fixtures or other receptors receiving the discharge of indirect waste pipes shall be approved for the use proposed and shall be of such shape and capacity as to prevent splashing or flooding and shall be located where they are readily accessible for inspection and cleaning. No standpipe receptor for a clothes washer shall extend more than 30 inches (762 mm), or not less than 18 inches (457 mm) above its trap weir. No trap for a clothes washer standpipe receptor shall be installed below the floor, but shall be roughed in not less than 6 inches (152 mm) and not more than 18 inches (457 mm) above the floor. No indirect waste receptor shall be installed in a toilet room, closet, cupboard, or storeroom, or in a portion of a building not in general use by the occupants thereof; except standpipes for clothes washers shall be permitted to be installed in toilet and bathroom areas where the clothes washer is installed in the same room.

805.0 Pressure Drainage Connections.

805.1 General. Indirect waste connections shall be provided for drains, overflows, or relief vents from the water supply system, and no piping or equipment carrying wastes or producing wastes or other discharges under pressure shall be directly connected to a part of the drainage system.

The preceding shall not apply to an approved sump pump or to an approved pressure-wasting plumbing fixture or device where the Authority Having Jurisdiction has been satisfied that the drainage system is adequately sized to accommodate the anticipated discharge thereof.

806.0 Sterile Equipment.

806.1 General. Appliances, devices, or apparatus such as stills, sterilizers, and similar equipment requiring water and waste and used for sterile materials shall be drained through an air gap.

807.0 Appliances.

807.1 Non-Classed Apparatus. Commercial dishwashing machines, silverware washing machines, and other appliances, devices, equipment, or other apparatus not regularly classed as plumbing fixtures, which are equipped with pumps, drips, or drainage outlets, shall be permitted to be drained by indirect waste pipes discharging through an air break into an approved type of open receptor.

807.2 Undiluted Condensate Waste. Where undiluted condensate waste from a fuel-burning condensing appliance is discharged into the drainage system, the material in the drainage system shall be cast-iron, galvanized iron, plastic, or other materials approved for this use.

Exceptions:

(1) Where the above condensate is discharged to an exposed fixture tailpiece and trap, such tailpiece and trap shall be permitted to be a copper alloy.

(2) Materials approved in Section 701.0 shall be permitted to be used where data is provided that the condensate waste is adequately diluted.

807.3 Domestic Dishwashing Machine. No domestic dishwashing machine shall be directly connected to a drainage system or food waste disposer without the use of an approved dishwasher air gap fitting on the discharge side of the dishwashing machine. Listed dishwasher air gap fittings shall be installed with the flood-level (FL) marking at or above the flood level of the sink or drainboard, whichever is higher.

808.0 Cooling Water.

808.1 General. Where permitted by the Authority Having Jurisdiction, clean running water used exclusively as a cooling medium in an appliance, device, or apparatus shall be permitted to discharge into the drainage system through the inlet side of a fixture trap in the event that a suitable fixture is not available to receive such discharge. Such trap connection shall be by means of a pipe connected to the inlet side of an approved fixture trap, the upper end terminating in a funnel-shaped receptacle set adjacent, and not less than 6 inches (152 mm) above the overflow rim of the fixture.

809.0 Drinking Fountains.

809.1 General. Drinking fountains shall be permitted to be installed with indirect wastes through an air break.

810.0 Steam and Hot Water Drainage Condensers and Sumps.

810.1 High-Temperature Discharge. No steam pipe shall be directly connected to plumbing or drainage system, nor shall water having a temperature above 140°F (60°C) be discharged under pressure directly into a drainage system. Pipes from boilers shall discharge by means of indirect waste piping as determined by the Authority Having Jurisdiction or the boiler manufacturer’s recommendations. Such pipes shall be permitted to be indirectly connected by discharging into an open or closed condenser or an intercepting sump of an approved type that will prevent the entrance of steam or such water under pressure into the drainage system. Closed condensers or sumps shall be provided with a vent that shall be taken off the top and extended separately, full size above the roof. Condensers and sumps shall be properly trapped at the outlet with a deep seal trap extending to within 6 inches (152 mm) of the bottom of the tank. The top of the deep seal trap shall have a ¼ of an inch (19.1 mm) opening located at the highest point of the trap to serve as a siphon breaker. Outlets shall be taken off from the side in such a manner as to allow a waterline to be maintained that will permanently occupy not less than one-half the capacity of the condenser or sump. Inlets shall enter above the waterline. Wearing plates or baf-
fles shall be installed in the tank to protect the shell. The sizes of the blowoff line inlet, the water outlets, and the vent shall be as shown in Table 810.1. The contents of condensers receiving steam or hot water under pressure shall pass through an open sump before entering the drainage system.

<p>| TABLE 810.1 |
| PIPE CONNECTIONS IN BLOWOFF CONDENSERS AND SUMPS |
| (inches) |</p>
<table>
<thead>
<tr>
<th>BOILER BLOWOFF</th>
<th>WATER OUTLET</th>
<th>VENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>½*</td>
<td>½*</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2½</td>
</tr>
<tr>
<td>1¼</td>
<td>1¼</td>
<td>3</td>
</tr>
<tr>
<td>1½</td>
<td>1½</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>2½</td>
<td>2½</td>
<td>6</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm
* To be used only with boilers of 100 square feet (9.29 m²) of heating surface or less.

810.2 Sumps, Condensers, and Intercepting Tanks. Sumps, condensers, or intercepting tanks that are constructed of concrete shall have walls and bottom, not less than 4 inches (102 mm) in thickness, and the inside shall be cement plastered not less than ½ of an inch (12.7 mm) in thickness. Condensers constructed of metal shall be not less than No. 12 U.S. standard gauge (0.109 inch) (2.77 mm), and such metal condensers shall be protected from external corrosion by an approved bituminous coating.

810.3 Cleaning. Sumps and condensers shall be provided with suitable means of access for cleaning and shall contain a volume of not less than twice the volume of water removed from the boiler or boilers connected to it where the normal water level of such boiler or boilers is reduced not less than 4 inches (102 mm).

810.4 Strainers. An indirect waste interceptor is receiving discharge-containing particles that would clog the receptor drain shall have a readily removable beehive strainer.

811.0 Chemical Wastes.

811.1 Pretreatment. Chemical or liquid industrial wastes that are likely to damage or increase maintenance costs on the sanitary sewer system, detrimentally affect sewage treatment or contaminate surface or subsurface waters shall be pretreated to render them innocuous before discharge into a drainage system. Detailed construction documents of the pretreatment facilities shall be required by the Authority Having Jurisdiction.

Piping conveying industrial, chemical, or process wastes from their point of origin to sewer-connected pretreatment facilities shall be of such material and design as to adequately perform its intended function to the satisfaction of the Authority Having Jurisdiction. Drainage discharge piping from pretreatment facilities or interceptors shall be in accordance with standard drainage installation procedures.

811.2 Waste and Vent Pipes. Each waste pipe receiving or intended to receive the discharge of a fixture into which acid or corrosive chemical is placed, and each vent pipe connected thereto, shall be constructed of chlorinated polyvinyl chloride (CPVC), polypropylene (PP), polyvinylidene fluoride (PVDF), chemical-resistant glass, high-silicon iron pipe, or lead pipe with a wall thickness of not less than ½ of an inch (3.2 mm); an approved type of ceramic glazed or unglazed vitrified clay; or other approved corrosion-resistant materials. CPVC pipe and fittings shall comply with ASTM F2618. PP pipe and fittings shall comply with ASTM F1412 or CSA B181.3. PVDF pipe and fittings shall comply with ASTM F1673 or CSA B181.3. Chemical-resistant glass pipe and fittings shall comply with ASTM C1053. High-silicon iron pipe and fittings shall comply with ASTM A861.

811.3 Joining Materials. Joining materials shall be of approved type and quality.

811.4 Access. Where practicable, the piping shall be readily accessible and installed with the maximum of clearance from other services.

811.5 Permanent Record. The owner shall make and keep a permanent record of the location of piping and venting carrying chemical waste.

811.6 Chemical Vent. No chemical vent shall intersect vents for other services.

811.7 Discharge. Chemical wastes shall be discharged in a manner approved by the Authority Having Jurisdiction.

811.8 Diluted Chemicals. The provisions of this section about materials and methods of construction shall not apply to installations such as photographic or x-ray darkrooms or research or control laboratories where minor amounts of adequately diluted chemicals are discharged.

812.0 Clear Water Wastes.

812.1 General. Water lifts, expansion tanks, cooling jackets, sprinkler systems, drip or overflow pans, or similar devices that discharge clear wastewater into the building drainage system shall discharge through an indirect waste.

813.0 Swimming Pools.

813.1 General. Pipes carrying wastewater from swimming or wading pools, including pool drainage and backwash from filters, shall be installed as an indirect waste. Where a pump is used to discharge pool waste water to the drainage system, the pump discharge shall be installed as an indirect waste.

814.0 Condensate Waste and Control.

814.1 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 using an indirect waste pipe. The waste pipe shall have a slope of not less than ¼ inch per foot (10.4 mm/m) or 1 percent slope and shall be of an approved corrosion-resistant material not smaller than the outlet size in accordance with Section 814.3 or Section 814.4 for air-cooling coils or condensing appliances, respectively. Condensate or wastewater shall not drain over a public way.

814.1.1 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.

814.2 Condensate Control. Where any equipment or appliance is installed in a space where damage is capable of resulting from condensate overflow, a drain line shall be provided and shall be drained in accordance with Section 814.1. An additional protection method for condensate overflow shall be provided in accordance with one of the following:

1. A water level detecting device that will shut off the equipment or appliance in the event the primary drain is blocked. Such detecting device shall be in accordance with the manufacturer’s installation instructions.

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 separate drain line at a level that is higher than the primary drain line connection of the drain pan.

4. An additional watertight pan of corrosion-resistant material with a water level detection device installed beneath the cooling coil, unit, or the appliance to catch the overflow condensate due to a clogged primary condensate drain and to shut off the equipment.

The additional pan or the additional drain line connection shall be provided with a drainpipe of not less than ¾ of an inch (20 mm) nominal pipe size, discharging at a point that is readily observed.

814.2.1 Protection of Appurtenances. Where insulation or appurtenances are installed where damage is capable of resulting from a condensate drain pan overflow, such installations shall occur above the rim of the drain pan with supports. Where the supports are in contact with the condensate waste, the supports shall be of approved corrosion-resistant material.

814.3 Condensate Waste Pipe Material and Sizing. Condensate waste pipes from air-cooling coils shall be sized in accordance with the equipment capacity as specified in Table 814.3. The material of the piping shall comply with the pressure and temperature rating of the appliance or equipment and shall be approved for use with the liquid being discharged.

<table>
<thead>
<tr>
<th>EQUIPMENT CAPACITY IN TONS OF REFRIGERATION</th>
<th>MINIMUM CONDENSATE PIPE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 20</td>
<td>¾</td>
</tr>
<tr>
<td>21 – 40</td>
<td>1</td>
</tr>
<tr>
<td>41 – 90</td>
<td>1½</td>
</tr>
<tr>
<td>91 – 125</td>
<td>2</td>
</tr>
<tr>
<td>126 – 250</td>
<td>2</td>
</tr>
</tbody>
</table>

For SI units: 1 ton of refrigerant = 3.52 kW, 1 inch = 25 mm

The size of condensate waste pipes is for one unit or a combination of units, or as recommended by the manufacturer. The capacity of waste pipes assumes a ½ inch per foot (10.4 mm/m) or 1 percent slope, with the pipe running three-quarters full at the following pipe conditions:

<table>
<thead>
<tr>
<th>Outside Air – 20%</th>
<th>Room Air – 80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB</td>
<td>WB</td>
</tr>
<tr>
<td>90°F</td>
<td>73°F</td>
</tr>
<tr>
<td>75°F</td>
<td>62.5°F</td>
</tr>
</tbody>
</table>

Condensate drain sizing for other slopes or other conditions shall be approved by the Authority Having Jurisdiction.

814.4 Appliance Condensate Drains. Condensate drain lines from individual condensing appliances shall be sized as required by the manufacturer’s instructions. Condensate drain lines serving more than one appliance shall be approved by the Authority Having Jurisdiction prior to installation.

814.5 Point of Discharge. Air-conditioning condensate waste pipes shall connect indirectly, except where permitted in Section 814.6, to the drainage system through an air gap or air break to trapped and vented receptors, dry wells, mop sinks, or leach pits, or the tailpiece of plumbing fixtures. A condensate drain shall be trapped in accordance with the appliance manufacturer’s instructions or as approved.

814.6 Condensate Waste from Air-Conditioning Coils. Where the condensate waste from air-conditioning coils discharges by direct connection to a lavatory tailpiece or to an approved accessible inlet on a bathtub overflow, the connection shall be located in the area controlled by the same person controlling the air-conditioned space.

814.7 Plastic Fittings. Female plastic screwed fittings shall be used with male plastic fittings and plastic threads.
CHAPTER 9
VENTS

901.0 General.
901.1 Applicability. This chapter shall govern the materials, design, and installation of plumbing vent systems.

901.2 Vents Required. Each plumbing fixture trap, except as otherwise provided in this code, shall be protected against siphonage and backpressure, and air circulation shall be ensured throughout all parts of the drainage system by means of vent pipes installed in accordance with the requirements of this chapter and as otherwise required by this code.

901.3 Trap Seal Protection. The vent system shall be designed to prevent a trap seal from being exposed to a pressure differential that exceeds 1 inch water column (0.24 kPa) on the outlet side of the trap.

902.0 Vents Not Required.
902.1 Interceptor. Vent piping shall be permitted to be omitted on an interceptor where such interceptor acts as a primary settling tank and discharges through a horizontal indirect waste pipe into a secondary interceptor. The second interceptor shall be properly trapped and vented.

902.2 Bars, Soda Fountains, and Counter. Traps serving sinks that are part of the equipment of bars, soda fountains, and counters need not be vented where the location and construction of such bars, soda fountains, and counters are such as to make it impossible to do so. Where such conditions exist, said sinks shall discharge using approved indirect waste pipes into a floor sink or other approved type of receptor.

903.0 Materials.
903.1 Applicable Standards. Vent pipe and fittings shall comply with the applicable standards referenced in Table 701.2, except that:

1. No galvanized steel or 304 stainless steel pipe shall be installed underground and shall be not less than 6 inches (152 mm) aboveground.

2. ABS and PVC DWV piping installations shall be in accordance with Chapter 14 “Firestop Protection.” Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a flame-spread index of not more than 25 and a smoke-developed index of not more than 50 where tested in accordance with ASTM E84 or UL 723. Plastic piping installed in plenums shall be tested in accordance with all requirements of ASTM E84 or UL 723. Mounting methods, supports and sample sizes of materials for testing that are not specified in ASTM E84 or UL 723 shall be prohibited.

903.2 Use of Copper or Copper Alloy Tubing. Copper or copper alloy tube for underground drainage and vent piping shall have a weight of not less than that of copper or copper alloy drainage tube type DWV.

903.2.1 Aboveground. Copper or copper alloy tube for aboveground drainage and vent piping shall have a weight of not less than that of copper or copper alloy drainage tube type DWV.

903.2.2 Prohibited Use. Copper or copper alloy tube shall not be used for chemical or industrial wastes as defined in Section 811.0.

903.2.3 Marking. Copper or copper alloy tubing, in addition to the required incised marking, shall be marked in accordance with either ASTM B306 or ASTM B88. The colors shall be Type K, green; Type L, blue; Type M, red; and Type DWV, yellow.

903.3 Changes in Direction. Changes in the direction of vent piping shall be made by the appropriate use of approved fittings, and no such pipe shall be strained or bent. Burred ends shall be reamed to the full bore of the pipe.

904.0 Size of Vents.
904.1 Size. The size of vent piping shall be determined from its length and the total number of fixture units connected thereto, in accordance with Table 703.2. The diameter of an individual vent shall be not less than 1½ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. In addition, the drainage piping of each building and each connection to a public sewer or a private sewage disposal system shall be vented by means of one or more vent pipes, the aggregate cross-sectional area of which shall be not less than that of the largest required building sewer as determined from Table 703.2. Vent pipes from fixtures located upstream from pumps, ejectors, backwater valves, or other devices that obstruct the free flow of air and other gases between the building sewer and the outside atmosphere shall not be used for meeting the cross-sectional area venting requirements of this section.

Exception: Where connected to a common building sewer, the drainage piping of two or more buildings located on the same lot and under one ownership shall be permitted to be vented by means of piping sized in accordance with Table 703.2, provided the aggregate cross-sectional area of vents is not less than that of the largest required common building sewer.

904.2 Length. Not more than one-third of the total permitted length, in accordance with Table 703.2, of a minimum-sized vent shall be installed in a horizontal position. Where a minimum-sized vent is increased one pipe size for its entire length, the maximum length limitation shall not apply.

905.0 Vent Pipe Grades and Connections.
905.1 Grade. Vent and branch vent pipes shall be free from drops or sags, and each such vent shall be level or shall be so graded and connected as to drip back by gravity to the drainage pipe it serves.
905.2 Horizontal Drainage Pipe. Where vents connect to a horizontal drainage pipe, each vent pipe shall have its invert taken off above the drainage centerline of such pipe down-stream of the trap being served.

905.3 Vent Pipe Rise. Unless prohibited by structural conditions, each vent shall rise vertically to a point not less than 6 inches (152 mm) above the flood-level rim of the fixture served before offsetting horizontally, and where two or more vent pipes converge, each such vent pipe shall rise to a point not less than 6 inches (152 mm) in height above the flood-level rim of the plumbing fixture it serves before being connected to any other vent. Vents less than 6 inches (152 mm) above the flood-level rim of the fixture shall be installed with approved drainage fittings, material, and grade to the drain.

905.4 Roof Termination. Vent pipes shall extend undiminished in size above the roof, or shall be reconnected with soil or waste vent of the proper size.

905.5 Location of Opening. The vent pipe opening from soil or waste pipe, except for water closets and similar fixtures, shall not be below the weir of the trap. Exception: Water closets and similar fixtures.

905.6 Common Vertical Pipe. Two fixtures shall be permitted to be served by a common vertical pipe where each such fixture wastes separately into an approved double fitting having inlet openings at the same level.

906.0 Vent Termination. 906.1 Roof Termination. Each vent pipe or stack shall extend through its flashing and shall terminate vertically not less than 6 inches (152 mm) above the roof, or not less than 1 foot (305 mm) above a vertical surface. ABS and PVC piping exposed to sunlight shall be protected by water-based synthetic latex paints.

906.2 Clearance. Each vent shall terminate not less than 10 feet (3048 mm) from, or not less than 3 feet (914 mm) above, an openable window, door, opening, air intake, or vent shaft, or not less than 3 feet (914 mm) in every direction from a lot line, alley and street excepted.

906.3 Use of Roof. Vent pipes shall be extended separately or combined, of full required size, not less than 6 inches (152 mm) above the roof or firewall. Flagpoles of vents shall be prohibited except where the roof is used for assembly purposes or parking. Vents within 10 feet (3048 mm) of a part of the roof that is used for assembly purposes or parking shall extend not less than 7 feet (2134 mm) above such roof and shall securely stay.

906.4 Outdoor Installations. Vent pipes for outdoor installations shall extend not less than 10 feet (3048 mm) above the surrounding ground and shall be securely supported.

906.5 Joints. Joints at the roof around vent pipes shall be made watertight by the use of approved flashings or flashing material.

906.6 Lead. (See Chapter 17) Sheet lead shall comply with the following:

1. For safe pans – not less than 4 pounds per square foot (lb/ft²) (19 kg/m²) or ⅛ of an inch (1.6 mm) thick.
2. For flashings or vent terminals – not less than 3 lb/ft² (15 kg/m²) or 0.0472 of an inch (1.2 mm) thick.
3. Lead bends and lead traps shall be not less than ⅛ of an inch (3.2 mm) in wall thickness.

906.7 Frost or Snow Closure. Where frost or snow closure is likely to occur in locations having minimum design temperature below 0°F (-17.8°C), vent terminals shall be not less than 23 inches (5976 mm) in diameter, but in no event smaller than the required vent pipe. The change in diameter shall be made inside the building not less than 1 foot (305 mm) below the roof in an insulated space and terminate not less than 10 inches (254 mm) above the roof, or in accordance with the Authority Having Jurisdiction.

907.0 Vent Stacks and Relief Vents. 907.1 Drainage Stack. Each drainage stack that extends 10 or more stories shall be served by a parallel vent stack, which shall extend undiminished in size from its upper terminal and connect to the drainage stack at or immediately below the lowest fixture drain. Each such vent stack shall also be connected to the drainage stack at each fifth floor, counting down from the uppermost fixture drain, using a yoke vent, the size of which shall be not less in diameter than either the drainage or the vent stack, whichever is smaller.

907.2 Yoke Vent. The yoke vent connection to the vent stack shall be placed not less than 42 inches (1067 mm) above the floor level, and the yoke vent connection to the drainage stack shall be using a wye-branch fitting placed below the lowest drainage branch connection serving that floor.

908.0 Wet Venting. 908.1 Vertical Wet Venting. Wet venting is limited to vertical drainage piping receiving the discharge from the trap arm of one and two fixture unit fixtures that also serves as a vent not exceeding four fixtures. Wet-vented fixtures shall be within the same story; provided, further, that fixtures with a continuous vent discharging into a wet vent shall be within the same story as the wet-vented fixtures. No wet vent shall exceed 6 feet (1829 mm) in developed length.

908.1.1 Size. The vertical piping between two consecutive inlet levels shall be considered a wet-vented section. Each wet-vented section shall be not less than one pipe size exceeding the required minimum waste pipe size of the upper fixture or shall be one pipe size exceeding the required minimum pipe size for the sum of the fixture units served by such wet-vented section, whichever is larger, but in no case less than 2 inches (50 mm) in diameter.

908.1.2 Vent Connection. Common vent sizing shall be the sum of the fixture units served but, in no case, smaller than the minimum vent pipe size required for a fixture served, or by Section 904.0.

908.2 Horizontal Wet Venting for a Bathroom Group. A bathroom group located on the same floor level shall be
permitted to be vented by a horizontal wet vent where all of the conditions of Section 908.2.1 through Section 908.2.5 are met.

908.2.1 Vent Connection. The dry vent connection to the wet vent shall be an individual vent for the bidet, shower, or bathtub. One or two vented lavatory(s) shall be permitted to serve as a wet vent for a bathroom group. Only one wet-vented fixture drain or trap arm shall discharge upstream of the dry-vented fixture drain connection. Dry vent connections to the horizontal wet vent shall be in accordance with Section 905.2 and Section 905.3.

908.2.2 Size. The wet vent shall be sized based on the fixture unit discharge into the wet vent. The wet vent shall be not less than 2 inches (50 mm) in diameter for 4 drainage fixture units (dfu) or less, and not less than 3 inches (80 mm) in diameter for 5 dfu or more. The dry vent shall be sized in accordance with Table 702.1 and Table 703.2 based on the total fixture units discharging into the wet vent.

908.2.3 Trap Arm. The length of the trap arm shall not exceed the limits in Table 1002.2. The trap size shall be in accordance with Section 1003.3. The vent pipe opening from the horizontal wet vent, except for water closets and similar fixtures, shall not be below the weir of the trap.

908.2.4 Water Closet. The water closet fixture drain or trap arm connection to the wet vent shall be downstream of fixture drain or trap arm connections to the horizontal wet vent.

908.2.5 Additional Fixtures. Additional fixtures shall discharge downstream of the wet vent system and be conventionally vented. Only the fixtures within the bathroom group shall connect to the wet-vented horizontal branch.

909.0 Special Venting for Island Fixtures.
909.1 General. Traps for island sinks and similar equipment shall be roughed in above the floor and shall be permitted to be vented by extending the vent as high as possible, but not less than the drainboard height and then returning it downward and connecting it to the horizontal sink drain immediately downstream from the vertical fixture drain. The return vent shall be connected to the horizontal drain through a wye-branch fitting and shall, in addition, be provided with a foot vent taken off the vertical fixture vent by means of a wye branch immediately below the floor and extending to the nearest partition and then through the roof to the open air, or shall be permitted to be connected to other vents at a point not less than 6 inches (152 mm) above the flood-level rim of the fixtures served. Drainage fittings shall be used on the vent below the floor level, and a slope of not less than \( \frac{1}{4} \) inch per foot (20.8 mm/m) back to the drain shall be maintained. The return bend used in the drainboard shall be a one-piece fitting or an assembly of a 45 degree (0.79 rad), a 90 degree (1.57 rad), and a 45 degree (0.79 rad) elbow in the order named. Pipe sizing shall be as elsewhere required in this code.

The island sink drain, upstream of the returned vent, shall serve no other fixtures. An accessible cleanout shall be installed in the vertical portion of the foot vent.

910.0 Combination Waste and Vent Systems.
910.1 Where Permitted. Combination waste and vent systems shall be permitted where structural conditions preclude the installation of conventional systems as otherwise prescribed by this code.

910.2 Approval. Construction documents for each combination waste and vent system shall first be approved by the Authority Having Jurisdiction before a portion of such system is installed.

910.3 Vents. Each combination waste and vent system, as defined in Chapter 2, shall be provided with a vent or vents adequate to ensure free circulation of air. A branch exceeding 15 feet (4572 mm) in length shall be separately vented in an approved manner. The area of a vent installed in a combination waste and vent system shall be not less than one-half the inside cross-sectional area of the drainpipe served. The vent connection shall be downstream of the uppermost drain. The vent connection shall be downstream of the uppermost drain.

910.4 Connections and Size. Branches serving traps shall connect to the main line at an angle not exceeding 2 percent. Each waste pipe and each trap in such a system shall be not less than two pipe sizes exceeding the sizes required by Chapter 7 of this code, and not less than two pipe sizes exceeding a fixture tailpiece or connection.

910.5 Vertical Waste Pipe. No vertical waste pipe shall be used in such a system, except the tailpiece or connection between the outlet of a plumbing fixture and the trap. Such tailpieces or connections shall be as short as possible, and in no case shall exceed 2 feet (610 mm).

Exception: Branch lines shall be permitted to have 45 degree (0.79 rad) vertical offsets.

910.6 Cleanouts. An accessible cleanout shall be installed in each vent for the combination waste and vent system. Cleanouts shall not be required on a wet-vented branch serving a single trap where the fixture tailpiece or connection is not less than 2 inches (50 mm) in diameter and provides ready access for cleaning through the trap.

910.7 Fixtures. No water closet or urinal shall be installed on such a system. Other one, two, or three unit fixtures remotely located from the sanitary system and adjacent to a combination waste and vent system shall be permitted to be connected to such system in the conventional manner by means of waste and vent pipes of regular sizes, providing that the two pipe size increase required in Section 910.4 is based on the total fixture unit load connected to the system.

See Appendix B of this code for explanatory notes on the design of combination waste and vent systems.

911.0 Circuit Venting.
911.1 Circuit Vent Permitted. A maximum of eight floor-outlet water closets, showers, bathtubs, or floor drains connected to a horizontal branch shall be permitted to be circuit vented. Each trap arm shall connect horizontally to the hori-
horizontal branch being circuit vented in accordance with Table 1002.2. The horizontal branch shall be classified as a drain and a vent from the most downstream trap arm connection to the most upstream trap arm connection to the horizontal branch.

**Exception:** Back-outlet and wall-hung water closets shall be permitted to be circuit vented provided that no floor-outlet fixtures are connected to the same horizontal branch. Back-outlet and wall-hung water closets shall connect horizontally to the horizontal circuit vented drain.

**911.2 Circuit Vent Size and Connection.** The circuit vent size shall be in accordance with Table 703.2 according to the number of circuit vented fixtures connected to the horizontal branch but shall be not less than 2 inches (50 mm) in diameter. The vent shall connect to the horizontal branch on the vertical between the two most upstream trap arms. The circuit vent pipe shall not receive the discharge of soil or waste.

**911.2.1 Multiple Circuit Vents.** When multiple circuit vents are interconnected according to Section 911.4.1, each individual circuit vent shall be sized according to Section 911.2. The vent pipe connecting each circuit vent shall be sized according to Table 703.2.

**911.3 Relief Vent.** A 2 inch (50 mm) relief vent shall be provided for circuit-vented horizontal branches receiving the discharge of four or more water closets when connecting to a drainage stack that receives the discharge of soil or waste from upper horizontal branches.

**911.3.1 Connection and Installation.** The relief vent shall connect to the horizontal branch between the stack and the most downstream trap arm of the circuit vent. The relief vent shall be installed on the vertical to the horizontal branch.

**911.3.2 Fixture Drain.** The relief vent is permitted to serve as a fixture drain. Fixtures discharging to a relief vent shall be one or two fixture unit fixtures but shall not exceed a total of 4 fixture units.

**911.4 Slope and Size of Horizontal Branch.** The vented section of the horizontal branch shall be uniformly sloped and not more than 1 inch per foot (83.3 mm/m). The entire length of the vented section of the horizontal branch shall be sized for the total drainage discharge to the branch according to Table 703.2.

**911.4.1 Multiple Circuit-Vented Branches.** Circuit-vented horizontal branches are permitted to be connected together. Each group of a maximum of eight fixtures shall be considered a separate circuit vent and shall be in accordance with Section 911.4.1.1 and Section 911.4.1.2.

**911.4.1.1 Size of Parallel Horizontal Branches.** Parallel horizontal circuit vented branches shall be permitted to connect on the same floor level. Each separate circuit-vented horizontal branch that is interconnected shall be sized independently in accordance with Section 911.4.

**911.4.1.2 Size of Continuous Horizontal Branches.** Two or more circuit vented systems continuous on the same horizontal branch shall be uniformly sized for the total discharge into the branch.

**911.5 Additional Fixtures.** Fixtures, other than the circuit-vented fixtures, are permitted to discharge to the horizontal branch drain. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.

**912.0 Engineered Vent System.**

**912.1 General.** The design and sizing of a vent system shall be permitted to be determined by accepted engineering practices. The system shall be designed by a registered design professional and approved in accordance with Section 301.5.

**912.2 Minimum Requirements.** An engineered vent system shall provide protection of the trap seal in accordance with Section 901.3.
CHAPTER 10
TRAPS AND INTERCEPTORS

1001.0 General.
1001.1 Applicability. This chapter shall govern the materials, design, and installation of traps and interceptors.

1001.2 Where Required. Each plumbing fixture shall be separately trapped by an approved type of liquid seal trap. This section shall not apply to fixtures with integral traps. Not more than one trap shall be permitted on a trap arm. Food waste disposers installed with a set of restaurant, commercial, or industrial sinks shall be connected to a separate trap. Each domestic clothes washer and each laundry tub shall be connected to a separate and independent trap, except that a trap serving a laundry tub shall also be permitted to receive the waste from a clothes washer set adjacent to it. The vertical distance between a fixture outlet and the trap weir shall be as short as practicable, but in no case shall the tailpiece exceed 24 inches (610 mm) in length. One trap shall be permitted to serve a set of not more than three single compartment sinks or laundry tubs of the same depth or three lavatories immediately adjacent to each other and in the same room where the waste outlets are not more than 30 inches (762 mm) apart, and the trap is centrally located where three compartments are installed.

1002.0 Traps Protected by Vent Pipes.
1002.1 Vent Pipes. Each plumbing fixture trap, except as otherwise provided in this code, shall be protected against siphonage, backpressure, and air circulation shall be assured throughout the drainage system using a vent pipe installed in accordance with the requirements of this code.

1002.2 Fixture Traps. Each fixture trap shall have a protecting vent so located that the developed length of the trap arm from the trap weir to the inner edge of the vent shall be within the distance given in Table 1002.2 but in no case less than two times the diameter of the trap arm.

### TABLE 1002.2
HORIZONTAL LENGTHS OF TRAP ARMS
(EXCEPT FOR WATER CLOSETS AND SIMILAR FIXTURES)\(^1,2\)

<table>
<thead>
<tr>
<th>TRAP ARM PIPE DIAMETER (inches)</th>
<th>DISTANCE TRAP TO VENT MINIMUM (inches)</th>
<th>LENGTH MAXIMUM (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(\frac{1}{4})</td>
<td>2(\frac{1}{2})</td>
<td>30</td>
</tr>
<tr>
<td>1(\frac{1}{2})</td>
<td>3</td>
<td>42</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>72</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>120</td>
</tr>
<tr>
<td>Exceeding 4</td>
<td>2 x Diameter</td>
<td>120</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

Notes:

1. Maintain \(\frac{1}{6}\) inch per foot slope (20.8 mm/m).
2. The developed length between the trap of a water closet or similar fixture (measured from the top face of the closest flange to the inner edge of the vent) and its vent shall not exceed 6 feet (1829 mm).

1002.3 Change of Direction. A trap arm shall be permitted to change direction without the use of a cleanout where such change of direction does not exceed 90 degrees (1.57 rad). Horizontal changes in the direction of trap arms shall be in accordance with Section 706.3.

**Exception:** For trap arms, 3 inches (80 mm) in diameter and larger, the change of direction shall not exceed 135 degrees (2.36 rad) without the use of a cleanout.

1002.4 Vent Pipe Opening. The vent pipe opening from soil or waste pipe, except for water closets and similar fixtures, shall not be below the weir of the trap.

1003.0 Traps – Described.
1003.1 General Requirements. Each trap, except for traps within an interceptor or similar device shall be self-cleaning. Traps for bathtubs, showers, lavatories, sinks, laundry tubs, floor drains, urinals, drinking fountains, dental units, and similar fixtures shall be of standard design, weight and shall be of ABS, cast-brass, cast-iron, lead, PP, PVC, or other approved material. An exposed and readily accessible drawn-copper alloy tubing trap, not less than 17 B & S Gauge (0.045 inch) (1.143 mm), shall be permitted to be used on fixtures discharging domestic sewage.

**Exception:** Drawn-copper alloy tubing traps shall not be used for urinals. Each trap shall have the manufacturer’s name stamped legibly in the metal of the trap, and each tubing trap shall have the gauge of the tubing in addition to the manufacturer’s name. A trap shall have a smooth and uniform interior waterway.

1003.2 Slip Joint Fittings. A maximum of one approved slip joint fitting shall be permitted to be used on the outlet side of a trap, and no tubing trap shall be installed without a listed tubing trap adapter. Listed plastic trap adapters shall be permitted to be used to connect listed metal tubing traps.

1003.3 Size. The size (nominal diameter) of a trap for a given fixture shall be sufficient to drain the fixture rapidly but in no case less than nor more than one pipe size larger than given in Table 702.1. The trap shall be the same size as the trap arm to which it is connected.

1004.0 Traps.
1004.1 Prohibited. No form of trap that depends for its seal upon the action of movable parts shall be used. No trap that has concealed interior partitions, except those of plastic, glass, or similar corrosion-resisting material, shall be used. “S” traps, bell traps, and crown-vented traps shall be prohibited. No fixture shall be double trapped. Drum and bottle traps shall be installed for special conditions. No trap shall be installed without a vent, except as otherwise provided in this code.
1004.2 Movable Parts. Bladders, check valves or another type of devices with moveable parts shall be prohibited to serve as a trap.

1005.0 Trap Seals.
1005.1 General. Each fixture trap shall have a liquid seal of not less than 2 inches (51 mm) and not more than 4 inches (102 mm), except where a deeper seal is found necessary by the Authority Having Jurisdiction. Traps shall be set true with respect to their liquid seals and, where necessary, they shall be protected from freezing.

1006.0 Floor Drain Traps.
1006.1 General. Floor drains shall connect into a trap so constructed that it can be readily cleaned and of a size to serve efficiently the purpose for which it is intended. The drain inlet shall be so located that it is in full view. Where subject to the reverse flow of sewage or liquid waste, such drains shall be equipped with an approved backwater valve.

1007.0 Trap Seal Protection.
1007.1 General. Floor drain or similar traps directly connected to the drainage system and subject to infrequent use shall be protected with a trap seal primer, except where not deemed necessary for safety or sanitation by the Authority Having Jurisdiction. Trap seal primers shall be accessible for maintenance.

1007.2 Trap Seal Primers. Potable water supply trap seal primer valves shall comply with ASSE 1018. Drainage and electronic design type trap seal primer devices shall comply with ASSE 1044 or IAPMO PS 76.

1008.0 Building Traps.
1008.1 General. Building traps shall not be installed except where required by the Authority Having Jurisdiction. Each building trap where installed shall be provided with a cleanout and with a relieving vent or fresh-air intake on the inlet side of the trap, which needs not be larger than one-half the diameter of the drain to which it connects. Such relieving vent or fresh-air intake shall be carried above grade and terminate in a screened outlet located outside the building.

1009.0 Interceptors (Clarifiers) and Separators.
1009.1 Where Required. Interceptors (clarifiers) (including grease, oil, sand, solid interceptors, etc.) shall be required by the Authority Having Jurisdiction where they are necessary for the proper handling of liquid wastes containing grease, flammable wastes, sand, solids, acid or alkaline substances, or other ingredients harmful to the building drainage system, the public or private sewer, or to public or private sewage disposal. A list of acceptable interceptor standards is referenced in Table 1009.1.

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Waste</td>
<td>IAPMO IGC 167</td>
</tr>
<tr>
<td>Non-petroleum Oil</td>
<td>ASME A112.14.6, IAPMO PS 80, PDI G-102</td>
</tr>
<tr>
<td>Petroleum Oil</td>
<td>ASTM D6104, IAPMO IGC 183, IAPMO IGC 325</td>
</tr>
</tbody>
</table>

1009.2 Approval. The size, type, and location of each interceptor (clarifier) or separator shall be approved by the Authority Having Jurisdiction. Except where otherwise specifically permitted, no wastes other than those requiring treatment or separation shall be discharged into an interceptor (clarifier).

1009.3 Design. Interceptors (clarifiers) for sand and similar heavy solids shall be so designed and located as to be readily accessible for cleaning and shall have a water seal of not less than 6 inches (152 mm).

1009.4 Relief Vent. Interceptors (clarifiers) shall be so designed that they will not become air-bound where closed covers are used. Each interceptor (clarifier) shall be properly vented.

1009.5 Location. Each interceptor (clarifier) cover shall be readily accessible for servicing and maintaining the interceptor (clarifier) in working and operating condition. The use of ladders or the removal of bulky equipment to service interceptors (clarifiers) shall constitute a violation of accessibility. Location of interceptors (clarifiers) shall be shown on the approved building plan.

1009.6 Maintenance of Interceptors. Interceptors shall be maintained in efficient operating condition by periodic removal of accumulated grease, scum, oil, or other floating substances and solids deposited in the interceptor.

1009.7 Discharge. The waste pipe from oil and sand interceptors shall discharge as approved by the Authority Having Jurisdiction.

1010.0 Slaughterhouses, Packing Establishments, etc.
1010.1 General. A fish, fowl, and animal slaughterhouse or establishment; a fish, fowl, and meat packing or curing establishment; a soap factory, tallow-rendering, fat-rendering, and a hide-curing establishment shall be connected to and shall drain or discharge into an approved grease interceptor (clarifier).

1011.0 Minimum Requirements for Auto Wash Racks.
1011.1 General. A private or public wash rack or floor or slab used for cleaning machinery or machine parts shall be adequately protected against storm or surface water and shall drain or discharge into an approved interceptor (clarifier).
1012.0 Commercial and Industrial Laundries.
1012.1 General. Laundry equipment in commercial and industrial buildings that do not have integral strainers shall discharge into an interceptor having a wire basket or similar device that is removable for cleaning and that will prevent passage into the drainage system of solids ½ of an inch (12.7 mm) or larger in maximum dimensions, such as string, rags, buttons, or other solid materials detrimental to the public sewerage system.

1013.0 Bottling Establishments.
1013.1 General. Bottling plants shall discharge their process wastes into an interceptor that will provide for the separation of broken glass or other solids, before discharging liquid wastes into the drainage system.

1014.0 Grease Interceptors.
1014.1 General. Where it is determined by the Authority Having Jurisdiction that waste pretreatment is required, an approved type of grease interceptor(s) shall comply with ASME A112.14.3, ASME A112.14.4, CSA B481, IAPMO Z1001, PDI G-101, or PDI G-102, and sized in accordance with Section 1014.2.1 or Section 1014.3.6. shall be installed in accordance with the manufacturer’s installation instructions to receive the drainage from fixtures or equipment that produce grease-laden waste. Grease-laden waste fixtures shall include, but not be limited to, sinks and drains, such as floor drains, floor sinks, and other fixtures or equipment in serving establishments, such as restaurants, cafes, lunch counters, cafeterias, bars and clubs, hotels, hospitals, sanitariums, factory or school kitchens, or other establishments where grease is introduced into the drainage or sewage system in quantities that can effect line stoppage or hinder sewage treatment or private sewage disposal systems. A combination of hydromechanical, gravity grease interceptors and engineered systems shall be allowed to meet this code and other applicable requirements of the Authority Having Jurisdiction where space or existing physical constraints of existing buildings necessitate such installations. A grease interceptor shall not be required for individual dwelling units or private living quarters. Water closets, urinals, and other plumbing fixtures conveying human waste shall not drain into or through the grease interceptor.

1014.1.1 Trapped and Vented. Each fixture discharging into a grease interceptor shall be individually trapped and vented in an approved manner.

1014.1.2 Maintenance. Grease interceptors shall be maintained in efficient operating condition by periodic removal of the accumulated grease and latent material. No such collected grease shall be introduced into drainage piping or a public or private sewer. Where the Authority Having Jurisdiction determines that a grease interceptor is not being properly cleaned or maintained, the Authority Having Jurisdiction shall have the authority to mandate the installation of additional equipment or devices and to mandate a maintenance program.

1014.1.3 Food Waste Disposers and Dishwashers. No food waste disposer or dishwasher shall be connected to or discharge into a grease interceptor. Commercial food waste disposers shall be permitted to discharge directly into the building’s drainage system.

Exception: Food waste disposers shall be permitted to discharge to grease interceptors that are designed to receive the discharge of food waste.

1014.2 Hydromechanical Grease Interceptors. Plumbing fixtures or equipment connected to a Type A and B hydromechanical grease interceptor shall discharge through an approved type of vented flow control installed in a readily accessible and visible location. Flow control devices shall be designed and installed so that the total flow through such device or devices shall at no time be greater than the rated flow of the connected grease interceptor. No flow control device having adjustable or removable parts shall be approved. The vented flow control device shall be located such that no system vent shall be between the flow control and the grease interceptor inlet. The vent or air inlet of the flow control device shall connect with the sanitary drainage vent system, as elsewhere required by this code, or shall terminate through the roof of the building, and shall not terminate to the free atmosphere inside the building.

Exception: Listed grease interceptors with integral flow controls or restricting devices shall be installed in an accessible location in accordance with the manufacturer’s installation instructions.

1014.2.1 Capacity. The total capacity in gallons (gal) (L) of fixtures discharging into a hydromechanical grease interceptor shall not exceed two and one-half times the certified gallon per minute (gpm) (L/s) flow rate of the interceptor in accordance with Table 1014.2.1.

For this section, the term “fixture” shall mean and include each plumbing fixture, appliance, apparatus, or other equipment required to be connected to or discharged into a grease interceptor by a provision of this section.

1014.2.2 Vent. A vent shall be installed downstream of hydromechanical grease interceptors in accordance with the requirements of this code.

### TABLE 1014.2.1
**HYDROMECHANICAL GREASE INTERCEPTOR SIZING USING GRAVITY FLOW RATES**

<table>
<thead>
<tr>
<th>DIAMETER OF GREASE WASTE PIPE (inches)</th>
<th>MAXIMUM FULL PIPE FLOW (gpm)</th>
<th>SIZE OF GREASE INTERCEPTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ONE-MINUTE DRAINAGE PERIOD (gpm)</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>230</td>
<td>250</td>
</tr>
<tr>
<td>6</td>
<td>375</td>
<td>400</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s

Notes:
1. For interceptor sizing by the fixture capacity see the example below.
2. ⅛ inch slope per foot (20.8 mm/m) based on Manning's formula with friction factor N = 0.012.
TRAPS AND INTERCEPTORS

EXAMPLE 1014.2.1
SIZING HYDROMECHANICAL GREASE INTERCEPTOR(S)
USING FIXTURE CAPACITY

Step 1: Determine the flow rate from each fixture.

\[ \text{Flow rate} = \text{Length} \times \text{Width} \times \text{Depth} \div 231 \times \text{Drain Period} \times 0.75 \]

Step 2: Calculate the total load from fixtures that discharge into the interceptor.

<table>
<thead>
<tr>
<th>FIXTURES</th>
<th>COMPARTMENTS</th>
<th>LOAD (gallons)</th>
<th>SIZE OF GREASE INTERCEPTOR ONE-MINUTE DRAINAGE PERIOD (gpm)</th>
<th>TWO-MINUTE DRAINAGE PERIOD (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compart-</td>
<td>24 inches x 24</td>
<td>44.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>size</td>
<td>inches x 12</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrant</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated</td>
<td></td>
<td>49.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appliance</td>
<td></td>
<td>50</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 gallon per minute = 0.06 L/s, 1 gallon = 3.785 L

1014.3 Gravity Grease Interceptors. Required gravity grease interceptors shall comply with the provisions of Section 1014.3.1 through Section 1014.3.7.

1014.3.1 General. The provisions of this section shall apply to the design, construction, installation, and testing of commercial kitchen gravity grease interceptors.

1014.3.2 Waste Discharge Requirements. Waste discharge in establishments from fixtures and equipment which contain grease, including but not limited to, scullery sinks, pot and pan sinks, dishwashers, soup kettles, and floor drains located in areas where grease-containing materials exist, shall be permitted to be drained into the sanitary waste through the interceptor where approved by the Authority Having Jurisdiction.

1014.3.3 Design. Gravity interceptors shall be constructed in accordance with the applicable standard in Chapter 17 or the design approved by the Authority Having Jurisdiction.

1014.3.4 Location. Each grease interceptor shall be so installed and connected that it shall be easily accessible for inspection, cleaning, and removal of the intercepted grease. A gravity grease interceptor that complies with IAPMO Z1001 shall not be installed in a building where food is handled. Location of the gravity interceptor shall meet the approval of the Authority Having Jurisdiction.

1014.3.5 Construction Requirements. Gravity grease interceptors shall be designed to remove grease from effluent and shall be sized in accordance with this section. Gravity grease interceptors shall also be designed to retain grease until accumulations can be removed by pumping the interceptor. It is recommended that a sample box is located at the outlet end of gravity grease interceptors so that the Authority Having Jurisdiction can periodically sample effluent quality.

1014.3.6 Sizing Criteria. The volume of the interceptor shall be determined by using Table 1014.3.6. Where drainage fixture units (DFUs) are not known, the interceptor shall be sized based on the maximum DFUs allowed for the pipe size connected to the inlet of the interceptor. Refer to Table 703.2, Drainage Piping, Horizontal.

<table>
<thead>
<tr>
<th>DRAINAGE FIXTURE UNITS1, 3</th>
<th>INTERCEPTOR VOLUME2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(DFUs)</td>
<td>(gallons)</td>
</tr>
<tr>
<td>8</td>
<td>500</td>
</tr>
<tr>
<td>21</td>
<td>750</td>
</tr>
<tr>
<td>35</td>
<td>1000</td>
</tr>
<tr>
<td>90</td>
<td>1250</td>
</tr>
<tr>
<td>172</td>
<td>1500</td>
</tr>
<tr>
<td>216</td>
<td>2000</td>
</tr>
<tr>
<td>307</td>
<td>2500</td>
</tr>
<tr>
<td>342</td>
<td>3000</td>
</tr>
<tr>
<td>428</td>
<td>4000</td>
</tr>
<tr>
<td>576</td>
<td>5000</td>
</tr>
<tr>
<td>720</td>
<td>7500</td>
</tr>
<tr>
<td>2112</td>
<td>10,000</td>
</tr>
<tr>
<td>2640</td>
<td>15,000</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon = 3.785 L

Notes:
1 The maximum allowable DFUs plumbed to the kitchen drain lines that will be connected to the grease interceptor.
2 This size is based on DFUs, the pipe size from this code; Table 703.2: Useful Tables for flow in half-full pipes (ref: Mohinder Nayyar Piping Handbook, 3rd Edition, 1992). Based on 30-minute retention time (ref: George Tchobanoglous and Metcalf & Eddy, Wastewater Engineering Treatment, Disposal, and Reuse, 3rd Ed. 1991 & Ronald Crites and George Tchobanoglous, Small and Decentralized Wastewater Management Systems, 1998). Rounded up to nominal interceptor volume.
3 Where the flow rate of directly connected fixture(s) or appliance(s) have no assigned DFU values, the additional grease interceptor volume shall be based on the known flow rate (gpm) (L/s) multiplied by 30 minutes.
EXAMPLE 1014.3.6
GRAVITY GREASE INTERCEPTOR SIZING EXAMPLE

Given: A restaurant with the following fixtures and equipment.

One food preparation sink; three-floor drains - one in the food prep area, one in the grill area, and one receiving the indirect waste from the ice machine and a mop sink.

Kitchen Drain Line DFU Count (from Table 702.1):
- 3 floor drains at 2 DFUs each = 6 DFUs
- Mop sink at 3 DFUs each = 3 DFUs
- Food prep sink at 3 DFUs each = 3 DFUs
- Total = 12 DFUs

Using Table 1014.3.6, the grease interceptor will be sized at 750 gallons (2389 L).

1014.3.7 Abandoned Gravity Grease Interceptors. Abandoned grease interceptors shall be pumped and filled as required for abandoned sewers and sewage disposal facilities in Section 722.0.

1015.0 FOG (Fats, Oils, and Greases) Disposal System.
1015.1 Purpose. The purpose of this section is to provide the necessary criteria for the sizing, application, and installation of FOG disposal systems designated as a pretreatment or discharge water quality compliance strategy.

1015.2 Components, Materials, and Equipment. FOG disposal systems, including components, materials, and equipment necessary for the proper function of the system, shall comply with ASME A112.14.6.

1015.3 Sizing and Installation. FOG disposal systems shall be sized and installed in accordance with the manufacturer’s installation instructions.

1015.4 Performance. FOG disposal systems shall produce an effluent quality not to exceed 5.84 grains per gallon (gr/gal) (100 mg/L) FOG.

1016.0 Sand Interceptors.
1016.1 Discharge. Where the discharge of a fixture or drain contains solids or semi-solids heavier than water that would be harmful to a drainage system or cause a stoppage within the system, the discharge shall be through a sand interceptor. Multiple floor drains shall be permitted to discharge into one sand interceptor.

1016.2 Authority Having Jurisdiction. Sand interceptors are required where the Authority Having Jurisdiction deems it advisable to have a sand interceptor to protect the drainage system.

1016.3 Construction and Size. Sand interceptors shall be built of brick or concrete, prefabricated coated steel, or other watertight material. The interceptor shall have an interior baffle for full separation of the interceptor into two sections. The outlet pipe shall be the same size as the inlet pipe of the sand interceptor, the minimum being 3 inches (80 mm), and the baffle shall have two openings of the same diameter as the outlet pipe and at the same invert as the outlet pipe. These openings shall be staggered so that there cannot be a straight line flow between the inlet pipe and the outlet pipe. The invert of the inlet pipe shall be no lower than the invert of the outlet pipe.

The sand interceptor shall have a minimum dimension of 2 square feet (0.2 m²) for the net free opening of the inlet section and a minimum depth under the invert of the outlet pipe of 2 feet (610 mm).

For each 5 gpm (0.3 L/s) flow or fraction thereof over 20 gpm (1.26 L/s), the area of the sand interceptor inlet section is to be increased by 1 square foot (0.09 m²). The outlet section shall at all times have a minimum area of 50 percent of the inlet section.

The outlet section shall be covered by a solid removable cover, set flush with the finished floor, and the inlet section shall have an open grating, set flush with the finished floor and suitable for the traffic in the area in which it is located.

1016.4 Separate Use. Sand and similar interceptors for every solid shall be so designed and located as to be readily accessible for cleaning, shall have a water seal of not less than 6 inches (152 mm), and shall be vented.

1017.0 Oil and Flammable Liquid Interceptors.
1017.1 Interceptors Required. Repair garages and gasoline stations with grease racks or grease pits, and factories that have oily, flammable, or both types of wastes as a result of manufacturing, storage, maintenance, repair, or testing processes, shall be provided with an oil or flammable liquid interceptor, that shall be connected to necessary floor drains in such locations shall be connected directly to oil and flammable liquid interceptors.

1017.2 Interceptor Design Alternatives. Oil interceptors shall comply with IAPMO IGC 183 or be in accordance with Section 1017.3 through Section 1017.4.

1017.3 Interceptor Details. Oil and flammable liquid interceptors shall be in accordance with the following:

1. The separation or vapor compartment shall be independently vented to the outer air. Where two or more separation or vapor compartments are used, each shall be vented to the outer air or shall be permitted to connect to a header that is installed at a minimum of 6 inches (152 mm) above the spill line of the lowest floor drain and vented independently to the outer air.

2. The minimum size of a flammable vapor vent shall be not less than 2 inches (50 mm), and, where vented through a sidewalk, the vent shall be not less than 10 feet (3048 mm) above the adjacent level at an approved location.

3. The interceptor shall be vented on the sewer side and shall not connect to a flammable vapor vent. Oil and flammable interceptors shall be provided with gastight cleanout covers that shall be readily accessible.

4. The waste line shall be not less than 3 inches (80 mm) in diameter with a full-size cleanout to grade.
Where an interceptor is provided with an overflow, it shall be provided with an overflow line [not less than 2 inches (50 mm) in diameter] to an approved waste oil tank having a minimum capacity of 550 gallons (2082 L) and meeting the requirements of the Authority Having Jurisdiction.

(a) The waste oil from the separator shall flow by gravity or shall be pumped to a higher elevation by an automatic pump.

(b) Pumps shall be adequately sized and accessible.

(c) Waste oil tanks shall have a 2 inch (50 mm) minimum pump-out connection at grade and an 1½ inch (40 mm) minimum vent to atmosphere at an approved location not less than 10 feet (3048 mm) above grade.

**1017.2-1017.4 Design of Interceptors.** Each manufactured interceptor that is rated shall be stamped or labeled by the manufacturer with an indication of its full discharge rate in gpm (L/s). The following shall apply:

(1) The full discharge rate to such an interceptor shall be determined at full flow. Each interceptor shall be rated equal to or greater than the incoming flow and shall be provided with an overflow line to an underground tank.

(2) Interceptors not rated by the manufacturer shall have a depth of not less than 2 feet (610 mm) below the invert of the discharge drain. The outlet opening shall have not less than an 18 inch (457 mm) water seal and shall have a minimum capacity as follows:

(a) Where not more than three motor vehicles are serviced, stored, or both, interceptors shall have a minimum capacity of 6 cubic feet (0.2 m³), and 1 cubic foot (0.03 m³) of capacity shall be added for each vehicle up to 10 vehicles.

(b) Above 10 vehicles, the Authority Having Jurisdiction shall determine the size of the interceptor required.

(c) Where vehicles are serviced and not stored, interceptor capacity shall be based on a net capacity of 1 cubic foot (0.03 m³) for each 100 square feet (9.29 m²) of the surface to be drained into the interceptor, with a minimum of 6 cubic feet (0.2 m³).
CHAPTER 11
STORM DRAINAGE

1101.0 General.

1101.1 Applicability. This chapter shall govern the materials, design, and installation of storm water drainage systems.

1101.2 Where Required. Roofs, paved areas, yards, courts, courtyards, vent shafts, light wells, or similar areas having rainwater, shall be drained into a separate storm sewer system, or into a combined sewer system where a separate storm sewer system is not available, or to some other place of disposal satisfactory to the Authority Having Jurisdiction. In the case of one- and two-family dwellings, storm water shall be permitted to be discharged on flat areas, such as streets or lawns, so long as the storm water shall flow away from the building and away from adjoining property, and shall not create a nuisance.

1101.3 Storm Water Drainage to Sanitary Sewer Prohibited. Storm water shall not be drained into sewers intended for sanitary drainage.

1101.4 Material Uses. Pipe, tube, and fittings conveying rainwater shall be of such materials and design as to perform their intended function to the satisfaction of the Authority Having Jurisdiction. Conductors within a vent or shaft shall be of cast-iron, galvanized steel, wrought iron, copper, copper alloy, lead, Schedule 40 ABS DWV, Schedule 40 PVC DWV, stainless steel 304 or 316L [stainless steel 304 pipe and fittings shall not be installed underground and shall be kept not less than 6 inches (152 mm) aboveground], or other approved materials, and changes in direction shall be in accordance with the requirements of Section 706.0. ABS and PVC DWV piping installations shall be installed in accordance with applicable standards referenced in Chapter 17 and Chapter 14 “Firestop Protection.” Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a flame-spread index of not more than 25 and a smoke-developed index of not more than 50, where tested in accordance with ASTM E84 or UL 723. Plastic piping installed in plenums shall be tested in accordance with all requirements of ASTM E84 or UL 723. Mounting methods, supports and sample sizes of materials for testing that are not specified in ASTM E84 or UL 723 shall be prohibited.

1101.4.1 Copper and Copper Alloys. Joints and connections in copper and copper alloy pipe and tube shall be installed in accordance with Section 705.3.

1101.4.2 Conductors. Conductors installed above-ground in buildings shall comply with the applicable standards referenced in Table 701.2 for aboveground drain, waste, and vent pipe. Conductors installed above-ground level shall be of seamless copper water tube, Type K, L, or M; Schedule 40 copper pipe or Schedule 40 copper alloy pipe; Type DWV copper drainage tube; service weight cast-iron soil pipe or hubless cast-iron soil pipe; standard weight galvanized steel pipe; stainless steel 304 or 316L [stainless steel 304 pipe and fittings shall not be installed underground and shall be kept not less than 6 inches (152 mm) aboveground], or Schedule 40 ABS or Schedule 40 PVC plastic pipe.

1101.4.3 Leaders. Leaders installed outside shall comply with the applicable standards referenced in Table 701.2 for aboveground drain, waste, and vent pipe; aluminum sheet metal; galvanized steel sheet metal; or copper sheet metal.

1101.4.4 Underground Building Storm Drains. Underground building storm drains shall comply with the applicable standards referenced in Table 701.2 for underground drain, waste, and vent pipe.

1101.4.5 Building Storm Sewers. Building storm sewers shall comply with the applicable standards referenced in Table 701.2 for building sewer pipe.

1101.4.6 Subsoil Drains. Subsoil drains shall be open jointed, perforated, or both and constructed of materials in conformance with Table 1101.4.6.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>REFERENCED STANDARD(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE</td>
<td>ASTM F667</td>
</tr>
<tr>
<td>PVC</td>
<td>ASTM D2729</td>
</tr>
<tr>
<td>Vitrified Clay (Extra strength)</td>
<td>ASTM C4, ASTM C700</td>
</tr>
</tbody>
</table>

1101.5 Expansion Joints Required. Expansion joints or sleeves shall be provided where warranted by temperature variations or physical conditions.

1101.6 Subsoil Drains. Subsoil drains shall be provided around the perimeter of buildings having basements, cellars, crawl spaces, or floors below grade. Such subsoil drains shall be permitted to be positioned inside or outside of the footing, shall be of perforated or open-jointed approved drain tile or pipe, not less than 3 inches (80 mm) in diameter, and shall be laid in gravel, slag, crushed rock, approved ¾ of an inch (19.1 mm) crushed, recycled glass aggregate, or other approved porous material with not less than 4 inches (102 mm) surrounding the pipe. Filter media shall be provided for exterior subsoil piping.

1101.6.1 Discharge. Subsoil drains shall be piped to a storm drain, to an approved water course, to the front street curb or gutter, to an alley, or the discharge from the subsoil drains shall be conveyed to the alley by a concrete gutter. Where a continuously flowing spring or groundwater is encountered, subsoil drains shall be piped to a storm drain or an approved water course.

1101.6.2 Sump. Where it is not possible to convey the drainage by gravity, subsoil drains shall discharge to an accessible sump provided with an approved automatic electric pump. The sump shall be not less than 15 inches (381 mm) in diameter, 18 inches (457 mm) in depth, and provided with a fitted cover. The sump pump shall have an adequate capacity to discharge water coming into the sump as it accumulates to the required discharge point.
and the capacity of the pump shall be not less than 15 gallons per minute (gpm) (0.95 L/s). The discharge piping from the sump pump shall be not less than 1½ inches (40 mm) in diameter and have a union or other approved quick-disconnect assembly to make the pump accessible for servicing.

1101.6.3 Splash Blocks. For separate dwellings not serving continuously flowing springs or groundwater, the sump discharge pipe shall be permitted to discharge onto a concrete splash block with a minimum length of 24 inches (610 mm). This pipe shall be within 4 inches (102 mm) of the splash block and positioned to direct the flow parallel to the recessed line of the splash block.

1101.6.4 Backwater Valve. Subsoil drains subject to backflow where discharging into a storm drain shall be provided with a backwater valve in the drain line so located as to be accessible for inspection and maintenance.

1101.6.5 Open Area. Nothing in Section 1101.6 shall prevent drains that serve either subsoil drains or areaways of a detached building from discharging to a properly graded open area, provided that:

1. They do not serve continuously flowing springs or groundwater.
2. The point of discharge is not less than 10 feet (3048 mm) from a property line.
3. It is impracticable to discharge such drains to a storm drain, to an approved water course, to the front street curb or gutter, or to an alley.

1101.7 Building Subdrains. Building subdrains located below the public sewer level shall discharge into a sump or receiving tank, the contents of which shall be automatically lifted and discharged into the drainage system as required for building sumps.

1101.8 Areaway Drains. Open subsurface space adjacent to a building, serving as an entrance to the basement or cellar of a building, shall be provided with a drain or drains. The areaway drains shall be not less than 2 inches (50 mm) in diameter for areaways at a maximum of 100 square feet (9.29 m²) in area, and shall be discharged in the manner provided for subsoil drains not serving continuously flowing springs or groundwater (see Section 1101.6.1). Areaways exceeding 100 square feet (9.29 m²) shall not drain into subsoil drains. The drains for areaways exceeding 100 square feet (9.29 m²) shall be sized in accordance with Table 1103.2.

1101.9 Window Areaway Drains. Window areaways at a maximum of 10 square feet (0.93 m²) in area shall be permitted to discharge to the subsoil drains through a 2 inch (50 mm) diameter pipe. However, window areaways exceeding 10 square feet (0.93 m²) in area shall be handled in the manner provided for entrance areaways (see Section 1101.8).

1101.10 Filling Stations and Motor Vehicle Washing Establishments. Public filling stations and motor vehicle washing establishments shall have the paved area sloped toward sumps or gratings within the property lines. Curbs not less than 6 inches (152 mm) high shall be placed where required to direct water to gratings or sumps.
that connects to an underground public storm sewer. The combined secondary and primary roof drain systems shall be sized in accordance with Section 1103.0 based on double the rainfall rate for the local area.

1101.13 Cleanouts. Cleanouts for building storm drains shall comply with the requirements of Section 719.0 of this code.

1101.13.1 Rain Leaders and Conductors. Rain leaders and conductors connected to a building storm sewer shall have a cleanout installed at the base of the outside leader or outside conductor before it connects to the horizontal drain.

1101.14 Rainwater Sumps. Rainwater sumps serving “public use” occupancy buildings shall be provided with dual pumps arranged to function alternately in the case of overload or mechanical failure. Pumps rated 600 V or less shall comply with UL 778 and shall be installed in accordance with the manufacturer’s installation instructions.

1101.15 Traps on Storm Drains and Leaders. Leaders and storm drains, where connected to a combined sewer, shall be trapped. Floor and area drains connected to a storm drain shall be trapped.

Exception: Traps shall not be required where roof drains, rain leaders, and other inlets are at locations permitted under Section 906.0, Vent Termination.

1101.15.1 Where Not Required. No trap shall be required for leaders or conductors that are connected to a sewer carrying storm water exclusively.

1101.15.2 Trap Size. Traps, where installed for individual conductors, shall be the same size as the horizontal drain to which they are connected.

1101.15.3 Method of Installation of Combined Sewer. Individual storm-water traps shall be installed on the stormwater drain branch serving each storm-water inlet, or a single trap shall be installed in the main storm drain just before its connection with the combined building sewer. Such traps shall be provided with an accessible cleanout on the outlet side of the trap.

1101.16 Leaders, Conductors, and Connections. Leaders or conductors shall not be used as soil, waste, or vent pipes nor shall soil, waste, or vent pipes be used as leaders or conductors.

1101.16.1 Protection of Leaders. Leaders installed along alleyways, driveways, or other locations where exposed to damage shall be protected by metal guards, recessed into the wall, or constructed from the ferrous pipe.

1101.16.2 Combining Storm with Sanitary Drainage. The sanitary and storm drainage system of a building shall be entirely separate, except where a combined sewer is used, in which case the building storm drain shall be connected in the same horizontal plane through a single wye fitting to the combined building sewer not less than 10 feet (3048 mm) downstream from a soil stack.

1102.0 Roof Drains.

1102.1 Applications. Roof drains shall be constructed of aluminum, cast-iron, copper alloy of not more than 15 percent zinc, leaded nickel bronze, stainless steel, ABS, PVC, polypropylene, polyethylene, or nylon and shall comply with ASME A112.3.1 or ASME A112.6.4.

1102.2 Dome Strainers Required. Roof drains shall have domed strainers.

Exception: Roof drain strainers for use on sun decks, parking decks, and similar areas that are normally serviced and maintained, shall be permitted to be of the flat surface type. Such roof drain strainers shall be level with the deck.

1102.3 Roof Drain Flashings. The connection between the roof and roof drains that pass through the roof and into the interior of the building shall be made watertight by the use of proper flashing material.

1102.3.1 Lead Flashing. Where lead flashing material is used, it shall be not less than 4 pounds per square foot (lb/ft²) (19 kg/m²).

1102.3.2 Copper Flashing. Where copper flashing material is used, it shall be not less than 12 ounces per square foot (oz/ft²) (3.7 kg/m²).

1103.0 Size of Leaders, Conductors, and Storm Drains.

1103.1 Vertical Conductors and Leaders. Vertical conductors and leaders shall be sized by the maximum projected roof area and Table 1103.1.

1103.2 Size of Horizontal Storm Drains and Sewers. The size of building storm drains, or building storm sewers or their horizontal branches shall be based on the maximum projected roof or paved area to be handled and Table 1103.2.

1103.3 Size of Roof Gutters. The size of semi-circular gutters shall be based on the maximum projected roof area and Table 1103.3.

1103.4 Side Walls Draining onto a Roof. Where vertical walls project above a roof to permit storm water to drain into the roof area below, the adjacent roof area shall be permitted to be computed from Table 1103.1 as follows:

(1) For one wall – add 50 percent of the wall area to the roof area figures.

(2) For two adjacent walls of equal height – add 35 percent of the total wall areas.

(3) For two adjacent walls of unequal height – add 35 percent of the total common height and add 50 percent of the remaining height of the highest wall.

(4) Two opposite walls of same height – add no additional area.

(5) Two opposite walls of differing heights – add 50 percent of the wall area above the top of the lower wall.

(6) Walls on three sides – add 50 percent of the area of the inner wall below the top of the lowest wall, plus an allowance for the area of the wall above the top of the lowest wall, in accordance with Section 1103.4(3) and Section 1103.4(5) above.
Walls on four sides – no allowance for wall areas below the top of the lowest wall – add for areas above the top of the lowest wall in accordance with Section 1103.4(1), Section 1103.4(3), Section 1103.4(5), and Section 1103.4(6) above.

1104.0 Values for Continuous Flow.

1104.1 General. Where there is a continuous or semi-continuous discharge into the building storm drain or building storm sewer, as from a pump, ejector, air-conditioning plant, or similar device, 1 gpm (0.06 L/s) of such discharge shall be computed as being equivalent to 24 square feet (2.2 m²) of roof area, based upon a rate of rainfall of 4 inches per hour (in/h) (102 mm/h).

1105.0 Controlled-Flow Roof Drainage.

1105.1 Application. Instead of sizing the storm drainage system in accordance with Section 1103.0, the roof drainage shall be permitted to be sized by controlled flow and storage of the storm water on the roof, provided the following conditions are met:

(1) The water from a 25-year frequency storm shall not be stored on the roof exceeding 24 hours.

(2) During the storm, the water depth on the roof shall not exceed the depths specified in Table 1105.1(1).

(3) Not less than two drains shall be installed in roof areas of 10 000 square feet (929 m²) or less, and not less than one additional drain shall be installed for each 10 000 square feet (929 m²) of roof area exceeding 10 000 square feet (929 m²).

(4) Each roof drain shall have a precalibrated, fixed (non-adjustable), and proportional weir (notched) in a standing water collar inside the strainer. No mechanical devices or valves shall be permitted.

(5) Pipe sizing shall be based on the pre-calibrated rate of flow (gpm) (L/s) of the pre-calibrated weir for the maximum allowable water depth, and Table 1103.1 and Table 1103.2.

(6) The height of stones or other granular material above the waterproofed surface shall not be considered in water depth measurement, and the roof surface in the vicinity of the drain shall not be recessed to create a reservoir.

(7) Roof design, where controlled-flow roof drainage is used, shall be such that the design roof live load is not less than 30 lb/ft² (146 kg/m²) to provide a safety factor exceeding the 15 lb/ft² (73 kg/m²) represented by the depth of water stored on the roof in accordance with Table 1105.1(1).

(8) Scuppers shall be provided in parapet walls. The distance of scupper bottoms above the roof level at the drains shall not exceed the maximum distances specified in Table 1105.1(2).

(9) Scupper openings shall be not less than 4 inches (102 mm) high and have a width equal to the circumference of the roof drain required for the area served, sized in accordance with Table 1103.1.

(10) Flashings shall extend above the top of the scuppers.

(11) At a wall or parapet, 45 degree (0.79 rad) cants shall be installed.

(12) Separate storm and sanitary drainage systems shall be provided within the building.

(13) Calculations for the roof drainage system shall be submitted along with the plans to the Authority Having Jurisdiction for approval.

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### TABLE 1103.1

<table>
<thead>
<tr>
<th>SIZE OF DRAIN, LEADER, OR PIPE</th>
<th>FLOW</th>
<th>MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>gpm¹</td>
<td>1 (in/h)</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>2880</td>
</tr>
<tr>
<td>3</td>
<td>92</td>
<td>8800</td>
</tr>
<tr>
<td>4</td>
<td>192</td>
<td>18 400</td>
</tr>
<tr>
<td>5</td>
<td>360</td>
<td>34 600</td>
</tr>
<tr>
<td>6</td>
<td>563</td>
<td>54 000</td>
</tr>
<tr>
<td>8</td>
<td>1208</td>
<td>116 000</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, 1 inch per hour = 25.4 mm/h, 1 square foot = 0.0929 m²

**Notes:**

1 Maximum discharge capacity, gpm (L/s) with approximately 1¼ inch (44 mm) head of water at the drain.

2 For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 inch per hour (25.4 mm/h) column by the desired rainfall rate.

3 Vertical piping shall be round, square, or rectangular. Square pipe shall be sized to enclose its equivalent round pipe. Rectangular pipe shall have not less than the same cross-sectional area as its equivalent round pipe, except that the ratio of its side dimensions shall not exceed 3 to 1.
1105.0 Setback Roofs. Drains on setback roofs shall be permitted to be connected to the controlled-flow drainage systems provided:

1. The setback is designed for storing water, or
2. The square footage of the setback drainage area is converted as outlined in Section 1105.0 to gpm, and the storm-water pipe sizes in the controlled-flow system are based on the sum of the loads.
3. The branch from each of the roof drains that are not provided with controlled flow shall be sized in accordance with Table 1103.1.

1106.0 Engineered Storm Drainage System.

1106.1 General. The design and sizing of a storm drainage system shall be permitted to be determined by accepted engineering practices. The system shall be designed by a registered design professional and approved in accordance with Section 301.5.

1106.2 Siphonic Roof Drainage Systems. The design of a siphonic roof drainage system shall comply with ASPE 45.

1106.3 Siphonic Roof Drains. Siphonic roof drains shall comply with ASME A112.6.9.

1107.0 Testing.

1107.1 Testing Required. New building storm drainage systems and parts of existing systems that have been altered, extended, or repaired shall be tested in accordance with Section 1107.2.1 or Section 1107.2.2 to disclose leaks and defects.

1107.2 Methods of Testing Storm Drainage Systems. Except for outside leaders and perforated or open-jointed drain tile, the piping of storm drain systems shall be tested upon completion of the rough piping installation by water or air, except that plastic pipe shall not be tested with air, and proved tight. The Authority Having Jurisdiction shall be permitted to require the removal of cleanout plugs to ascertain whether the pressure has reached parts of the system. One of the following test methods shall be used in accordance with Section 1107.2.1 through Section 1107.2.3.

1107.2.1 Water Test. After piping has been installed, the water test shall be applied to the drainage system, either to the entire system or sections. Where the test is applied to the entire system, all openings in the piping shall be tightly closed except for the highest opening, and the system shall be filled with water to the point of overflow. Where the system is tested in sections, each opening shall be tightly plugged except for the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10 foot (3048 mm) head of water. In testing successive sections, not less than the upper 10 feet (3048 mm) of the next preceding section shall be tested so that no joint of pipe in the building except the uppermost 10 feet (3048 mm) of a roof drainage system, which shall be filled with water to the flood level of the uppermost roof drain, shall have been submitted to a test of less than 10 foot (3048 mm) head of water. The water shall be kept in the system or the portion of the test for not less than 15 minutes before inspection starts; the system shall then be tight.

1107.2.2 Air Test. The air test shall be made by attaching an air compressor testing apparatus to a suitable opening after closing other inlets and outlets to the system, forcing air into the system until there is a uniform gauge pressure of 5 pounds-force per square inch (psi) (34 kPa) or sufficient pressure to balance a column of mercury 10 inches (34 kPa) in height. This pressure shall be held without the introduction of additional air for not less than 15 minutes.

1107.2.3 Exceptions. Where circumstances exist that make air and water tests described in Section 1107.2.1 and Section 1107.2.2 impractical, see Section 105.3.
TABLE 1103.2
SIZING OF HORIZONTAL RAINWATER PIPING\(^1,2\)

<table>
<thead>
<tr>
<th>SIZE OF PIPE ((\frac{1}{8}) inch per foot slope)</th>
<th>MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>gpm</td>
</tr>
<tr>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>4</td>
<td>78</td>
</tr>
<tr>
<td>5</td>
<td>139</td>
</tr>
<tr>
<td>6</td>
<td>222</td>
</tr>
<tr>
<td>8</td>
<td>478</td>
</tr>
<tr>
<td>10</td>
<td>860</td>
</tr>
<tr>
<td>12</td>
<td>1384</td>
</tr>
<tr>
<td>15</td>
<td>2473</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIZE OF PIPE ((\frac{1}{2}) inch per foot slope)</th>
<th>MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>gpm</td>
</tr>
<tr>
<td>3</td>
<td>48</td>
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<tr>
<td>4</td>
<td>110</td>
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<tr>
<td>5</td>
<td>196</td>
</tr>
<tr>
<td>6</td>
<td>314</td>
</tr>
<tr>
<td>8</td>
<td>677</td>
</tr>
<tr>
<td>10</td>
<td>1214</td>
</tr>
<tr>
<td>12</td>
<td>1953</td>
</tr>
<tr>
<td>15</td>
<td>3491</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIZE OF PIPE ((\frac{3}{8}) inch per foot slope)</th>
<th>MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>gpm</td>
</tr>
<tr>
<td>3</td>
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<tr>
<td>4</td>
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<td>6</td>
<td>222</td>
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<tr>
<td>8</td>
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<tr>
<td>10</td>
<td>860</td>
</tr>
<tr>
<td>12</td>
<td>1384</td>
</tr>
<tr>
<td>15</td>
<td>2473</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, \(\frac{1}{8}\) inch per foot = 10.4 mm/m, 1 inch per hour = 25.4 mm/h, 1 square foot = 0.0929 m\(^2\)

Notes:

1. The sizing data for horizontal piping are based on the pipes flowing full.
2. For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 inch per hour (25.4 mm/h) column by the desired rainfall rate.
### TABLE 1103.3
SIZE OF GUTTERS

#### DIAMETER OF GUTTER (1/8 inch per foot slope)

<table>
<thead>
<tr>
<th>Diameter (inches)</th>
<th>2 (in/h)</th>
<th>3 (in/h)</th>
<th>4 (in/h)</th>
<th>5 (in/h)</th>
<th>6 (in/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>340</td>
<td>226</td>
<td>170</td>
<td>136</td>
<td>113</td>
</tr>
<tr>
<td>4</td>
<td>720</td>
<td>480</td>
<td>360</td>
<td>288</td>
<td>240</td>
</tr>
<tr>
<td>5</td>
<td>1250</td>
<td>834</td>
<td>625</td>
<td>500</td>
<td>416</td>
</tr>
<tr>
<td>6</td>
<td>1920</td>
<td>1280</td>
<td>960</td>
<td>768</td>
<td>640</td>
</tr>
<tr>
<td>7</td>
<td>2760</td>
<td>1840</td>
<td>1380</td>
<td>1100</td>
<td>918</td>
</tr>
<tr>
<td>8</td>
<td>3980</td>
<td>2655</td>
<td>1990</td>
<td>1590</td>
<td>1325</td>
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<td>10</td>
<td>7200</td>
<td>4800</td>
<td>3600</td>
<td>2880</td>
<td>2400</td>
</tr>
</tbody>
</table>

#### DIAMETER OF GUTTER (1/4 inch per foot slope)

<table>
<thead>
<tr>
<th>Diameter (inches)</th>
<th>2 (in/h)</th>
<th>3 (in/h)</th>
<th>4 (in/h)</th>
<th>5 (in/h)</th>
<th>6 (in/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>480</td>
<td>320</td>
<td>240</td>
<td>192</td>
<td>160</td>
</tr>
<tr>
<td>4</td>
<td>1020</td>
<td>681</td>
<td>510</td>
<td>408</td>
<td>340</td>
</tr>
<tr>
<td>5</td>
<td>1760</td>
<td>1172</td>
<td>880</td>
<td>704</td>
<td>587</td>
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<td>1815</td>
<td>1360</td>
<td>1085</td>
<td>905</td>
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<tr>
<td>7</td>
<td>3900</td>
<td>2600</td>
<td>1950</td>
<td>1560</td>
<td>1300</td>
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<td>5600</td>
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</tr>
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<td>10 200</td>
<td>6800</td>
<td>5100</td>
<td>4080</td>
<td>3400</td>
</tr>
</tbody>
</table>

#### DIAMETER OF GUTTER (1/8 inch per foot slope)

<table>
<thead>
<tr>
<th>Diameter (inches)</th>
<th>2 (in/h)</th>
<th>3 (in/h)</th>
<th>4 (in/h)</th>
<th>5 (in/h)</th>
<th>6 (in/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
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<td>454</td>
<td>340</td>
<td>272</td>
<td>226</td>
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<td>720</td>
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<td>1000</td>
<td>834</td>
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<td>1536</td>
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<td>14 400</td>
<td>9600</td>
<td>7200</td>
<td>5750</td>
<td>4800</td>
</tr>
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</table>

#### DIAMETER OF GUTTER (1/8 inch per foot slope)

<table>
<thead>
<tr>
<th>Diameter (inches)</th>
<th>2 (in/h)</th>
<th>3 (in/h)</th>
<th>4 (in/h)</th>
<th>5 (in/h)</th>
<th>6 (in/h)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>640</td>
<td>480</td>
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<td>20 000</td>
<td>13 330</td>
<td>10 000</td>
<td>8000</td>
<td>6660</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1/8 inch per foot = 5.2 mm/m, 1 inch per hour = 25.4 mm/h, 1 square foot = 0.0929 m²
CHAPTER 12
FUEL GAS PIPING

1201.0 General.
1201.1 Applicability. The regulations of this chapter shall govern the installation of fuel gas piping in or in connection with a building, structure or within the property lines of premises up to 5 pounds-force per square inch (psi) (34 kPa) for natural gas and 10 psi (69 kPa) for undiluted propane, other than service pipe. Fuel oil piping systems shall be installed in accordance with NFPA 31.

1202.0 Coverage of Piping System.
1202.1 General. Coverage of piping systems shall extend from the point of delivery to the appliance connections. For other than undiluted liquefied petroleum gas (LP-Gas) systems, the point of delivery shall be the outlet of the service meter assembly or the outlet of the service regulator or service shutoff valve where no meter is provided. For undiluted LP-Gas systems, the point of delivery shall be considered to be the outlet of the final pressure regulator, exclusive of line gas regulators where no meter is installed. Where a meter is installed, the point of delivery shall be the outlet of the meter. [NFPA 54:1.1.1.1(A)]

1202.2 Piping System Requirements. Requirements for piping systems shall include design, materials, components, fabrication, assembly, installation, testing, inspection, operation, and maintenance. [NFPA 54:1.1.1.1(E)]

1202.3 Applications. This code chapter shall not apply to the following items:
(1) Portable LP-Gas appliances and equipment of all types that are not connected to a fixed fuel piping system.
(2) Installation of appliances such as brooders, dehydrators, dryers, and irrigation equipment used for agricultural purposes.
(3) Raw material (feedstock) applications except for piping to special atmosphere generators.
(4) Oxygen-fuel gas cutting and welding systems.
(5) Industrial gas applications using such gases as acetylene and acetylenic compounds, hydrogen, ammonia, carbon monoxide, oxygen, and nitrogen.
(6) Petroleum refineries, pipeline compressor or pumping stations, loading terminals, compounding plants, refinery tank farms, and natural gas processing plants.
(7) Large integrated chemical plants or portions of such plants where flammable or combustible liquids or gases are produced by chemical reactions or used in chemical reactions.
(8) LP-Gas installations at utility gas plants.
(9) Liquefied natural gas (LNG) installations.
(10) Proprietary items of equipment, apparatus, or instruments such as gas-generating sets, compressors, and calorimeters.
(11) LP-Gas equipment for vaporization, gas mixing, and gas manufacturing.
(12) LP-Gas piping for buildings under construction or renovations that is not to become part of the permanent building piping system—that is, temporary fixed piping for building heat.
(13) Installation of LP-Gas systems for railroad switch heating.
(14) Installation of LP-Gas and compressed natural gas (CNG) systems on vehicles.
(15) Gas piping, meters, gas pressure regulators, and other appurtenances used by the serving gas supplier in distribution of gas, other than undiluted LP-Gas.
(16) Building design and construction, except as specified herein.
(17) Fuel gas systems on recreational vehicles manufactured in accordance with NFPA 1192.
(18) LP-Gas equipment for vaporization, gas mixing, and gas manufacturing.
(19) LP-Gas piping for buildings under construction or renovation that is not to become part of the permanent building piping system—that is, temporary fixed piping for building heat.
(20) Construction of appliances. [NFPA 54:1.1.1.2]

1203.0 Inspection.
1203.1 Inspection Notification. Upon completion of the installation, alteration, or repair of gas piping, and prior to the use thereof, the Authority Having Jurisdiction shall be notified that such gas piping is ready for inspection.

1203.2 Excavation. Excavations required for the installation of underground piping shall be kept open until the piping has been inspected and approved. Where such piping is covered or concealed before such approval, it shall be exposed upon the direction of the Authority Having Jurisdiction.

1203.3 Type of Inspections. The Authority Having Jurisdiction shall make the following inspections and either shall approve that portion of the work as completed or shall notify the permit holder wherein the same fails to be in accordance with this code.

1203.3.1 Rough Piping Inspection. This inspection shall be made after gas piping authorized by the permit has been installed and before such piping has been covered or concealed or fixture or appliance has been attached thereto. This inspection shall include a determination that the gas piping size, material, and installation meet the requirements of this code.

1203.3.2 Final Piping Inspection. This inspection shall be made after piping authorized by the permit has been installed, and after portions, thereof that are to be covered or concealed are so concealed, and before fixture, appliance, or shutoff valve has been attached thereto.
1204.0 Certificate of Inspection.

1204.1 Issuance. Whereupon final piping inspection, the installation is found to be in accordance with the provisions of this code, a certificate of inspection shall be permitted to be issued by the Authority Having Jurisdiction.

1204.2 Gas Supplier. A copy of the certificate of such final piping inspection shall be issued to the serving gas supplier supplying gas to the premises.

1204.3 Unlawful. It shall be unlawful for a serving gas supplier, or person is furnishing gas, to turn on or cause to be turned on, a fuel gas or a gas meter or meters, until such certificate of final inspection, as herein provided, has been issued.

1205.0 Authority to Render Gas Service.

1205.1 Authorized Personnel. It shall be unlawful for a person, firm, or corporation, excepting an authorized agent or employee of a person, firm, or corporation engaged in the business of furnishing or supplying gas and whose service pipes supply or connect with the particular premises, to turn on or reconnect gas service in or on a premises where and when gas service is, at the time, not being rendered.

1205.2 Outlets. It shall be unlawful to turn on or connect gas in or on the premises unless outlets are securely connected to gas appliances or capped or plugged with screw joint fittings.

1206.0 Authority to Disconnect.

1206.1 Disconnection. The Authority Having Jurisdiction or the serving gas supplier is hereby authorized to disconnect gas piping or appliance or both that shall be found not to be in accordance with the requirements of this code or that are found defective and in such condition as to endanger life or property.

1206.2 Notice. Where such disconnection has been made, a notice shall be attached to such gas piping or appliance or both that shall state the same has been disconnected, together with the reasons thereof.

1206.3 Capped Outlets. It shall be unlawful to remove or disconnect gas piping or gas appliance without capping or plugging with a screw joint fitting, the outlet from which said pipe or appliance was removed. Outlets to which gas appliances are not connected shall be left capped and gastight on a piping system that has been installed, altered, or repaired.

Exception: Where an approved listed quick-disconnect device is used.

1207.0 Temporary Use of Gas.

1207.1 General. Where temporary use of gas is desired, and the Authority Having Jurisdiction deems the use necessary, a permit shall be permitted to be issued for such use for a period not to exceed that designated by the Authority Having Jurisdiction, provided that such gas piping system otherwise is in accordance with the requirements of this code regarding material, sizing, and safety.

1208.0 Gas Piping System Design, Materials, and Components.

1208.1 Installation of Piping System. Where required by the Authority Having Jurisdiction, a piping sketch or plan shall be prepared before proceeding with the installation. The plan shall show the proposed location of piping, the size of different branches, the various load demands, and the location of the point of delivery. [NFPA 54:5.1.1]

1208.1.1 Addition to Existing System. When additional appliances are being connected to a gas piping system, the existing piping shall be checked to determine whether it has adequate capacity. If the capacity of the system is determined to be inadequate for the additional appliances, the existing system shall be enlarged as required, or separate gas piping of adequate capacity shall be provided. [NFPA 54:5.1.2]

1208.2 Provision for Location of Point of Delivery. The location of the point of delivery shall be acceptable to the serving gas supplier. [NFPA 54:5.2]

1208.2.1 Interconnections Between Gas Piping Systems—Supplying Separate Users. Where two or more meters, or two or more service regulators where meters are not provided, are located on the same premises and supply separate users, the gas piping systems shall not be interconnected on the outlet side of the meters or service regulators. [NFPA 54:5.3.1–5.3.2.1]

1208.3 Interconnections for Standby Fuels. Where a supplementary gas for standby use is connected downstream from a meter or a service regulator where a meter is not provided, equipment to prevent backflow shall be installed. A three-way valve installed to admit the standby supply and at the same time shut off the regular supply shall be permitted to be used for this purpose. [NFPA 54:5.3.2.1–5.3.2.2–5.2.2.2–5.2.2.3]

1208.4 Sizing of Gas Piping Systems. Gas piping systems shall be of such size and so installed as to provide a supply of gas sufficient to meet the maximum demand and supply gas to each appliance inlet not at less than the minimum supply pressure required by the appliance. [NFPA 54:5.4.1–5.3.1]

1208.4.1–1208.3.1 Maximum Gas Demand. The volumetric flow rate of gas to be provided shall be the sum of the maximum input of the appliances served. The volumetric flow rate of gas to be provided shall be adjusted for altitude where the installation is above 2000 feet (610 m). [NFPA 54:5.4.2.1–5.4.2.2–5.3.2.1–5.3.2.2] Where the input rating is not indicated, the gas supplier, appliance manufacturer, or a qualified agency shall be contacted, or the rating from Table 1208.4.1
shall be used for estimating the volumetric flow rate of gas to be supplied.

The total connected hourly load shall be used as the basis for piping sizing, assuming all appliances are operating at full capacity simultaneously.

Exception: Sizing shall be permitted to be based upon established load diversity factors. [NFPA 54:5.3.2.3]

**TABLE 1208.4.1-1208.3.1 APPROXIMATE GAS INPUT FOR TYPICAL APPLIANCES [NFPA 54: TABLE A.5.4.2.1-A.5.3.2.1]**

<table>
<thead>
<tr>
<th>APPLIANCE</th>
<th>INPUT (Btu/h approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Space Heating Units</strong></td>
<td></td>
</tr>
<tr>
<td>Warm air furnace</td>
<td></td>
</tr>
<tr>
<td>Single family</td>
<td>100 000</td>
</tr>
<tr>
<td>Multifamily, per unit</td>
<td>60 000</td>
</tr>
<tr>
<td>Hydronic boiler</td>
<td></td>
</tr>
<tr>
<td>Single family</td>
<td>100 000</td>
</tr>
<tr>
<td>Multifamily, per unit</td>
<td>60 000</td>
</tr>
<tr>
<td><strong>Space and Water Heating Units</strong></td>
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</tr>
<tr>
<td>Hydronic boiler</td>
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</tr>
<tr>
<td>Single-family</td>
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</tr>
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<td>Multifamily, per unit</td>
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<tr>
<td><strong>Water Heating Appliances</strong></td>
<td></td>
</tr>
<tr>
<td>Water heater, automatic storage 30 to 40 gallon tank</td>
<td>35 000</td>
</tr>
<tr>
<td>Water heater, automatic storage 50 gallon tank</td>
<td>50 000</td>
</tr>
<tr>
<td>Water heater, automatic instantaneous capacity at 2 gallons per minute</td>
<td>142 800</td>
</tr>
<tr>
<td>Capacity at 4 gallons per minute</td>
<td>285 000</td>
</tr>
<tr>
<td>Capacity at 6 gallons per minute</td>
<td>428 400</td>
</tr>
<tr>
<td>Water heater, domestic, circulating or side-arm</td>
<td>35 000</td>
</tr>
<tr>
<td><strong>Cooking Appliances</strong></td>
<td></td>
</tr>
<tr>
<td>Range, freestanding, domestic</td>
<td>65 000</td>
</tr>
<tr>
<td>Built-in oven or broiler unit, domestic</td>
<td>25 000</td>
</tr>
<tr>
<td>Built-in top unit, domestic</td>
<td>40 000</td>
</tr>
<tr>
<td><strong>Other Appliances</strong></td>
<td></td>
</tr>
<tr>
<td>Refrigerator</td>
<td>3000</td>
</tr>
<tr>
<td>Clothes dryer, Type 1 (domestic)</td>
<td>35 000</td>
</tr>
<tr>
<td>Gas fireplace direct-vent</td>
<td>40 000</td>
</tr>
<tr>
<td>Gas log</td>
<td>80 000</td>
</tr>
<tr>
<td>Barbecue</td>
<td>40 000</td>
</tr>
<tr>
<td>Gaslight</td>
<td>2500</td>
</tr>
</tbody>
</table>

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

(2) Other approved engineering methods.
(42) Sizing tables included in a listed piping system manufacturer’s installation instructions.

(3) Engineering methods. [NFPA 54:5.4.2.3, 5.3.3]

**1208.4-1208.3.3 Allowable Pressure Drop.** The design pressure loss in any piping system under maximum probable flow conditions, from the point of delivery to the inlet connection of the appliance—shall be such that the supply pressure at the each appliance inlet is greater than or equal to the minimum pressure required by the appliance. [NFPA 54:5.5.4, 5.3.4]

**1208.5-1208.4 Maximum Operating Pressure in Buildings.** The maximum operating pressure for any piping systems located inside buildings shall not exceed 5 psi (34 kPa) unless one or more of the following conditions are met:

1. The piping joints are welded or brazed.
2. The piping is joined by fittings listed to ANSI LC 4/CSA 6.32 and installed according to the manufacturer’s installation instructions.
3. The piping joints are flanged and all pipe-to-flange connections are made by welding or brazing.
4. The piping is located in a ventilated chase or otherwise enclosed for protection against accidental gas accumulation.
5. The piping is located inside buildings or separate areas of buildings used exclusively for one of the following:
   a. Industrial processing or heating
   b. Research
   c. Warehousing
   d. Boiler or mechanical rooms
6. The piping is a temporary installation for buildings under construction.
7. The piping serves appliances or equipment used for agricultural purposes.
8. The piping system is an LP-Gas piping system with an operating pressure greater than 20 psi (138 kPa) and complies with NFPA 58. [NFPA 54:5.5.4.5.4.4]

**1208.5.1-1208.4.1 LP-Gas Systems Operating Below -5°F (-21°C).** LP-Gas systems designed to operate below -5°F (-21°C) or with butane or a propane-butane mix shall be designed to either accommodate liquid LP-Gas or to prevent LP-Gas vapor from condensing back into a liquid. [NFPA 54:5.5.5.5.4.5]

**1208.6-1208.5 Acceptable Piping Materials and Joining Methods.** Materials used for piping systems shall either comply with the requirements of this chapter Section 1208.5.1 through Section 1208.5.6 or be acceptable to the Authority Having Jurisdiction. [NFPA 54:5.5.5.5.1.14]

**1208.6.1-1208.5.1 Used Materials.** Pipe, fittings, valves, or other materials shall not be used again unless they are free of foreign materials and have been ascertained to be adequate for the service intended. [NFPA 54:5.5.6.1.2-5.5.1.2]
1208.6.2 Other Materials. Material not covered by the standard specifications listed herein shall meet the following criteria:

(1) Be investigated and tested to determine that it is safe and suitable for the proposed service.

(2) Be recommended for that service by the manufacturer.

(3) Be acceptable to the Authority Having Jurisdiction.

1208.6.3-1208.5.2 Metallic Pipe. Metallic pipe shall be in accordance with the Section 1208.5.2.1 through Section 1208.5.2.4.

1208.5.2.1 Cast Iron. Cast-iron pipe shall not be used. [NFPA 54:5.6.2.4-5.5.2.1]

1208.5.2.2 Steel, Stainless Steel, and Wrought-Iron Pipe. Steel, stainless steel, and wrought-iron pipe shall be at least Schedule 40 and shall comply with the dimensional standards of ASME B36.10M and one of the following:

(1) ASTM A53
(2) ASTM A106
(3) ASTM A312 [NFPA 54:5.6.2.2-5.5.2.2]

1208.5.2.3 Copper and Copper Alloy Pipe. Copper and copper alloy pipe shall not be used if the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 scf of gas (0.7 mg/100 L). Copper tubing shall comply with standard Type K or Type L of ASTM B88 or ASTM B280. [NFPA 54:5.5.3.4]

1208.5.2.4 Aluminum Alloy Pipe. Aluminum alloy pipe shall not be used in exterior locations or underground. [NFPA 54:5.6.2.5-5.5.2.5]

1208.6.3-1208.5.2.4 Aluminum Alloy Pipe. Aluminum alloy pipe shall comply with ASTM B241 (except that the use of alloy 5456 is prohibited), and shall be marked at each end of each length indicating compliance. Aluminum alloy pipe shall be coated to protect against external corrosion where it is in contact with masonry, plaster, or insulation or is subject to repeated wettings by such liquids as water, detergents, or sewage. Aluminum alloy tubing shall not be used in exterior locations or underground. [NFPA 54:5.6.2.6-5.5.2.6]

1208.6.4-1208.5.3 Metallic Tubing. Tubing shall not be used with gases corrosive to the tubing material. [NFPA 54:5.6.2.2-5.5.3.1]

1208.6.4.2-1208.5.3.1 Steel Tubing. Steel tubing shall comply with ASTM A254. [NFPA 54:5.6.3.2-5.5.3.2]

1208.6.4.1-1208.5.3.2 Stainless Steel. Stainless steel tubing shall comply with one of the following:

(1) ASTM A268
(2) ASTM A269 [NFPA 54:5.6.7.2-5.5.3.3]

1208.6.4.3-1208.5.3.3 Copper and Copper Alloy Tubing. Copper and copper alloy tubing shall not be used if the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 scf of gas (0.7 mg/100 L). Copper tubing shall comply with standard Type K or Type L of ASTM B88 or ASTM B280. [NFPA 54:5.5.3.4]

1208.6.4.4-1208.5.3.4 Aluminum Alloy Tubing. Aluminum alloy tubing shall comply with ASTM B210 or ASTM B241. Aluminum alloy tubing shall be coated to protect against external corrosion where it is in contact with masonry, plaster, or insulation or is subject to repeated wettings by such liquids as water, detergent, or sewage. Aluminum alloy tubing shall not be used in exterior locations or underground. [NFPA 54:5.6.3.5-5.5.3.5]

1208.6.4.5-1208.5.3.5 Corrugated Stainless Steel Tubing. Corrugated stainless steel tubing shall be listed in accordance with CSA LC 1. [NFPA 54:5.6.3.6-5.5.3.6]

1208.6.4-1208.5.4 Plastic Pipe, Tubing, and Fittings. Polyethylene plastic pipe, tubing, and fittings used to supply fuel gas shall conform to ASTM D2513. Pipe to be used shall be marked “gas” and “ASTM D2513.” Polyamide pipe, tubing, and fittings shall be identified in and conform to ASTM F2945. Pipe to be used shall be marked “gas” and “ASTM F2945.” Polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) plastic pipe, tubing, and fittings shall not be used to supply fuel gas. [NFPA 54:5.6.4.1.1-5.6.4.1.3]

1208.6.6-1208.5.5 Regulator Vent Piping. Plastic pipe and fittings used to connect regulator vents to remote vent terminations shall be PVC conforming to UL 651 (Schedule 40 and 80). PVC vent piping shall not be installed indoors. [NFPA 54:5.6.4.2-5.5.4.2]

1208.6.7-1208.5.6 Anodeless Risers. Anodeless risers shall comply with Section 1208.6.7.1-1208.5.6.1 through Section 1208.6.7.3-1208.5.6.3.

1208.6.7-1208.5.6.1 Factory-Assembled Anodeless Risers. Factory-assembled anodeless risers shall be recommended by the manufacturer for the gas used and shall be leak tested by the manufacturer in accordance with written procedures. [NFPA 54:5.6.4.1.1-5.6.4.1.3(1)]

1208.6.7-1208.5.6.2 Service Head Adapters and Field-Assembled Anodeless Risers. Service head adapters and field-assembled anodeless risers incorporating service head adapters shall be recommended by the manufacturer for the gas used and shall be design-certified to meet the requirements of Category I of ASTM D2513 and 49 CFR 192.281(e). The manufacturer shall provide the user qualified installation instructions as prescribed by 49 CFR 192.283(b). [NFPA 54:5.6.4.2-5.5.4.3(2)]

1208.6.7-1208.5.6.3 Undiluted Liquefied Petroleum Gas Piping. The use of plastic pipe, tubing, and fittings in undiluted LP-Gas piping sys-
tems shall be in accordance with NFPA 58. [NFPA 54:5.6.4.1(3), 5.5.4.3(3)]

1208.6.8 1208.5.7 Workmanship and Defects. Gas pipe, tubing, and fittings shall be clear and free from cutting burrs and defects in structure or threading, and shall be thoroughly brushed and chip and scale blown. Defects in pipe, tubing, and fittings shall not be repaired. Defective pipe, tubing, and fittings shall be replaced. [NFPA 54:5.6.5.5]

1208.6.9 1208.5.8 Metallic Pipe Threads. Metallic pipe and fitting threads shall be taper pipe threads and shall comply with ASME B1.20.1. [NFPA 54:5.6.6.1-5.5.6.1]

1208.6.9.1-1208.5.8.1 Damaged Threads. Pipe with threads that are stripped, chipped, corroded, or otherwise damaged shall not be used. Where a weld opens during the operation of cutting or threading, that portion of the pipe shall not be used. [NFPA 54:5.6.6.2-5.5.6.2]

1208.6.9.2-1208.5.8.2 Number of Threads. Field threading of metallic pipe shall be in accordance with Table 1208.6.9.2-1208.5.8.2. [NFPA 54:5.6.6.3-5.5.6.3]

<table>
<thead>
<tr>
<th>IRON PIPE SIZE (inches)</th>
<th>APPROXIMATE LENGTH OF THREADED PORTION (inches)</th>
<th>APPROXIMATE NUMBER OF THREADS TO BE CUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1⁄8</td>
<td>1⁄4</td>
<td>10</td>
</tr>
<tr>
<td>1⁄4</td>
<td>1⁄4</td>
<td>10</td>
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<tr>
<td>1⁄2</td>
<td>1⁄4</td>
<td>10</td>
</tr>
<tr>
<td>1⁄2</td>
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<tr>
<td>1⁄2</td>
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<td>11</td>
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<td>1</td>
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<tr>
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<td>31⁄2</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>13</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm

1208.6.9.3-1208.5.8.3 Thread Joint Compounds-Sealing. Threaded joints shall be made using a thread joint sealing material. [NFPA 54:5.5.6.4.1] Thread joint sealing materials shall be compatible with the pipe and fitting material on which the compounds are used. [NFPA 54:5.5.6.4.2] Thread joint compounds-sealing materials shall be resistant to the action of LP-Gas or to any other chemical constituents of the gases to be conducted through the piping. [NFPA 54:5.5.6.4.3]

1208.6.10-1208.5.9 Metallic Piping Joints and Fittings. The type of piping joint used shall be suitable for the pressure and temperature conditions and shall be selected giving consideration to joint tightness and mechanical strength under the service conditions. The joint shall be able to sustain the maximum end force due to the internal pressure and any additional forces due to temperature expansion or contraction, vibration, fatigue, or the weight of the pipe and its contents. [NFPA 54:5.6.7-5.5.7]

1208.6.10.1-1208.5.9.1 Pipe Joints. Schedule 40 and heavier pipe joints shall be threaded, flanged, brazed, welded, or assembled with press-connect fittings listed to CSA LC 4.

1. Where nonferrous pipe is brazed, the brazing materials shall have a melting point in excess of 1000°F (538°C).

2. Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.6.7.1-5.5.7.1]

1208.6.10.2-1208.5.9.2 Copper Tubing Joints. Copper tubing joints shall be assembled with approved gas tubing fittings, shall be brazed with a material having a melting point in excess of 1000°F (538°C), or shall be assembled with press-connect fittings listed to CSA LC 4. Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys shall not contain more than 0.05 percent phosphorus. [NFPA 54:5.6.7.2-5.5.7.2]

1208.6.10.3-1208.5.9.3 Stainless Steel Tubing Joints. Stainless steel joints shall be welded, assembled with approved tubing fittings, brazed with a material having a melting point in excess of 1000°F (538°C), or assembled with press-connect fittings listed to CSA LC 4. Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems. Brazing alloys and fluxes shall be recommended by the manufacturer for use on stainless steel alloys. [NFPA 54:5.6.7.3-5.5.7.3]

1208.6.10.4-1208.5.9.4 Flared Joints. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing where experience or tests have demonstrated that the joint is suitable for the conditions and where provisions are made in the design to prevent separation of the joints. [NFPA 54:5.6.7.4-5.5.7.4]

1208.6.10.5-1208.5.9.5 Metallic Pipe Fittings. Metallic fittings shall comply with the following:

1. Threaded fittings in sizes larger than 4 inches (100 mm) shall not be used.

2. Fittings used with steel, stainless steel, or wrought-iron pipe shall be steel, stainless steel, copper alloy, malleable iron, or cast iron.

3. Fittings used with copper or copper alloy pipe shall be copper or copper alloy.

4. Fittings used with aluminum alloy pipe shall be aluminum alloy.

5. Cast-iron fittings shall comply with the following:
1208.6.11—1208.5.10 Plastic Piping, Joints, and Fittings. Plastic pipe, tubing, and fittings shall be joined in accordance with the manufacturer’s instructions. Section 1208.6.11—1208.5.10.1 through Section 1208.6.11.4—1208.5.10.4 shall be observed when making such joints. [NFPA 54:5.6.8(4)—5.5.7.5]

1208.6.11.1—1208.5.10.1 Joint Design. The joint shall be designed and installed so that the longitudinal pullout resistance of the joint will be at least equal to the tensile strength of the plastic piping material. [NFPA 54:5.6.8(4)—5.5.8(1)]

1208.6.11.2—1208.5.10.2 Heat-Fusion Joint. Heat-fusion joints shall be made in accordance with qualified procedures that have been established and proven by test to produce gastight joints at least as strong as the pipe or tubing being joined. Joints shall be made with the joining method recommended by the pipe manufacturer. Polyethylene heat-fusion fittings shall be marked “ASTM D2513.” Polyamide heat-fusion fittings shall be marked “ASTM F2945.” [NFPA 54:5.6.8(2)—5.5.8(2)]

1208.6.11.3—1208.5.10.3 Compression-Type Mechanical Joints. Where compression-type mechanical joints are used, the gasket material in the fitting shall be compatible with the plastic piping and with the gas distributed by the system. An internal tubular rigid stiffener shall be used in conjunction with the fitting. The stiffener shall be flush with the end of the pipe or tubing and shall extend at least to the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force fit in the plastic. Split tubular stiffeners shall not be used. [NFPA 54:5.6.8(3)—5.5.8(3)]

1208.6.12—1208.5.11 Flange Specification. Flanges shall comply with Section 1208.6.12—1208.5.11.1 through Section 1208.6.12.7—1208.5.11.7.

1208.6.12.1—1208.5.11.1 Cast Iron Flanges. Cast iron flanges shall be in accordance with ASME B16.1. [NFPA 54:5.6.9.1.1—5.5.9.1.1]

1208.6.12.2—1208.5.11.2 Steel Flanges. Steel flanges shall be in accordance with the following:

1. ASME B16.5
2. ASME B16.47. [NFPA 54:5.6.9.1.2—5.5.9.1.2]

1208.6.12.3—1208.5.11.3 Non-Ferrous Flanges. Non-ferrous flanges shall be in accordance with ASME B16.24. [NFPA 54:5.6.9.1.3—5.5.9.1.3]

1208.6.12.4—1208.5.11.4 Ductile Iron Flanges. Ductile iron flanges shall be in accordance with ASME B16.42. [NFPA 54:5.6.9.1.4—5.5.9.1.4]

1208.6.12.5—1208.5.11.5 Dissimilar Flange Connections. Raised-face flanges shall not be joined to flat-faced cast iron, ductile iron or nonferrous material flanges. [NFPA 54:5.6.9.2—5.5.9.2]

1208.6.12.6—1208.5.11.6 Flange Facings. Standard facings shall be permitted for use under this code. Where 150 psi (1034 kPa) steel flanges are bolted to Class 125 cast-iron flanges, the raised face on the steel flange shall be removed. [NFPA 54:5.6.9.3—5.5.9.3]

1208.6.12.7—1208.5.11.7 Lapped Flanges. Lapped flanges shall be used only aboveground or in exposed locations accessible for inspection. [NFPA 54:5.6.9.4—5.5.9.4]
1208.6.13-1208.5.12 Flange Gaskets. The material for gaskets shall be capable of withstanding the design temperature and pressure of the piping system and the chemical constituents of the gas being conducted without change to its chemical and physical properties. The effects of fire exposure to the joint shall be considered in choosing the material. [NFPA 54:5.6.10.5.5.10]

1208.6.13.4-1208.5.12.1 Flange Gasket Materials. Acceptable materials shall include the following:
(1) Metal (plain or corrugated)
(2) Composition
(3) Aluminum “O” rings
(4) Spiral-wound metal gaskets
(5) Rubber-faced phenolic
(6) Elastomeric [NFPA 54:5.6.10.5.5.10.1]

1208.6.13.2-1208.5.12.2 Metallic Flange Gaskets. Metallic flange gaskets shall be in accordance with ASME B16.20. [NFPA 54:5.6.10.2.4.5.5.10.2.1]

1208.6.13.1-1208.5.12.3 Non-Metallic Flange Gaskets. Non-metallic flange gaskets shall be in accordance with ASME B16.21. [NFPA 54:5.6.10.2.2.5.5.10.2.2]

1208.6.13.4-1208.5.12.4 Full-Face Flange Gasket. Full-face flange gaskets shall be used with all non-steel flanges. [NFPA 54:5.6.10.5.5.10.3]

1208.6.13.5-1208.5.12.5 Separated Flanges. When a flanged joint is separated, the gasket shall be replaced. [NFPA 54:5.6.10.4.5.5.10.4]

1208.7-1208.6 Gas Meters. Gas meters shall be selected for the maximum expected pressure and permissible pressure drop. [NFPA 54:5.5.7.4.5.6.1]

1208.7.1-1208.6.1 Location. Gas meters shall be located in ventilated spaces readily accessible for examination, reading, replacement, or necessary maintenance. [NFPA 54:5.7.2.1.5.6.2.1]

1208.7.1.1-1208.6.1.1 Subject to Protection from Damage. Gas meters shall not be placed where they will be subjected to damage, such as adjacent to a driveway, under a fire escape, in public passages, halls, or where they will be subject to excessive corrosion or vibration. [NFPA 54:5.6.2.2.5.5.6.2.2]

1208.7.1.2-1208.6.1.2 Extreme Temperatures. Gas meters shall not be located where they will be subjected to extreme temperatures or sudden extreme changes in temperature or in areas where they are subjected to temperatures beyond those recommended by the manufacturer. [NFPA 54:5.6.2.3.5.6.2.3]

1208.7.2-1208.6.2 Supports. Gas meters shall be supported or connected to rigid piping so as not to exert a strain on the meters. Where flexible connectors are used to connect a gas meter to downstream piping at mobile homes in mobile home parks, the meter shall be supported by a post or bracket placed in a firm footing or by other means providing equivalent support. [NFPA 54:5.6.7.3.5.5.6.3]

1208.7.3-1208.6.3 Meter Protection. Meters shall be protected against overpressure, backpressure, and vacuum. [NFPA 54:5.7.4.5.6.4]

1208.7.4-1208.6.4 Identification. Gas piping at multiple meter installations shall be marked by a metal tag or other permanent means designating the building or the part of the building being supplied and attached by the installing agency. [NFPA 54:5.7.5.5.6.5]

1208.8-1208.7 Gas Pressure Regulators. A line pressure regulator shall be installed where the gas supply pressure exceeds the maximum allowable inlet pressure of the appliance served. [NFPA 54:5.8.4.5.7.1]

1208.8.1-1208.7.1 Listing. Line pressure regulators shall be listed in accordance with CSA Z21.80 where the outlet pressure is set to 2 psi (14 kPa) or less. [NFPA 54:5.8.2.5.7.2]

1208.8.2-1208.7.2 Location. The gas pressure regulator shall be accessible for servicing. [NFPA 54:5.8.3.5.7.3]

1208.8.3-1208.7.3 Regulator Protection. Pressure regulators shall be protected against physical damage. [NFPA 54:5.8.4.5.7.4]

1208.8.4-1208.7.4 Venting of Line Pressure Regulators. Regulator vents. Regulator vents shall be in accordance with Section 1208.15. [NFPA 54:5.7.5] Line pressure regulators shall comply with all of the following:
(a) An independent vent to the exterior of the building, sized in accordance with the regulator manufacturer’s instructions, shall be provided where the location of a regulator is such that a ruptured diaphragm will cause a hazard.
(b) Where more than one regulator is at a location, each regulator shall have a separate vent to the outdoors or, if approved by the Authority Having Jurisdiction, the vent lines shall be permitted to be manifolded in accordance with accepted engineering practices to minimize back pressure in the event of diaphragm failure.
(c) Materials for vent piping shall be in accordance with Section 1208.6 through Section 1208.6.13.5.

Exception: A regulator and vent limiting means combination listed as complying with CSA Z21.80 shall be permitted to be used without a vent to the outdoors.

(2) The vent shall be designed to prevent the entry of water, insects, or other foreign material that could cause blockage.
(3) The regulator vent shall terminate at least 3 feet (914 mm) from a source of ignition.
(4) At locations where regulators might be submerged during floods, a special anti-flood type breather vent fitting shall be installed, or the vent line shall be extended above the height of the expected flood waters.

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1208.8 Overpressure Protection Required.
Where the serving gas supplier delivers gas at a pressure greater than 2 psi (14 kPa) for piping systems serving appliances designed to operate at a gas pressure of 14 inches water column (3.5 kPa) or less, overpressure protection devices shall be installed. Piping systems serving equipment designed to operate at inlet pressures greater than 14 inches water column (3.5 kPa) shall be equipped with overpressure protection devices as required by the appliance manufacturer’s installation instructions. [NFPA 54:5.8.1]

1208.10 Overpressure Protection Devices.
Overpressure protection devices shall be one of the following:
(1) Pressure relief valve.
(2) Monitor regulator.
(3) Series regulator installed upstream from the line regulator and set to continuously limit the pressure on the inlet of the line regulator to the maximum values specified by Section 1208.11 or less.
(4) Automatic shutoff device installed in series with the line pressure regulator and set to shut off when the pressure on the downstream piping system reaches the maximum values specified by Section 1208.11 or less. This device shall be designed so that it will remain closed until manually reset. [NFPA 54:5.8.4]

1208.10.1 Separate Devices. The devices in Section 1208.10 shall be installed either as an integral part of the service or line pressure regulator or as separate units. Where separate overpressure protection devices are installed, they shall comply with Section 1208.10.2 through Section 1208.10.7. [NFPA 54:5.8.3.2]

1208.10.2 Construction and Installation. All overpressure protection devices shall meet the following requirements:
(1) Be constructed of materials so that the operation of the device is not impaired by corrosion of external parts by the atmosphere or of internal parts by the gas.
(2) Be designed and installed so they can be operated to determine whether the valve is free. The devices shall also be designed and installed so they can be tested to determine the pressure at which they operate and be examined for leakage when in the closed position. [NFPA 54:5.8.4]

1208.10.3 External Control Piping. External control piping shall be designed and installed so that damage to the control piping of one device does not render both the regulator and the overpressure protective device inoperative. [NFPA 54:5.8.5]

1208.10.4 Setting. Each pressure limiting or pressure relieving device shall be set so that the gas pressure supplied to the connected appliance(s) does not exceed the limits specified in Section 1208.11 or Section 1208.10.1. [NFPA 54:5.8.6]

1208.10.5 Unauthorized Operation. Where unauthorized operation of any shutoff valve could render a pressure relieving valve or pressure limiting device inoperative, one of the following shall be accomplished:
(1) The valve shall be locked in the open position. Instruct authorized personnel in the importance of leaving the shutoff valve open and of being present while the shutoff valve is closed so that it can be locked in the open position before leaving the premises.
(2) Duplicate relief valves shall be installed, each having adequate capacity to protect the system, and arrange the isolating valves or three-way valve so that only one relief valve can be rendered inoperative at a time. [NFPA 54:5.8.7]

1208.10.6 Discharge of Vents. The discharge stacks, vents, or outlet parts of all pressure relieving and pressure limiting devices shall be located so that gas is safely discharged to the outdoors. Discharge stacks or vents shall be designed to prevent the entry of water, insects, or other foreign material that could cause blockage.

The discharge stack or vent line shall be at least the same size as the outlet of the pressure relieving device. [NFPA 54:5.8.8]

1208.10.7 Size of Fittings, Pipe, and Openings. The fittings, pipe, and openings located between the system to be protected and the pressure relieving device shall be sized to prevent hammering of the valve and to prevent impairment of relief capacity. [NFPA 54:5.8.9]

1208.11 Pressure Limitation Requirements.
Where piping systems serving appliances designed to operate with a gas supply pressure greater than 14 inches water column (3.5 kPa) are required to be equipped with overpressure protection by Section 1208.9, each overpressure protection device shall be adjusted to limit the gas pressure to each connected appli-
An independent vent pipe to the outdoors, sized in accordance with the appliance manufacturer’s installation instructions. [NFPA 54:5.10.2.5.9.2.2]

**1208.11.2 – 1208.10.2 Overpressure Protection Devices.** Each overpressure protection device installed to meet the requirements of this section shall be capable of limiting the pressure to its connected appliance(s) as required by this section independently of any other pressure control equipment in the piping system. [NFPA 54:5.9.2.3–5.8.2.3]

**1208.11.3 – 1208.10.3 Detection of Failure.** Each gas piping system for which an overpressure protection device is required by this section shall be designed and installed so that a failure of the primary pressure control device(s) is detectable. [NFPA 54:5.9.2.4–5.8.2.4]

**1208.11.4 – 1208.10.4 Flow Capacity.** If a pressure relief valve is used to meet the requirements of this section, it shall have a flow capacity such that the pressure in the protected system is maintained at or below the limits specified in Section 1208.11–1208.10 under the following conditions:

1. The line pressure regulator for which the relief valve is providing overpressure protection has failed wide open.
2. The gas pressure at the inlet of the line pressure regulator for which the relief valve is providing overpressure protection is not less than the regulator's normal operating inlet pressure. [NFPA 54:5.9.2.5–5.8.2.5]

**1208.12 – 1208.11 Backpressure Protection.** Protective devices shall be installed as close to the equipment as practical where the design of equipment connected is such that air, oxygen, or standby gases could be forced into the gas supply system.

Gas and air combustion mixers incorporating double diaphragm “zero” or “atmospheric” governors or regulators shall require no further protection unless connected directly to compressed air or oxygen at pressures of 5 psi (34 kPa) or more. [NFPA 54:5.10.1.1–5.10.1.2–5.9.1.1–5.9.1.2]

**1208.12.1 – 1208.11.1 Protective Devices.** Protective devices shall include but not be limited to the following:

1. Check valves.
2. Three-way valves (of the type that completely closes one side before starting to open the other side).
3. Reverse flow indicators controlling positive shutoff valves.
4. Normally closed air-actuated positive shutoff pressure regulators. [NFPA 54:5.10.2.5.9.2]

**1208.13 – 1208.12 Low-Pressure Protection.** A protective device shall be installed between the meter and the appliance or equipment if the operation of the appliance or equipment is such that it could produce a vacuum or a dangerous reduction in gas pressure at the meter. Such protective devices include, but are not limited to, mechanical, diaphragm-operated, or electrically operated low-pressure shutoff valves. [NFPA 54:5.14–5.10]

**1208.14 – 1208.13 Shutoff Valves.** Shutoff valves shall be approved and shall be selected giving consideration to pressure drop, service involved, emergency use, and reliability of operation in accordance with Table 1208.13. Shutoff valves of size 1 inch (25 mm) National Pipe Thread and smaller shall be listed and labeled. Where used outdoors, such use shall be in accordance with the manufacturer’s recommendation. [NFPA 54:5.14–5.11]

**Table 1208.13**

<table>
<thead>
<tr>
<th>Shutoff Valve Application</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliance shutoff valve up to ½ psi</td>
<td>ANSI/ASME B16.44</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32</td>
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<td>Valve up to ½ psi</td>
<td>ANSI/ASME B16.44</td>
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<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td></td>
<td>ANSI LC 4/CSA 6.32</td>
</tr>
<tr>
<td>Valve up to 2 psi</td>
<td>ANSI/ASME B16.44 labeled 2G</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td>Valve up to 5 psi</td>
<td>ANSI LC 4/CSA 6.32 with ANSI/ASME B16.44 labeled 2G or labeled 5G</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33 marked 125 G</td>
</tr>
<tr>
<td>Valve up to 125 psi</td>
<td>ANSI/ASME B16.44 labeled 5G</td>
</tr>
<tr>
<td></td>
<td>ANSI/ASME B16.33</td>
</tr>
</tbody>
</table>

For SI Units: 1 pound-force per square inch = 6.8947 kPa

**1208.15 – 1208.14 Expansion and Flexibility.** Piping systems shall be designed to prevent failure from thermal expansion or contraction. [NFPA 54:5.14–5.13.1]

**1208.15.1 – 1208.14.1 Special Local Conditions.** Where local conditions include earthquake, tornado, unstable ground, or flood hazards, special consideration shall be given to increased strength and flexibility of piping supports and connections. [NFPA 54:5.14–5.13.2]

**1208.15 Pressure Regulator and Pressure Control Venting.** The venting of the atmospheric side of diaphragms in line pressure regulators, gas appliance regulators, and gas pressure limit controls shall be in accordance with all of the following:

1. An independent vent pipe to the outdoors, sized in accordance with the device manufacturer’s instructions, shall be provided where the location of a device is such that a
discharge of fuel gas will cause a hazard. For devices other than appliance regulators, vents are not required to be independent where the vents are connected to a common manifold designed in accordance with engineering methods to minimize backpressure in the event of diaphragm failure and such design is approved.

Exceptions:

(1) A regulator and vent limiting means combination listed as complying with ANSI Z21.80/CSA 6.22 shall not be required to be vented to the outdoors.

(2) A listed gas appliance regulator factory equipped with a vent limiting device is not required to be vented to the outdoors.

(2) Materials for vent piping shall be in accordance with Section 1208.5 through Section 1208.5.12.5.

(3) The vent terminus shall be designed to prevent the entry of water, insects, and other foreign matter that could cause blockage.

(4) Vent piping shall be installed to minimize static loads and bending moments placed on the regulators and gas pressure control devices.

(5) Vents shall terminate not less than 3 feet (914 mm) from a possible source of ignition.

(6) At locations where a vent termination could be submerged during floods or snow accumulations, an anti-flood-type breather vent fitting shall be installed, or the vent terminal shall be located above the height of the expected flood waters or snow.

(7) Vent piping from pressure regulators and gas pressure control devices shall not be connected to a common manifold that serves a bleed line from a diaphragm-type gas valve.

[NFPA 54:5.14]

1209.0 Excess Flow Valve.

1209.1 General. Where automatic excess flow valves are installed, they shall be listed in accordance with CSA-ANSI Z21.93/CSA 6.30 and shall be sized and installed in accordance with the manufacturer’s instructions. [NFPA 54:7.1.14 – 7.1.12]

1210.0 Gas Piping Installation.

1210.1 Piping Underground. Underground gas piping shall be installed with sufficient clearance from any other underground structure to avoid contact therewith, to allow maintenance, and to protect against damage from proximity to other structures. In addition, underground plastic piping shall be installed with sufficient clearance or shall be insulated from any source of heat so as to prevent the heat from impairing the serviceability of the pipe. [NFPA 54:7.1.1.1 – 7.1.1.2]

1210.1.1 Cover Requirements. Underground piping systems shall be installed with a minimum of 12 inches (305 mm) of cover. The minimum cover shall be increased to 18 inches (457 mm) if external damage to the pipe or tubing from external forces is likely to result. Where a minimum of 12 inches (305 mm) of cover cannot be provided, the piping shall be installed in conduit or bridged (shielded). [NFPA 54:7.1.2.1 – 7.1.2.1(B)]

1210.1.2 Trenches. The trench shall be graded so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. [NFPA 54:7.1.2.2]

1210.1.2.1 Backfilling. Where flooding of the trench is done to consolidate the backfill, care shall be exercised to see that the pipe is not floated from its firm bearing on the trench bottom. [NFPA 54:7.1.2.3]

1210.1.3 Protection Against Corrosion. Steel pipe and steel tubing installed underground shall be installed in accordance with Section 1210.1.3.1 through Section 1210.1.3.9. [NFPA 54:7.1.3]

1210.1.3.1 Zinc Coating. Zinc coating (galvanizing) shall not be deemed adequate protection for underground gas piping. [NFPA 54:7.1.3.1]

1210.1.3.2 Underground Piping. Underground piping shall comply with one or more of the following unless approved technical justification is provided to demonstrate that protection is unnecessary:

(1) The piping shall be made of corrosion-resistant material that is suitable for the environment in which it will be installed.

(2) Pipe shall have a factory-applied, electrically insulating coating. Fittings and joints between sections of coated pipe shall be coated in accordance with the coating manufacturer’s instructions.

(3) The piping shall have a cathodic protection system installed, and the system shall be maintained in accordance with Section 1210.1.3.3 or Section 1210.1.3.6. [NFPA 54:7.1.3.2]

1210.1.3.3 Cathodic Protection. Cathodic protection systems shall be monitored by testing and the results shall be documented. The test results shall demonstrate one of the following:

(1) A pipe-to-soil voltage of −0.85 volts or more negative is produced, with reference to a saturated copper-copper sulfate half cell.

(2) A pipe-to-soil voltage of −0.78 volts or more negative is produced, with reference to a saturated KCl calomel half cell.

(3) A pipe-to-soil voltage of −0.80 volts or more negative is produced, with reference to a silver-silver chloride half cell.

(4) Compliance with a method described in Appendix D of Title 49 of the code of Federal Regulations, Part 192. [NFPA 54:7.1.3.3]

1210.1.3.4 Sacrificial Anodes. Sacrificial anodes shall be tested in accordance with the following:

(1) Upon installation of the cathodic protection system, except where prohibited by climatic conditions, in which case the testing shall be performed not later than 180 days after the installation of the system.

(2) 12 to 18 months after the initial test.

(3) Upon successful verification testing in accordance with Section 1210.1.3.4(1) and Section
1210.1.3.4(2), periodic follow-up testing shall be performed at intervals not to exceed 36 months. [NFPA 54:7.1.3.4]

1210.1.3.5 System Failing Tests. Systems failing a test shall be repaired not more than 180 days after the date of the failed testing. The testing schedule shall be restarted as required in Section 1210.1.3.4(1) and Section 1210.1.3.4(2), and the results shall comply with Section 1210.1.3.3. [NFPA 54:7.1.3.5]

1210.1.3.6 Impressed Current Cathodic Protection. Impressed current cathodic protection systems shall be inspected and tested in accordance with the following schedule:

(1) The impressed current rectifier voltage output shall be checked at intervals not exceeding two months.

(2) The pipe-to-soil voltage shall be tested at least annually. [NFPA 54:7.1.3.6]

1210.1.3.7 Documentation. Documentation of the results of the two most recent tests shall be retained. [NFPA 54:7.1.3.7]

1210.1.3.8 Dissimilar Metals. Where dissimilar metals are joined underground, an insulating coupling or fitting shall be used. [NFPA 54:7.1.3.8]

1210.1.3.9 Steel Risers. Steel risers, other than anodeless risers, connected to plastic piping shall be cathodically protected by means of a welded anode. [NFPA 54:7.1.3.9]

1210.1.4 Protection Against Freezing. Where the formation of hydrates or ice is known to occur, piping shall be protected against freezing. [NFPA 54:7.1.4]

1210.1.5 Piping through Foundation Wall. Piping through a foundation wall shall comply with all of the following:

(1) Underground piping, where installed through the outer foundation or basement wall of a building, shall be encased in a protective sleeve or protected by an approved device or method.

(2) The spaces between the gas piping and the sleeve and between the sleeve and the wall shall be sealed to prevent entry of gas and water.

(3) Sealing materials shall be compatible with the piping and sleeve. [NFPA 54:7.1.5]

1210.1.6 Piping Underground Beneath Buildings. Where gas piping is installed underground beneath buildings, the piping shall be either of the following:

(1) Encased in an approved conduit designed to withstand the imposed loads and installed in accordance with Section 1210.1.6.1 or Section 1210.1.6.2.

(2) A piping/encasement system listed for installation beneath buildings. [NFPA 54:7.1.6]

1210.1.6.1 Conduit with One End Terminating Outdoors. The conduit shall extend into an accessible portion of the building and, at the point where the conduit terminates in the building, the space between the conduit and the gas piping shall be sealed to prevent the possible entrance of any gas leakage. Where the end sealing is of a type that retains the full pressure of the pipe, the conduit shall be designed for the same pressure as the pipe. The conduit shall extend at least 4 inches (102 mm) outside the building, be vented outdoors above finished ground level, and be installed so as to prevent the entrance of water and insects. [NFPA 54:7.1.6.1]

1210.1.6.2 Conduit with Both Ends Terminating Indoors. Where the conduit originates and terminates within the same building, the conduit shall originate and terminate in an accessible portion of the building and shall not be sealed. [NFPA 54:7.1.6.2]

1210.1.7 Connections of Plastic Piping. Plastic piping shall be installed outdoors, underground only.

Exceptions:

(1) Plastic piping shall be permitted to terminate aboveground where an anodeless riser is used.

(2) Plastic piping shall be permitted to terminate with a wall head adapter aboveground in buildings, including basements, where the plastic piping is inserted in a piping material permitted for use in buildings. [NFPA 54:7.1.7.1]

1210.1.7.1 Connections Between Metallic and Plastic Piping. Connections made between metallic and plastic piping shall be made with fittings conforming to one of the following:

(1) ASTM D2513, Category I transition fittings

(2) ASTM F1973

(3) ASTM F2509 [NFPA 54:7.1.7.2]

1210.1.7.2 Tracer Wire. An electrically continuous corrosion-resistant tracer shall be buried with the plastic pipe to facilitate locating. The tracer shall be one of the following:

(1) A product specifically designed for that purpose.

(2) Insulated copper conductor not less than 14 AWG.

Where tracer wire is used, access shall be provided from aboveground, or one end of the tracer wire or tape shall be brought aboveground at a building wall or riser. [NFPA 54:7.1.7.3 – 7.1.7.3.2]

1210.2 CSST Piping Systems. CSST piping systems shall be installed in accordance with this code and the manufacturer’s installation instructions. [NFPA 54:7.1.8]

1210.3 Installation of Aboveground Piping. Piping installed aboveground shall comply with all of the following:

(1) Piping shall be securely supported and located where it will be protected from physical damage.

(2) Where passing through an exterior wall, the piping shall also be protected from corrosion by coating or wrapping with an inert material approved for such applications.

(3) The piping shall be sealed around its circumference at the point of the exterior penetration to prevent the entry of water, insects, and rodents.
Where piping is encased in a protective pipe sleeve, the annular spaces between the gas piping and the sleeve and between the sleeve and the wall opening shall be sealed.

Piping installed outdoors shall be elevated not less than 3½ inches (89 mm) above the ground.

Sealing materials shall be compatible with the piping and sleeve. [NFPA 54:7.2.1]

1210.3.1 Protective Coating. Where piping is in contact with a material or an atmosphere corrosive to the piping system, the piping and fittings shall be coated with a corrosion-resistant material. Any such coating used on piping or components shall not be considered as adding strength to the system. [NFPA 54:7.2.2]

1210.3.2 Building Structure. The installation of gas piping shall not cause structural stresses within building components to exceed allowable design limits. Approval shall be obtained before any beams or joists are cut or notched. [NFPA 54:7.2.3.1 – 7.2.3.2]

1210.3.3 Gas Piping to be Sloped. Piping for other than dry gas conditions shall be sloped not less than 1/8 inch in 15 feet (6.4 mm in 4.6 m) to prevent traps. [NFPA 54:7.2.4]

1210.3.3.1 Ceiling Locations. Gas piping shall be permitted to be installed in accessible spaces between a fixed ceiling and a dropped ceiling, whether or not such spaces are used as a plenum. Valves shall not be located in such spaces.

Exception: Appliance or equipment shutoff valves required by this code shall be permitted to be installed in accessible spaces containing vented appliances.

1210.3.4 Prohibited Locations. Gas piping inside any building shall not be installed in or through a clothes chute, chimney or gas vent, dumbwaiter, elevator shaft, or air duct, other than combustion air ducts. [NFPA 54:7.2.5]

Exception: Ducts used to provide ventilation air in accordance with Section 506.0 or to above-ceiling spaces in accordance with Section 1210.3.3.1.

1210.3.5 Hangers, Supports, and Anchors. Piping shall be supported with metal pipe hooks, metal pipe straps, metal bands, metal brackets, metal hangers, or building structural components, suitable for the size of piping, of adequate strength and quality, and located at intervals so as to prevent or damp out excessive vibration. Piping shall be anchored to prevent undue strains and supported by other piping. Pipe hangers and supports shall conform to the requirements of MSS SP-58. [NFPA 54:7.2.6.1]

1210.3.5.1 Spacing. Spacing of supports in gas piping installations shall not be greater than shown in Table 1210.3.5.1. Spacing of supports of CSST shall be in accordance with the CSST manufacturer’s instructions. [NFPA 54:7.2.6.2]

1210.3.5.2 Expansion and Contraction. Supports, hangers, and anchors shall be installed so as not to interfere with the free expansion and contraction of the piping between anchors. All parts of the supporting system shall be designed and installed so they are not disengaged by movement of the supported piping. [NFPA 54:7.2.6.3]

1210.3.5.3 Piping on Roofs. Gas piping installed on the roof surfaces shall be elevated above the roof surface and shall be supported in accordance with Table 1210.3.5.1. Gas piping shall be elevated not less than 3½ inches (89 mm) above the roof surface. [NFPA 54:7.2.6.4.1, 7.2.6.4.2]

1210.4 Concealed Piping in Buildings. Gas piping in concealed locations shall be installed in accordance with this section. [NFPA 54:7.3.1]

1210.4.1 Connections. Where gas piping is to be concealed, connections shall be of the following type:

(1) Pipe fittings such as elbows, tees, couplings, and right/left nipple/couplings.

(2) Joining tubing by brazing (see Section 1208.6.10.1 1208.5.9.1).

(3) Press-connect fittings listed to CSA LC 4.

(4) CSST fittings listed to CSA LC 1.

(5) Where necessary to insert fittings into a gas pipe system that has been installed in a concealed location, the pipe shall be reconnected by welding, flanges, or the use of a right/left nipple/coupling.

1210.4.2 Piping in Partitions. Concealed gas piping shall not be located in solid partitions. [NFPA 54:7.3.3]

1210.4.3 Tubing in Partitions. This provision shall not apply to tubing that pierces walls, floors, or partitions. Tubing installed vertically and horizontally inside hollow walls or partitions without protection along its entire concealed length shall meet the following requirements:

(1) A steel striker barrier not less than 0.0508 of an inch (1.3 mm) thick, or equivalent, is installed between the tubing and the finished wall and extends at least 4 inches (102 mm) beyond concealed penetrations of plates, firestops, wall studs, and so on.

(2) The tubing is installed in single runs and is not rigidly secured. [NFPA 54:7.3.4]
1210.4.4 Piping in Floors—Industrial Occupancies. In industrial occupancies, gas piping in solid floors such as concrete shall be laid in channels in the floor and covered to permit access to the piping with a minimum of damage to the building. Where piping in floor channels could be exposed to excessive moisture or corrosive substances, the piping shall be protected in an approved manner. [NFPA 54:7.3.5.1] 1210.4.5 Other Occupancies. In other than industrial occupancies and where approved by the Authority Having Jurisdiction, gas piping embedded in concrete floor slabs constructed with portland cement shall be surrounded with a minimum of 1/2 inches (38 mm) of concrete and shall not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. All piping, fittings, and risers shall be protected against corrosion in accordance with Section 1210.3.1. Piping shall not be embedded in concrete slabs containing quick set additives or cinder aggregate. [NFPA 54:7.3.5.1 – 7.3.5.2] 1210.5 Piping in Vertical Chases. Where gas piping exceeding 5 psi (34 kPa) is located within vertical chases in accordance with Section 1208.5(3)–1208.4(4), the requirements of Section 1210.5.1 through Section 1210.5.3 shall apply. [NFPA 54:7.4] 1210.5.1 Pressure Reduction. Where pressure reduction is required in branch connections for compliance with Section 1208.5–1208.4, such reduction shall take place either inside the chase or immediately adjacent to the outside wall of the chase. Regulator venting and downstream overpressure protection shall comply with Section 1208.4.1, Section 1208.8.5 and Section 1208.9–1208.11.4 through Section 1208.10.4. The regulator shall be accessible for service and repair and vented in accordance with one of the following:

1. Where the fuel gas is lighter than air, regulators equipped with a vent limiting means shall be permitted to be vented into the chase. Regulators not equipped with a vent limiting means shall be permitted to be vented either directly to the outdoors or to a point within the top 1 foot (305 mm) of the chase.

2. Where the fuel gas is heavier than air, the regulator vent shall be vented only directly to the outdoors. [NFPA 54:7.4.1] 1210.5.2 Chase Construction. Chase construction shall comply with local building codes with respect to fire resistance and protection of horizontal and vertical openings. [NFPA 54:7.4.2] 1210.5.3 Ventilation. A chase shall be ventilated to the outdoors and only at the top. The opening(s) shall have a minimum free area [in square inches (square meters)] equal to the product of one-half of the maximum pressure in the piping [in pounds per square inch (kilopascals)] times the largest nominal diameter of that piping [in inches (millimeters)], or the cross-sectional area of the chase, whichever is smaller. Where more than one fuel gas piping system is present, the free area for each system shall be calculated and the largest area used. [NFPA 54:7.4.3] 1210.6 Gas Pipe Turns. Changes in direction of gas pipe shall be made by the use of fittings, factory bends, or field bends. [NFPA 54:7.5] 1210.6.1 Metallic Pipe. Metallic pipe bends shall comply with the following:

1. Bends shall be made only with bending tools and procedures intended for that purpose.

2. All bends shall be smooth and free from buckling, cracks, or other evidence of mechanical damage.

3. The longitudinal weld of the pipe shall be near the neutral axis of the bend.

4. Pipe shall not be bent through an arc of more than 90 degrees.

5. The inside radius of a bend shall be not less than 6 times the outside diameter of the pipe. [NFPA 54:7.5.1] 1210.6.2 Plastic Pipe. Plastic pipe bends shall comply with the following:

1. The pipe shall not be damaged, and the internal diameter of the pipe shall not be effectively reduced.

2. Joints shall not be located in pipe bends.

3. The radius of the inner curve of such bends shall not be less than 25 times the inside diameter of the pipe.

4. Where the piping manufacturer specifies the use of special bending tools or procedures, such tools or procedures shall be used. [NFPA 54:7.5.2] 1210.6.3 Elbows. Factory-made welding elbows or transverse segments cut therefrom shall have an arc length measured along the crotch of at least 1 inch (25.4 mm) for pipe sizes 2 inches (50 mm) and larger. [NFPA 54:7.5.3] 1210.7 Drips and Sediment Traps. For other than dry gas conditions, a drip shall be provided at any point in the line of pipe where condensate could collect. Where required by the Authority Having Jurisdiction or the serving gas supplier, a drip shall also be provided at the outlet of the meter. This drip shall be installed so as to constitute a trap wherein an accumulation of condensate shuts off the flow of gas before it runs back into the meter. [NFPA 54:7.6.1] 1210.7.1 Location of Drips. All drips shall be installed only in such locations that they are readily accessible to permit cleaning or emptying. A drip shall not be located where the condensate is likely to freeze. [NFPA 54:7.6.2] 1210.7.2 Sediment Traps. The installation of sediment traps shall be in accordance with Section 1212.9. [NFPA 54:7.6.3] 1210.8 Outlets. Outlets shall be located and installed in accordance with the following requirements:

1. The outlet fittings or piping shall be securely fastened in place.

2. Outlets shall not be located behind doors.

3. Outlets shall be located far enough from floors, walls, patios, slabs, and ceilings to permit the use of wrenches without straining, bending, or damaging the piping.
Where a system shall be readily accessible from the appliance or equipment location, an individual shutoff valve for each apartment or tenant line shall be provided at a convenient point of general accessibility. In a common system serving a number of individual buildings, shutoff valves shall be marked with a metal tag or other permanent means attached by the installing agency so that the gas piping systems supplied through them can be readily identified. [NFPA 54:7.7.2.2]

1210.12.2 Optional Components. The following components shall also be permitted to be utilized in any type of central premix system:

(1) Flowmeter(s)
(2) Flame arrester(s) [NFPA 54:7.11.2]

1210.12.3 Additional Requirements. Gas-mixing machines shall have nonsparking blowers and shall be constructed so that a flashback does not rupture machine casings. [NFPA 54:7.11.3]

1210.12.4 Special Requirements for Mixing Blowers. A mixing blower system shall be limited to applications with minimum practical lengths of mixture piping, limited to a maximum mixture pressure of 10 inches water column (2.5 kPa) and limited to gases containing no more than 10 percent hydrogen. The blower shall be equipped...
with a gas control valve at its air entrance arranged so that gas is admitted to the airstream, entering the blower in proper proportions for correct combustion by the type of burners employed, the said gas control valve being of either the zero governor or mechanical ratio valve type that controls the gas and air adjustment simultaneously. No valves or other obstructions shall be installed between the blower discharge and the burner or burners. [NFPA 54:7.11.14]

**1210.12.5 Installation of Gas-Mixing Machines.** Installation of gas-mixing machines shall comply with the following: Section 1210.12.5.1 through Section 1210.12.5.5.

(1) **1210.12.5.1 Location.** The gas-mixing machine shall be located in a well-ventilated area or in a detached building or cutoff room provided with room construction and explosion vents in accordance with sound engineering principles or methods. Such rooms or below-grade installations shall have adequate positive ventilation. [NFPA 54:7.11.5.1]

(2) **1210.12.5.2 Electrical Requirements.** Where gas-mixing machines are installed in well-ventilated areas, the type of electrical equipment shall be in accordance with NFPA 70 for general service conditions unless other hazards in the area prevail. Where gas-mixing machines are installed in small detached buildings or cutoff rooms, the electrical equipment and wiring shall be installed in accordance with NFPA 70 for hazardous locations (Articles 500 and 501, Class I, Division 2). [NFPA 54:7.11.5.2]

(3) **1210.12.5.3 Air Intakes.** Air intakes for gas-mixing machines using compressors or blowers shall be taken from outdoors whenever practicable. [NFPA 54:7.11.5.3]

(4) **1210.12.5.4 Controls.** Controls for gas-mixing machines shall include interlocks and a safety shut-off valve of the manual reset type in the gas supply connection to each machine arranged to automatically shut off the gas supply in the event of high or low gas pressure. Except for open burner installations only, the controls shall be interlocked so that the blower or compressor stops operating following a gas supply failure. Where a system employs pressurized air, means shall be provided to shut off the gas supply in the event of air failure. [NFPA 54:7.11.5.4]

(5) **1210.12.5.5 Installation in Parallel.** Centrifugal gas-mixing machines in parallel shall be reviewed by the user and equipment manufacturer before installation, and means or plans for minimizing the effects of downstream pulsation and equipment overload shall be prepared and utilized as needed. [NFPA 54:7.11.5.1—7.11.5.5]

**1210.12.6 Use of Automatic Firechecks, Safety Blowouts, or Backfire Preventers.** Automatic firechecks and safety blowouts or backfire preventers shall be provided in piping systems distributing flammable air-gas mixtures from gas-mixing machines to protect the piping and the machines in the event of flashback, in accordance with the following:

(1) Approved automatic firechecks shall be installed upstream as close as practical to the burner inlets following the firecheck manufacturer’s instructions.

(2) A separate manually operated gas valve shall be provided at each automatic firecheck for shutting off the flow of the gas-air mixture through the firecheck after a flashback has occurred. The valve shall be located upstream as close as practical to the inlet of the automatic firecheck.

**Caution:** These valves shall not be reopened after a flashback has occurred until the firecheck has cooled sufficiently to prevent re-ignition of the flammable mixture and has been reset properly.

(3) A safety blowout or backfiring preventer shall be provided in the mixture line near the outlet of each gas-mixing machine where the size of the piping is larger than 2½ inches (65 mm) NPS, or equivalent, to protect the mixing equipment in the event of an explosion passing through an automatic firecheck. The manufacturer’s instructions shall be followed when installing these devices, particularly after a disc has burst. The discharge from the safety blowout or backfire preventer shall be located or shielded so that particles from the ruptured disc cannot be directed toward personnel. Wherever there are interconnected installations of gas-mixing machines with safety blowouts or backfire preventers, provision shall be made to keep the mixture from other machines from reaching any ruptured disc opening. Check valves shall not be used for this purpose.

(4) Large-capacity premix systems provided with explosion heads (rupture discs) to relieve excessive pressure in pipelines shall be located at and vented to a safe outdoor location. Provisions shall be provided for automatically shutting off the supply of the gas-air mixture in the event of rupture. [NFPA 54:7.11.6]

**1211.0 Electrical Bonding and Grounding.**

**1211.1 Pipe and Tubing Other than CSST.** Each above-ground portion of a gas piping system, other than CSST, that is likely to become energized shall be electrically continuous and bonded to an effective ground-fault current path. Gas piping, other than CSST, shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance. [NFPA 54:7.12.1]

**1211.2 Bonding of CSST Gas Piping.** CSST gas piping systems, and gas piping systems containing one or more segments of CSST, shall be electrically continuous and bonded to the electrical service grounding electrode system or, where provided, lightning protection grounding electrode system. [NFPA 54:7.12.2]

**1211.2.1 Bonding Jumper Connection.** The bonding jumper shall connect to a metallic pipe, pipe fitting, or CSST fitting. [NFPA 54:7.12.2.1]

**1211.2.2 Bonding Jumper Size.** The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent. [NFPA 54:7.12.2.2]
1212.3 Bonding Jumper Length. The length of the jumper between the connection to the gas piping system and the grounding electrode system shall not exceed 75 feet (22,860 mm). Any additional grounding electrodes installed to meet this requirement shall be bonded to the electrical service grounding electrode system or, where provided, lightning protection grounding electrode system. [NFPA 54:7.12.2.3]

1212.4 Bonding Connections. Bonding connections shall be in accordance with NFPA 70. [NFPA 54:7.12.2.4]

1212.5 Devices Used for Bonding. Devices used for the bonding connection shall be listed for the application in accordance with UL 467. [NFPA 54:7.12.2.5]

1211.3 Arc-Resistant Jacketed CSST. CSST listed with an arc resistant jacket or coating system in accordance with CSA LC 1 shall be electrically continuous and bonded to an effective ground fault current path. Where any CSST component of a piping system does not have an arc-resistant jacket or coating system, the bonding requirements of Section 1211.2 shall apply. Arc-resistant jacketed CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance. [NFPA 54:7.12.3]

1211.4 Prohibited Use. Gas piping shall not be used as a grounding conductor or electrode. [NFPA 54:7.12.4]

1211.5 Lightning Protection System. Where a lightning protection system is installed, the bonding of the gas piping shall be in accordance with NFPA 780. [NFPA 54:7.12.5]

1211.6 Electrical Circuits. Electrical circuits shall not utilize gas piping or components as conductors.

Exception: Low-voltage (50 V or less) control circuits, ignition circuits, and electronic flame detection device circuits shall be permitted to make use of piping or components as a part of an electric circuit. [NFPA 54:7.13]

1211.7 Electrical Connections. All electrical connections between wiring and electrically operated control devices in a piping system shall conform to the requirements of NFPA 70. [NFPA 54:7.14.1]

1211.7.1 Safety Control. Any essential safety control depending on electric current as the operating medium shall be of a type that shuts off (fail safe) the flow of gas in the event of current failure. [NFPA 54:7.14.2]

1212.0 Appliance and Equipment Connections to Building Piping.

1212.1 Connecting Appliances and Equipment. Appliances and equipment shall be connected to the building piping in compliance with Section 1212.6 through Section 1212.8 by one of the following:

1. Rigid metallic pipe and fittings.
2. Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing shall not be used in exterior locations.
3. A listed connector for gas appliances listed in compliance with CSA ANSI Z21.24/CSA 6.27. The connector shall be used in accordance with the manufacturer’s installation instructions and shall be in the same room as the appliance. Only one connector shall be used per appliance.
4. A listed connector for outdoor gas appliances and manufactured homes listed in compliance with CSA ANSI Z21.75/CSA 6.27. Only one connector shall be used per appliance.
5. CSST where installed in accordance with the manufacturer’s installation instructions. CSST shall not be directly routed into a metallic appliance enclosure where the appliance is connected to a metallic vent that terminates above a roofline. CSST shall connect only to appliances that are fixed in place.
6. Listed nonmetallic gas hose connectors in accordance with Section 1212.3.
7. Unlisted gas hose connectors for use in laboratories and educational facilities in accordance with Section 1212.4. [NFPA 54:9.6.1]

1212.1.1 Commercial Cooking Appliances and Service Appliance Connectors. Connectors used with commercial cooking food service appliances that are moved for cleaning and sanitation purposes shall be installed in accordance with the connector manufacturer’s installation instructions. Such connectors shall be listed in accordance with ANSI Z21.69/CSA 6.16. [NFPA 54:9.6.1.3]

1212.1.2 Restraining Device. Movement of appliances with casters shall be limited by a restraining device installed in accordance with the connector and appliance manufacturer’s installation instructions. [NFPA 54:9.6.1.4]

1212.2 Suspended Low-Intensity Infrared Tube Heaters. Suspended low-intensity infrared tube heaters shall be connected to the building piping system with a connector listed for the application in accordance with CSA Z21.24/ANSI Z21.24/CSA 6.27 as follows:

1. The connector shall be installed in accordance with the tube heater installation instructions and shall be in the same room as the appliance.
2. Only one connector shall be used per appliance. [NFPA 54:9.6.1.5]

1212.3 Use of Nonmetallic Gas Hose Connectors. Listed gas hose connectors shall be used in accordance with the manufacturer’s installation instructions and in accordance with Section 1212.3.1 and Section 1212.3.2. [NFPA 54:9.6.2]

1212.3.1 Indoor. Indoor gas hose connectors shall be used only to connect laboratory, shop, and ironing appliances requiring mobility during operation and installed in accordance with the following:

1. An appliance shutoff valve shall be installed where the connector is attached to the building piping.
2. The connector shall be of minimum length and shall not exceed 6 feet (1829 mm).
3. The connector shall not be concealed and shall not extend from one room to another or pass through wall partitions, ceilings, or floors. [NFPA 54:9.6.2(1)]
1212.3.2 Outdoor. Where outdoor gas hose connectors are used to connect portable outdoor appliances, the connector shall be listed in accordance with CSA Z21.54 and installed in accordance with the following:

(1) An appliance shutoff valve, a listed quick-disconnect device, or a listed gas convenience outlet shall be installed where the connector is attached to the supply piping and in such a manner as so to prevent the accumulation of water or foreign matter.

(2) This connection shall be made only in the outdoor area where the appliance is to be used. [NFPA 54:9.6.2(2)]

(3) The connector length shall not exceed 15 feet (4572 mm).

1212.4 Injection (Bunsen) Burners. Injection (Bunsen) burners used in laboratories and educational facilities shall be permitted to be connected to the gas supply by an unlisted hose. [NFPA 54:9.6.3]

1212.5 Connection of Portable and Mobile Industrial Gas Appliances. Where portable industrial appliances or appliances requiring mobility or subject to vibration are connected to the building gas piping system by the use of a flexible hose, the hose shall be suitable and safe for the conditions under which it can be used. [NFPA 54:9.6.4.1]

1212.5.1 Swivel Joints or Couplings. Where industrial appliances requiring mobility are connected to the rigid piping by the use of swivel joints or couplings, the swivel joints or couplings shall be suitable for the service required, and only the minimum number required shall be installed. [NFPA 54:9.6.4.2]

1212.5.2 Metal Flexible Connectors. Where industrial appliances subject to vibration are connected to the building piping system by the use of all metal flexible connectors, the connectors shall be suitable for the service required. [NFPA 54:9.6.4.3]

1212.5.3 Flexible Connectors. Where flexible connections are used, they shall be of the minimum practical length and shall not extend from one room to another or pass through any walls, partitions, ceilings, or floors. Flexible connections shall not be used in any concealed location. They shall be protected against physical or thermal damage and shall be provided with gas shutoff valves in readily accessible locations in rigid piping upstream from the flexible connections. [NFPA 54:9.6.4.4]

1212.6 Appliance Shutoff Valves and Connections. Each appliance connected to a piping system shall have an accessible, approved manual shutoff valve with a nondisplaceable valve member, or a listed gas convenience outlet. Appliance shutoff valves and convenience outlets shall serve a single appliance only. [NFPA 54:9.6.5.1] The shutoff valve shall be located within 6 feet (1829 mm) of the appliance it serves. [NFPA 54:9.6.5.1] Where a connector is used, the valve shall be installed upstream of the connector. A union or flanged connection shall be provided downstream from the valve to permit removal of appliance controls. [NFPA 54:9.6.5.1(A)]

Exceptions:

(1) Shutoff valves serving decorative appliances in a fireplace shall not be located within the fireplace firebox except where the valve is listed for such use. [NFPA 54:9.6.5.1(B)]

(2) Shutoff valves shall be permitted to be accessibly located inside wall heaters and wall furnaces listed for recessed installation where necessary maintenance is performed without removal of the shutoff valve.

1212.7 Quick-Disconnect Devices. Quick-disconnect devices used to connect appliances to the building piping shall be listed in accordance with CSA-ANSI Z21.41/CSA 6.9. Where installed indoors, an approved manual shutoff valve with a non-displaceable nondisplaceable valve member shall be installed upstream of the quick-disconnect device. [NFPA 54:9.6.6.1 – 9.6.6.2]

1212.8 Gas Convenience Outlets. Appliances shall be permitted to be connected to the building piping by means of a listed gas convenience outlet, in conjunction with a listed appliance connector, installed in accordance with the manufacturer’s installation instructions.

Gas convenience outlets shall be listed in accordance with CSA Z21.90 and installed in accordance with the manufacturer’s installation instructions. [NFPA 54:9.6.7]

1212.9 Sediment Trap. Where a sediment trap is not incorporated as a part of the appliance, a sediment trap shall be installed downstream of the appliance shutoff valve as close to the inlet of the appliance as practical at the time of appliance installation. The sediment trap shall be either a tee fitting with a capped nipple in the bottom outlet, as illustrated in Figure 1212.9, or another device recognized as an effective sediment trap. Illuminating appliances, gas ranges, clothes dryers, decorative appliances for installation in vented fireplaces, gas fireplaces, and outdoor cooking appliances shall not be required to be so equipped. [NFPA 54:9.6.8]

For SI units: 1 inch = 25.4 mm

METHOD OF INSTALLING A TEE FITTING SEDIMENT TRAP

FIGURE 1212.9

1212.10 Installation of Piping. Piping shall be installed in a manner not to interfere with inspection, maintenance, or servicing of the appliances. [NFPA 54:9.6.9]
1213.0 Pressure Testing, Inspection, and Purging.

1213.1 Piping Installations. Prior to acceptance and initial operation, all piping installations shall be visually inspected and pressure tested to determine that the materials, design, fabrication, and installation practices comply with the requirements of this code. [NFPA 54:8.1.1.1]  

1213.1.1 Inspection Requirements. Inspection shall consist of visual examination, during or after manufacture, fabrication, assembly, or pressure tests. [NFPA 54:8.1.1.2]  

1213.1.2 Repairs and Additions. Where repairs or additions are made following the pressure test, the affected piping shall be tested. Minor repairs and additions are not required to be pressure tested, provided that the work is inspected and connections are tested with a noncorrosive leak-detecting fluid or other leak-detecting methods approved by the Authority Having Jurisdiction. [NFPA 54:8.1.1.3]  

1213.1.3 New Branches. Where new branches are installed to new appliance(s), only the newly installed branch(es) shall be required to be pressure tested. Connections between the new piping and the existing piping shall be tested with a noncorrosive leak-detecting fluid or approved leak-detecting methods. [NFPA 54:8.1.1.4]  

1213.1.4 Piping System. A piping system shall be tested as a complete unit or in sections. Under no circumstances shall a valve in a line be used as a blockhead between gas in one section of the piping system and test medium in an adjacent section, unless a double block and bleed valve system is installed. A valve shall not be subjected to the test pressure unless it can be determined that the valve, including the valve closing mechanism, is designed to safely withstand the pressure. [NFPA 54:8.1.1.5]  

1213.1.5 Regulators and Valves. Regulator and valve assemblies fabricated independently of the piping system in which they are to be installed shall be permitted to be tested with inert gas or air at the time of fabrication. [NFPA 54:8.1.1.6]  

1213.1.6 Test Medium. The test medium shall be air, nitrogen, carbon dioxide, or an inert gas. Oxygen shall not be used as a test medium. [NFPA 54:8.1.1.2]  

1213.2 Test Preparation. Test preparation shall comply with Section 1213.2.1 through Section 1213.2.6.  

1213.2.1 Pipe Joints. Pipe joints, including welds, shall be left exposed for examination during the test.  

**Exception:** Covered or concealed pipe end joints that have been previously tested in accordance with this code. [NFPA 54:8.1.3.1]  

1213.2.2 Expansion Joints. Expansion joints shall be provided with temporary restraints, if required, for the additional thrust load under test. [NFPA 54:8.1.3.2]  

1213.2.3 Appliances and Equipment. Appliances and equipment that are not to be included in the test shall be either disconnected from the piping or isolated by blanks, blind flanges, or caps. Flanged joints at which blinds are inserted to blank off other equipment during the test shall not be required to be tested. [NFPA 54:8.1.3.3]  

1213.2.4 Designed for Operating Pressures Less Than Test Pressure. Where the piping system is connected to appliances or equipment designed for operating pressures of less than the test pressure, such appliances or equipment shall be isolated from the piping system by disconnecting them and capping the outlet(s). [NFPA 54:8.1.3.4]  

1213.2.5 Designed for Operating Pressures Equal to or Greater Than Test Pressure. Where the piping system is connected to appliances or equipment designed for operating pressures equal to or greater than the test pressure, such appliances or equipment shall be isolated from the piping system by closing the individual appliance or equipment shutoff valve(s). [NFPA 54:8.1.3.5]  

1213.2.6 Safety. All testing of piping systems shall be performed in a manner that protects the safety of employees and the public during the test. [NFPA 54:8.1.3.6]  

1213.3 Test Pressure. This inspection shall include an air, CO₂, or nitrogen pressure test, at which time the gas piping shall withstand a pressure of not less than 10 psi (69 kPa) gauge pressure. Test pressures shall be held for a length of time satisfactory to the Authority Having Jurisdiction but in no case less than 15 minutes with no perceptible drop in pressure. For welded piping, and for piping carrying gas at pressures in excess of 14 inches water column pressure (3.5 kPa), the test pressure shall be not less than 60 psi (414 kPa) and shall be continued for a length of time satisfactory to the Authority Having Jurisdiction, but in no case for less than 30 minutes. For CSST carrying gas at pressures in excess of 14 inches water column (3.5 kPa) pressure, the test pressure shall be not less than 30 psi (207 kPa) for 30 minutes. These tests shall be made using air, CO₂, or nitrogen pressure and shall be made in the presence of the Authority Having Jurisdiction. Necessary apparatus for conducting tests shall be furnished by the permit holder. Test gauges used in conducting tests shall be in accordance with Section 318.0.  

1213.4 Detection of Leaks and Defects. The piping system shall withstand the test pressure specified without showing any evidence of leakage or other defects. Any reduction of test pressures as indicated by pressure gauges shall be deemed to indicate the presence of a leak unless such reduction can be readily attributed to some other cause. [NFPA 54:8.1.5.1]  

1213.4.1 Detecting Leaks. The leakage shall be located by means of an approved gas detector, a noncorrosive leak detection fluid, or other approved leak detection methods. [NFPA 54:8.1.5.2]  

1213.4.2 Repair or Replace. Where leakage or other defects are located, the affected portion of the piping system shall be repaired or replaced and retested. [NFPA 54:8.1.5.3]
1213.5 Piping System Leak Test. Leak checks using fuel gas shall be permitted in piping systems that have been pressure-tested in accordance with Section 1213.0 through Section 1213.4.2. [NFPA 54:8.2.1]

1213.5.1 Turning Gas On. During the process of turning gas on into a system of new gas piping, the entire system shall be inspected to determine that there are no open fittings or ends and that all valves at unused outlets are closed and plugged or capped. [NFPA 54:8.2.2]

1213.5.2 Leak Check. Immediately after the gas is turned on into a new system or into a system that has been initially restored after an interruption of service, the piping system shall be checked for leakage. Where leakage is indicated, the gas supply shall be shut off until the necessary repairs have been made. [NFPA 54:8.2.3]

1213.5.3 Placing Appliances and Equipment in Operation. Appliances and equipment shall not be placed in operation until after the piping system has been checked for leakage in accordance with Section 1213.5.2, the piping system is purged in accordance with Section 1213.6, and connections to the appliance are checked for leakage. [NFPA 54:8.2.4]

1213.6 Purging Requirements. The purging of piping shall be in accordance with Section 1213.6.1 through Section 1213.6.3. [NFPA 54:8.3]

1213.6.1 Piping Systems Required to be Purged Outdoors. The purging of piping systems shall be in accordance with Section 1213.6.1.1 through Section 1213.6.1.5 where the piping system meets either of the following:

1. The design operating gas pressure is greater than 2 psig (14 kPa).
2. The piping being purged contains one or more sections of pipe or tubing meeting the size and length criteria of Table 1213.6.1. [NFPA 54:8.3.1]  

<table>
<thead>
<tr>
<th>NOMINAL PIPING SIZE</th>
<th>LENGTH OF PIPING</th>
</tr>
</thead>
<tbody>
<tr>
<td>(inches)</td>
<td>(feet)</td>
</tr>
<tr>
<td>≥ 2½ &lt; 3</td>
<td>&gt; 50</td>
</tr>
<tr>
<td>≥ 3 &lt; 4</td>
<td>&gt; 30</td>
</tr>
<tr>
<td>≥ 4 &lt; 6</td>
<td>&gt; 15</td>
</tr>
<tr>
<td>≥ 6 &lt; 8</td>
<td>&gt; 10</td>
</tr>
<tr>
<td>≥ 8</td>
<td>Any length</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm  
* CSST EHD size of 62 is equivalent to nominal 2 inches (50 mm) pipe or tubing size.

1213.6.1.1 Removal from Service. Where existing gas piping is opened, the section that is opened shall be isolated from the gas supply and the line pressure vented in accordance with Section 1213.6.1.4. Where gas piping meeting the criteria of Table 1213.6.1 is removed from service, the residual fuel gas in the piping shall be displaced with an inert gas. [NFPA 54:8.3.1.1]

1213.6.1.2 Removal of Piping. Where piping containing gas is to be removed, the line shall be first disconnected from sources of gas and then thoroughly purged with air, water, or inert gas before cutting, or welding is done.

1213.6.1.3 Placing in Operation. Where gas piping containing air and meeting the criteria of Table 1213.6.1 is placed in operation, the air in the piping shall first be displaced with an inert gas. The inert gas shall then be displaced with fuel gas in accordance with Section 1213.6.1.4. [NFPA 54:8.3.1.2]

1213.6.1.4 Outdoor Discharge of Purged Gases. The open end of a piping system being pressure vented or purged shall discharge directly to an outdoor location. Purging operations shall comply with all of the following requirements:

1. The point of discharge shall be controlled with a shutoff valve.
2. The point of discharge shall be located at least 10 feet (3048 mm) from sources of ignition, at least 10 feet (3048 mm) from building openings and at least 25 feet (7620 mm) from mechanical air intake openings.
3. During discharge, the open point of discharge shall be continuously attended and monitored with a combustible gas indicator that complies with Section 1213.6.1.5.
4. Purging operations introducing fuel gas shall be stopped when 90 percent fuel gas by volume is detected within the pipe.
5. Persons not involved in the purging operations shall be evacuated from all areas within 10 feet (3048 mm) of the point of discharge. [NFPA 54:8.3.1.3]

1213.6.1.5 Combustible Gas Indicator. Combustible gas indicators shall be listed and calibrated in accordance with the manufacturer’s instructions. Combustible gas indicators shall numerically display a volume scale from 0 percent to 100 percent in 1 percent or smaller increments. [NFPA 54:8.3.1.4]

1213.6.2 Piping Systems Allowed to be Purged Indoors or Outdoors. The purging of piping systems shall be in accordance with the provisions of Section 1213.6.2.1 where the piping system meets both of the following:

1. The design operating pressure is 2 psig (14 kPag) or less.
2. The piping being purged is constructed entirely from pipe or tubing not meeting the size and length criteria of Table 1213.6.1. [NFPA 54:8.3.2]

1213.6.2.1 Purging Procedure. The piping system shall be purged in accordance with one or more of the following:
1214.0 Required Gas Supply.

1214.1 General. The following regulations shall comply with this section and Section 1215.0, shall be the standard for the installation of gas piping. Natural gas regulations and tables are based on the use of a gas having a specific gravity of 0.60 and for undiluted liquefied petroleum gas, having a specific gravity of 1.50. Where gas of a different specific gravity is to be delivered, the specific gravity conversion factors provided by the serving gas supplier shall be used in sizing piping systems from the pipe sizing tables in this chapter.

1214.2 Volume. The hourly volume of gas required at each piping outlet shall be taken as not less than the maximum hourly rating as specified by the manufacturer of the appliance or appliances to be connected to each such outlet.

1214.3 Gas Appliances. Where the gas appliances to be installed have not been specified, Table 1208.4.1 shall be permitted to be used as a reference to estimate requirements of typical appliances.

To obtain the cubic feet per hour (m$^3$/h) of gas required, divide the input of the appliances by the average Btu (kW•h) heating value per cubic foot (m$^3$) of the gas. The average Btu (kW•h) per cubic foot (m$^3$) of the gas in the area of the installation shall be permitted to be obtained from the serving gas supplier.

1214.4 Size of Piping Outlets. The size of the supply piping outlet for a gas appliance shall be not less than $\frac{1}{2}$ of an inch in diameter (15 mm).

The size of a piping outlet for a mobile home shall be not less than $\frac{1}{3}$ of an inch in diameter (20 mm).

1215.0 Required Gas Piping Size.

1215.1 Pipe Sizing Methods. Where the pipe size is to be determined using any of the methods in Section 1215.1.1 through Section 1215.1.3, the diameter of each pipe segment shall be obtained from the pipe sizing tables in Section 1215.2 or from the sizing equations in Section 1215.3. [NFPA 54:6.1.1]

1215.1.1 Longest Length Method. The pipe size of each section of gas piping shall be determined using the length of piping from the point of delivery to the most remote outlet and the load of the section. [NFPA 54:6.1.1] (see calculation example in Figure 1215.1.1)

1215.1.2 Branch Length Method. Pipe shall be sized as follows:

1. Pipe size of each section of the longest pipe run from the point of delivery to the most remote outlet shall be determined using the longest run of piping and the load of the section.
2. The pipe size of each section of branch piping not previously sized shall be determined using the length of piping from the point of delivery to the most remote outlet in each branch and the load of the section. [NFPA 54:6.1.2]

1215.1.3 Hybrid Pressure. The pipe size for each section of higher pressure gas piping shall be determined using the longest length of piping from the point of delivery to the most remote line pressure regulator. The pipe size from the line pressure regulator to each outlet shall be determined using the length of piping from the regulator to the most remote outlet served by the regulator. [NFPA 54:6.1.3]

1215.2 Sizing of Gas Piping Systems. Sizing of piping systems shall be in accordance with Section 1215.2.1 for natural gas piping systems and Section 1215.2.2 for propane piping systems.

1215.2.1 Natural Gas Piping Systems. Table 1215.2(1) through Table 1215.2(23) shall be used in conjunction with one of the methods described in Section 1215.1.1 through Section 1215.1.3 for piping materials other than non-corrugated stainless steel tubing. Section 1215.3 shall be used in conjunction with one of the methods described in Section 1215.1.1 through Section 1215.1.3 for non-corrugated stainless steel tubing. [NFPA 54:6.2.1, 6.2.2]

1215.2.2 Propane Piping Systems. Table 1215.2(24) through Table 1215.2(36) shall be used in conjunction with one of the methods described in Section 1215.1.1 through Section 1215.1.3 for piping materials other than non-corrugated stainless steel tubing. Section 1215.3 shall be used in conjunction with one of the methods described in Section 1215.1.1 through Section 1215.1.3 for non-corrugated stainless steel tubing. [NFPA 54:6.3.1, 6.3.2]

1215.3 Sizing Equations. The inside diameter of smooth wall pipe or tubing shall be determined by Equation
1215.3(1), Equation 1215.3(2) and Table 1215.3 using the equivalent pipe length determined by the methods in Section 1215.1.1 through Section 1215.1.3. [NFPA 54:6.4]

**LOW-PRESSURE GAS FORMULA (LESS THAN 1.5 psi)**

[Equation 1215.3(1)]

\[ D = \frac{Q^{0.381}}{19.17 \left( \frac{\Delta H}{Cr \times L} \right)^{0.206}} \]

Where:

- **D** = inside diameter of pipe, inches
- **Q** = input rate appliance(s), cubic feet per hour at 60°F and 30 inch mercury column
- **L** = equivalent length of pipe, feet
- **ΔH** = pressure drop, inches water column
- **Cr** = in accordance with Table 1215.3

**HIGH-PRESSURE GAS FORMULA (1.5 psi AND ABOVE)**

[Equation 1215.3(2)]

\[ D = \frac{Q^{0.381}}{18.93 \left[ \frac{(P_1^2 - P_2^2) \cdot Y}{Cr \times L} \right]^{0.206}} \]

Where:

- **D** = inside diameter of pipe, inches
- **Q** = input rate appliance(s), cubic feet per hour at 60°F and 30 inch mercury column
- **P_1** = upstream pressure, psia (P_1 + 14.7)
- **P_2** = downstream pressure, psia (P_2 + 14.7)
- **L** = equivalent length of pipe, feet
- **Cr** = in accordance with Table 1215.3
- **Y** = in accordance with Table 1215.3

For SI units: 1 cubic foot = 0.0283 m³, 1000 British thermal units per hour = 0.293 kW, 1 inch = 25 mm, 1 foot = 304.8 mm, 1 pound-force per square inch = 6.8947 kPa, °C = (°F-32)/1.8, 1 inch mercury column = 3.39 kPa, 1 inch water column = 0.249 kPa

### Table 1215.3

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<th>Y</th>
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<td>Undiluted Propane</td>
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### 1215.4 Sizing of Piping Sections.

To determine the size of each section of pipe in a system within the range of Table 1215.2(1) through Table 1215.2(36), proceed as follows:

1. Measure the length of the pipe from the gas meter location to the most remote outlet on the system.
2. Select the length in feet column and row showing the distance, or the next longer distance where the table does not give the exact length.
3. Starting at the most remote outlet, find in the row just selected the gas demand for that outlet. Where the exact figure of demand is not shown, choose the next larger figure in the row.
4. At the top of this column will be found the correct size of pipe.
5. Using this same row, proceed in a similar manner to each section of pipe serving this outlet. For each section of pipe, determine the total gas demand supplied by that section. Where gas piping sections serve both heating and cooling appliances and the installation prevents both units from operating simultaneously, the larger of the two demand loads needs to be used in sizing these sections.
6. Size each section of branch piping not previously sized by measuring the distance from the gas meter location to the most remote outlet in that branch and follow the procedures of steps 2, 3, 4, and 5 above. Size branch piping in the order of their distance from the meter location, beginning with the most distant outlet not previously sized.

### 1215.5 Engineering Methods.

For conditions other than those covered by Section 1215.1, such as longer runs or greater gas demands, the size of each gas piping system shall be determined by standard engineering methods acceptable to the Authority Having Jurisdiction, and each such system shall be so designed that the total pressure drop between the meter or another point of supply and an outlet where full demand is being supplied to all outlets, shall be in accordance with the requirements of Section 1208.4.

### 1215.6 Variable Gas Pressure.

Where the supply gas pressure exceeds 5 psi (34.6 kPa) for natural gas and 10 psi (69 kPa) for undiluted propane or is less than 6 inches (1.5 kPa) of water column, or where diversity demand factors are used, the design, pipe, sizing, materials, location, and use of such systems first shall be approved by the Authority Having Jurisdiction. Piping systems designed for pressures exceeding the serving gas supplier’s standard delivery pressure shall have prior verification from the gas supplier of the availability of the design pressure.
**FUEL GAS PIPING**

**FIGURE 1215.1.1**

**EXAMPLE ILLUSTRATING USE OF TABLE 1208.4.1 AND TABLE 1215.2(1)**

**Problem:** Determine the required pipe size of each section and outlet of the piping system shown in Figure 1215.1.1. Gas to be used has a specific gravity of 0.60 and 1100 British thermal units (Btu) per cubic foot (0.0114 kW•h/L), delivered at 8 inch water column (2.0 kPa) pressure.

For SI units: 1 foot = 304.8 mm, 1 gallon = 3.785 L, 1000 British thermal units per hour = 0.293 kW, 1 cubic foot per hour = 0.0283 m³/h

**Solution:**

1. Maximum gas demand of Outlet A — 
   32 cubic feet per hour (0.91 m³/h) (from Table 1208.4.1).
2. Maximum gas demand of Outlet B — 
   3 cubic feet per hour (0.08 m³/h) (from Table 1208.4.1).
3. Maximum gas demand of Outlet C — 
   59 cubic feet per hour (1.67 m³/h) (from Table 1208.4.1).
4. Maximum gas demand of Outlet D — 
   136 cubic feet per hour (3.85 m³/h) [150 000 Btu/hour (44 kW) divided by 1100 Btu per cubic foot (0.0114 kW•h/L)].

2. The length of pipe from the gas meter to the most remote outlet (Outlet A) is 60 feet (18 288 mm).
3. Using the length in feet column row marked 60 feet (18 288 mm) in Table 1215.2(1):
   - Outlet A, supplying 32 cubic feet per hour (0.91 m³/h), requires ½ of an inch (15 mm) pipe.
   - Section 1, supplying Outlets A and B, or 35 cubic feet per hour (0.99 m³/h) requires ½ of an inch (15 mm) pipe.
   - Section 2, supplying Outlets A, B, and C, or 94 cubic feet per hour (2.66 m³/h) requires ¾ of an inch (20 mm) pipe.
   - Section 3, supplying Outlets A, B, C, and D, or 230 cubic feet per hour (6.51 m³/h), requires 1 inch (25 mm) pipe.
4. Using the column marked 60 feet (18 288 mm) in Table 1215.2(1):
   - Outlet B supplying 3 cubic feet per hour (0.08 m³/h), requires ½ of an inch (15 mm) pipe.
   - Outlet C, supplying 59 cubic feet per hour (1.67 m³/h), requires ½ of an inch (15 mm) pipe.
5. Using the column marked 60 feet (18 288 mm) in Table 1215.2(1):
   - Outlet D, supplying 136 cubic feet per hour (3.85 m³/h), requires ¾ of an inch (20 mm) pipe.
### TABLE 1215.2(1)
SCHEDULE 40 METALLIC PIPE [NFPA 54; TABLE 6.2.1(b)]¹ ²

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<tr>
<th>ACTUAL ID:</th>
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<th>0.824</th>
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<th>1.610</th>
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<th>3.068</th>
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<th>6.065</th>
<th>7.981</th>
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</table>

**Notes:**
- Table entries are rounded to 3 significant digits.
- NA means a flow of less than 10 ft³/h (0.283 m³/h).

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa.

¹ Table entries are rounded to 3 significant digits.
² NA means a flow of less than 10 ft³/h (0.283 m³/h).
### FUEL GAS PIPING

#### TABLE 1215.2(2)
**SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.2.1(c)]**

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For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

* Table entries are rounded to 3 significant digits.
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<th>GAS</th>
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**TABLE 1215.2(3)**

SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.2.1(d)]*

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<th>2½</th>
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**CAPACITY IN CUBIC FEET OF GAS PER HOUR**

| LENGTH (feet) | 10       | 20     | 30     | 40     | 50     | 60     | 70     | 80     | 90     | 100    | 110    | 120    | 130    | 140    | 150    | 160    | 170    | 180    | 190    | 200    |
|---------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Capacity      | 660     | 454    | 364    | 312    | 276    | 250    | 230    | 214    | 201    | 190    | 180    | 170    | 160    | 150    | 140    | 130    | 120    | 110    | 100    | 90     |

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

* Table entries are rounded to 3 significant digits.
### TABLE 1215.2(4)
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**For SI units:** 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa

*Table entries are rounded to 3 significant digits.
### TABLE 1215.2(5)
SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.2.1(f)∗]

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<td>8800</td>
<td>18000</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa

* Table entries are rounded to 3 significant digits.
## FUEL GAS PIPING

### TABLE 1215.2(6)
**SCHEDULE 40 METALLIC PIPE** [NFPA 54: TABLE 6.2.1(g)]*

<table>
<thead>
<tr>
<th>PIPE SIZE (inch)</th>
<th>NOMINAL: 1/8</th>
<th>1/4</th>
<th>1/2</th>
<th>3/4</th>
<th>1</th>
<th>1 1/4</th>
<th>1 1/2</th>
<th>2</th>
<th>2 1/2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH (feet)</td>
<td>6.22</td>
<td>0.824</td>
<td>1.049</td>
<td>1.380</td>
<td>1.610</td>
<td>2.067</td>
<td>2.469</td>
<td>3.068</td>
<td>4.026</td>
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<td>CAPACITY IN CUBIC FEET OF GAS PER HOUR</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa

* Table entries are rounded to 3 significant digits.
**TABLE 1215.2(7)**

**SEMI-RIGID COPPER TUBING [NFPA 54: TABLE 6.2.1(h)]**

<table>
<thead>
<tr>
<th>TUBE SIZE (inch)</th>
<th>K &amp; L:</th>
<th>¼</th>
<th>½</th>
<th>¾</th>
<th>1</th>
<th>1¼</th>
<th>1½</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACR:</strong></td>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td><strong>OUTSIDE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>554</td>
<td>873</td>
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<td>11</td>
<td>23</td>
<td>47</td>
<td>82</td>
<td>116</td>
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<td>701</td>
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<td>20</td>
<td>40</td>
<td>70</td>
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<td>88</td>
<td>187</td>
<td>337</td>
<td>532</td>
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<tr>
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<table>
<thead>
<tr>
<th>LENGTH (feet)</th>
<th>CAPACITY IN CUBIC FEET OF GAS PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>30</td>
<td>11</td>
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<tr>
<td>40</td>
<td>10</td>
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<tr>
<td>50</td>
<td>NA</td>
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<table>
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<tr>
<th>PRESSURE DROP:</th>
<th>2 psi</th>
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<tbody>
<tr>
<td>INLET PRESSURE:</td>
<td>LESS THAN 2 psi</td>
</tr>
<tr>
<td>GAS:</td>
<td>NATURAL</td>
</tr>
<tr>
<td>PRESSURE DROP:</td>
<td>0.3 in. w.c.</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY:</td>
<td>0.60</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

Notes:
1. Table entries are rounded to 3 significant digits.
2. NA means a flow of less than 10 ft³/h (0.283 m³/h).
3. Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.
# FUEL GAS PIPING

## TABLE 1215.2(8)

### SEMI-RIGID COPPER TUBING (NFPA 54: TABLE 6.2.1(0))

<table>
<thead>
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<th>TUBE SIZE (inch)</th>
<th>NOMINAL:</th>
<th>K &amp; L:</th>
<th>ACR:</th>
<th>¼</th>
<th>⅜</th>
<th>⅝</th>
<th>⅞</th>
<th>1</th>
<th>1¼</th>
<th>1½</th>
<th>2</th>
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<tbody>
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<td>0.500</td>
<td>0.625</td>
<td>0.750</td>
<td>0.875</td>
<td>1.125</td>
<td>1.375</td>
<td>1.625</td>
<td>2.125</td>
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<tr>
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<td>0.652</td>
<td>0.745</td>
<td>0.995</td>
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<td>1.481</td>
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### LENGTH (feet) | CAPACITY IN CUBIC FEET OF GAS PER HOUR
<table>
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<tbody>
<tr>
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<td>30</td>
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<td>2000</td>
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</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

Notes:

1. Table entries are rounded to 3 significant digits.
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3. Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.
### TABLE 1215.2(9)
SEMI-RIGID COPPER TUBING [NFPA 54: TABLE 6.2.1(j)]

<table>
<thead>
<tr>
<th>GAS:</th>
<th>NATURAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>INLET PRESSURE:</td>
<td>LESS THAN 2 psi</td>
</tr>
<tr>
<td>PRESSURE DROP:</td>
<td>1.0 in. w.c.</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY:</td>
<td>0.60</td>
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</tbody>
</table>

#### INTENDED USE: TUBE SIZING BETWEEN HOUSE LINE REGULATOR AND THE APPLIANCE

<table>
<thead>
<tr>
<th>NOMINAL:</th>
<th>TUBE SIZE (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K &amp; L:</td>
<td>%</td>
</tr>
<tr>
<td>ACR:</td>
<td>%</td>
</tr>
<tr>
<td>OUTSIDE:</td>
<td>0.375</td>
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<tr>
<td>INSIDE:</td>
<td>0.305</td>
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</tbody>
</table>

#### LENGTH (feet)

<table>
<thead>
<tr>
<th>CAPACITY IN CUBIC FEET OF GAS PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>10: 39 80 162 283 402 859 1550 2440 5080</td>
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<tr>
<td>20: 27 55 111 195 276 590 1060 1680 3490</td>
</tr>
<tr>
<td>30: 21 44 89 156 222 474 853 1350 2800</td>
</tr>
<tr>
<td>40: 18 38 77 134 190 406 730 1150 2400</td>
</tr>
<tr>
<td>50: 16 33 68 119 168 359 647 1020 2130</td>
</tr>
<tr>
<td>60: 15 30 61 107 152 326 586 925 1930</td>
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<tr>
<td>70: 13 28 57 99 140 300 539 851 1770</td>
</tr>
<tr>
<td>80: 13 26 53 92 131 279 502 791 1650</td>
</tr>
<tr>
<td>90: 12 24 49 86 122 262 471 742 1550</td>
</tr>
<tr>
<td>100: 11 23 47 82 116 247 445 701 1460</td>
</tr>
<tr>
<td>125: NA 20 41 72 103 219 394 622 1290</td>
</tr>
<tr>
<td>150: NA 18 37 65 93 198 357 563 1170</td>
</tr>
<tr>
<td>175: NA 17 34 60 85 183 329 518 1080</td>
</tr>
<tr>
<td>200: NA 16 32 56 79 170 306 482 1000</td>
</tr>
<tr>
<td>250: NA 14 28 50 70 151 271 427 890</td>
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<td>300: NA 13 26 45 64 136 245 387 806</td>
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<tr>
<td>350: NA 12 24 41 59 125 226 356 742</td>
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<tr>
<td>400: NA 11 22 39 55 117 210 331 690</td>
</tr>
<tr>
<td>450: NA 10 21 36 51 110 197 311 647</td>
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<td>500: NA NA 20 34 48 103 186 294 612</td>
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<td>550: NA NA NA 19 32 46 98 177 279 581</td>
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<tr>
<td>750: NA NA NA 16 27 39 83 150 236 491</td>
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<td>900: NA NA NA 14 25 35 75 135 214 445</td>
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<tr>
<td>950: NA NA NA 14 24 34 73 132 207 432</td>
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<tr>
<td>1000: NA NA NA 13 23 33 71 128 202 420</td>
</tr>
<tr>
<td>1100: NA NA NA 13 22 32 68 122 192 399</td>
</tr>
<tr>
<td>1200: NA NA NA 12 21 30 64 116 183 381</td>
</tr>
<tr>
<td>1300: NA NA NA 12 20 29 62 111 175 365</td>
</tr>
<tr>
<td>1400: NA NA NA 11 20 28 59 107 168 350</td>
</tr>
<tr>
<td>1500: NA NA NA 11 19 27 57 103 162 338</td>
</tr>
<tr>
<td>1600: NA NA NA 10 18 26 55 99 156 326</td>
</tr>
<tr>
<td>1700: NA NA NA 10 18 25 53 96 151 315</td>
</tr>
<tr>
<td>1800: NA NA NA 10 18 24 52 93 147 306</td>
</tr>
<tr>
<td>1900: NA NA NA 17 24 50 90 143 297</td>
</tr>
<tr>
<td>2000: NA NA NA 16 23 49 88 139 289</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

Notes:
1. Table entries are rounded to 3 significant digits.
2. NA means a flow of less than 10 ft³/h (0.283 m³/h).
3. Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.
## TABLE 1215.2(10)

### SEMI-RIGID COPPER TUBING [NFPA 54: TABLE 6.2.1(k)]

<table>
<thead>
<tr>
<th>NOMINAL: K &amp; L:</th>
<th>TUBE SIZE (inch)</th>
<th>CAPACITY IN CUBIC FEET OF GAS PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>OUTSIDE:</td>
<td>0.375</td>
<td>0.500</td>
</tr>
<tr>
<td>INSIDE:¹</td>
<td>0.305</td>
<td>0.402</td>
</tr>
<tr>
<td>LENGTH (feet)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>190</td>
<td>391</td>
</tr>
<tr>
<td>20</td>
<td>130</td>
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<td>11</td>
<td>22</td>
</tr>
</tbody>
</table>

Notes:
1. Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.
2. Table entries are rounded to 3 significant digits.

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa
## Table 1215.2(11)
### Semi-Rigid Copper Tubing [NFPA 54: Table 6.2.1(l)]

**Table 1215.2(11)**

<table>
<thead>
<tr>
<th>Length (feet)</th>
<th>Capacity in Cubic Feet of Gas per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>54.52</td>
</tr>
<tr>
<td>20</td>
<td>54.52</td>
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<tr>
<td>30</td>
<td>54.52</td>
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<tr>
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<tr>
<td>70</td>
<td>54.52</td>
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<tr>
<td>80</td>
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<td>90</td>
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<tr>
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<td>175</td>
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</tr>
<tr>
<td>950</td>
<td>54.52</td>
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<tr>
<td>1000</td>
<td>54.52</td>
</tr>
</tbody>
</table>

**For SI units:** 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa

**Notes:**
1. Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.
2. Table entries are rounded to 3 significant digits.
### Table 1215.2(12)
Semi-Rigid Copper Tubing (NFPA 54: Table 6.2.1(m))

<table>
<thead>
<tr>
<th>TUBE SIZE (inch)</th>
<th>K &amp; L: 1⁄4</th>
<th>1⁄8</th>
<th>1⁄8</th>
<th>5⁄32</th>
<th>1⁄4</th>
<th>1⁄4</th>
<th>1⁄4</th>
<th>1⁄2</th>
<th>1⁄2</th>
<th>1⁄2</th>
<th>1⁄2</th>
<th>1⁄2</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTSIDE:</td>
<td>0.0375</td>
<td>0.0625</td>
<td>0.075</td>
<td>0.0875</td>
<td>0.1125</td>
<td>0.1375</td>
<td>0.1625</td>
<td>2.125</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>INSIDE:</td>
<td>0.0305</td>
<td>0.0402</td>
<td>0.0527</td>
<td>0.0652</td>
<td>0.0765</td>
<td>0.0995</td>
<td>0.1245</td>
<td>1.481</td>
<td>1.959</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LENGTH (feet)</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>100</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>CAPACITY IN CUBIC FEET OF GAS PER HOUR</td>
<td>320</td>
<td>350</td>
<td>360</td>
<td>370</td>
<td>380</td>
<td>390</td>
<td>400</td>
<td>410</td>
<td>420</td>
<td>430</td>
<td>440</td>
<td>450</td>
</tr>
</tbody>
</table>

#### Notes:
1. Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.
2. Where this table is used to size the tubing upstream of a line pressure regulator, the pipe or tubing downstream of the line pressure regulator shall be sized using a pressure drop no greater than 1 inch water column (0.249 kPa).
3. Table entries are rounded to 3 significant digits.

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa
### TABLE 1215.2(13)
**SEMI-RIGID COPPER TUBING [NFPA 54: TABLE 6.2.1(n)]**

<table>
<thead>
<tr>
<th>TUBE SIZE (inch)</th>
<th>K &amp; L: 1⁄4</th>
<th>1⁄8</th>
<th>3⁄32</th>
<th>1⁄32</th>
<th>1⁄16</th>
<th>1⁄32</th>
<th>2⁄32</th>
<th>3⁄32</th>
<th>1⁄16</th>
<th>1⁄8</th>
<th>1⁄4</th>
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<th>3⁄4</th>
<th>11⁄8</th>
<th>13⁄8</th>
<th>11⁄2</th>
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<tbody>
<tr>
<td>INLET PRESSURE:</td>
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</tr>
<tr>
<td>PRESSURE DROP:</td>
<td>3.5 psi</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>GAS: NATURAL</td>
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<td>LENGTH (feet)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAPACITY IN CUBIC FEET OF GAS PER HOUR</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Notes:
1. Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.
2. Table entries are rounded to 3 significant digits.

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa

PREPRINT
### TABLE 1215.2(14)
CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54: TABLE 6.2.1(o)]

<table>
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<th>15</th>
<th>18</th>
<th>19</th>
<th>23</th>
<th>25</th>
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<th>46</th>
<th>48</th>
<th>60</th>
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</tr>
</thead>
<tbody>
<tr>
<td>LENGTH (feet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>5</td>
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<td>63</td>
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<td>134</td>
<td>225</td>
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<td>471</td>
<td>546</td>
<td>895</td>
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For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

**Notes:**
1. Table entries are rounded to 3 significant digits.
2. Table includes losses for four 90 degree (1.57 rad) bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing to the following equation: \( L = 1.3 \times n \), where \( L \) is additional length (ft) of tubing and \( n \) is the number of additional fittings, bends, or both.
3. EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.
TABLE 1215.2(15)
CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54: TABLE 6.2.1(p)]

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For SI units: 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

Notes:
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### TABLE 1215.2(16)
CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54: TABLE 6.2.1(q)]¹, ²

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#### INTENDED USE: INITIAL SUPPLY PRESSURE OF 11.0 INCH WATER COLUMN OR GREATER

| INLET PRESSURE: LESS THAN 2 psi |
| PRESSURE DROP: 6.0 in. w.c. |
| SPECIFIC GRAVITY: 0.60 |

#### TUBE SIZE (EHD)³

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For SI units: 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

<table>
<thead>
<tr>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>¹ Table entries are rounded to 3 significant digits.</td>
</tr>
<tr>
<td>² Table includes losses for four 90 degree (1.57 rad) bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing to the following equation: L = 1.3 n, where L is additional length (ft) of tubing and n is the number of additional fittings, bends, or both.</td>
</tr>
<tr>
<td>³ EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.</td>
</tr>
</tbody>
</table>
**TABLE 1215.2(17)**
CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54: TABLE 6.2.1(r)]

For SI units: 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa

Notes:
1. Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds 0.75 psi (5.17 kPa), DO NOT USE THIS TABLE. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across a regulator are capable of varying with flow rate.
2. CAUTION: Capacities shown in table are capable of exceeding maximum capacity for a selected regulator. Consult with regulator or tubing manufacturer for guidance.
3. Table includes losses for four 90 degree (1.57 rad) bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing according to the following equation: \( L = 1.3 \times n \), where \( L \) is additional length (ft) of tubing and \( n \) is the number of additional fittings, bends, or both.
4. Table entries are rounded to 3 significant digits.
5. EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.

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<thead>
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<th>46</th>
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<td>CAPACITY IN CUBIC FEET OF GAS PER HOUR</td>
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For SI units: 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa

Notes:
1. Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds 0.75 psi (5.17 kPa), DO NOT USE THIS TABLE. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across a regulator are capable of varying with flow rate.
2. CAUTION: Capacities shown in table are capable of exceeding maximum capacity for a selected regulator. Consult with regulator or tubing manufacturer for guidance.
3. Table includes losses for four 90 degree (1.57 rad) bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing according to the following equation: \( L = 1.3 \times n \), where \( L \) is additional length (ft) of tubing and \( n \) is the number of additional fittings, bends, or both.
4. Table entries are rounded to 3 significant digits.
5. EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.
### TABLE 1215.2(18)
CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54: TABLE 6.2.1(s)]

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<td><strong>PRESSURE DROP:</strong></td>
</tr>
<tr>
<td><strong>SPECIFIC GRAVITY:</strong></td>
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**TUBE SIZE (EHD)**

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</table>

For SI units: 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa

**Notes:**

1. Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds 1 psi (7 kPa), DO NOT USE THIS TABLE. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across regulator are capable of varying with the flow rate.
2. CAUTION: Capacities shown in table are capable of exceeding the maximum capacity of selected regulator. Consult tubing manufacturer for guidance.
3. Table includes losses for four 90 degree (1.57 rad) bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing to the following equation: \( L = 1.3 \times n \), where \( L \) is additional length (feet) of tubing and \( n \) is the number of additional fittings, bends, or both.
4. Table entries are rounded to 3 significant digits.
5. **EHD** = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.
### TABLE 1215.2(19)
POLYETHYLENE PLASTIC PIPE [NFPA 54: TABLE 6.2.1(t)]*

| GAS: NATURAL |
| INLET PRESSURE: LESS THAN 2 psi |
| PRESSURE DROP: 0.3 in. w.c. |
| SPECIFIC GRAVITY: 0.60 |

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<thead>
<tr>
<th>PIPE SIZE (inch)</th>
<th>NOMINAL OD:</th>
<th>DESIGNATION:</th>
<th>ACTUAL ID:</th>
<th>LENGTH (feet)</th>
<th>CAPACITY IN CUBIC FEET OF GAS PER HOUR</th>
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For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

* Table entries are rounded to 3 significant digits.
FUEL GAS PIPING

TABLE 1215.2(20)
POLYETHYLENE PLASTIC PIPE [NFPA 54: TABLE 6.2.1(u)]*

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<tr>
<td>SPECIFIC GRAVITY:</td>
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<table>
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<th>1 ¹⁄₂</th>
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<td>55</td>
<td>99</td>
<td>174</td>
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<td>160</td>
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<td>435</td>
<td>1200</td>
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<td>500</td>
<td>24</td>
<td>48</td>
<td>88</td>
<td>152</td>
<td>229</td>
<td>411</td>
<td>1140</td>
<td>2200</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

* Table entries are rounded to 3 significant digits.
### TABLE 1215.2(21)
POLYETHYLENE PLASTIC PIPE [NFPA 54: TABLE 6.2.1(v)]

<table>
<thead>
<tr>
<th>pipe size (inch)</th>
<th>CAPACITY IN CUBIC FEET OF GAS PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH (feet)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1860 3720 6710 11 600 17 600 31 600 87 300 169 000</td>
</tr>
<tr>
<td>20</td>
<td>1280 2560 4610 7990 12 100 21 700 60 000 116 000</td>
</tr>
<tr>
<td>30</td>
<td>1030 2050 3710 6420 9690 17 400 48 200 93 200</td>
</tr>
<tr>
<td>40</td>
<td>878 1760 3170 5490 8300 14 900 41 200 79 700</td>
</tr>
<tr>
<td>50</td>
<td>778 1560 2810 4870 7350 13 200 36 600 70 700</td>
</tr>
<tr>
<td>60</td>
<td>705 1410 2550 4410 6660 12 000 33 100 64 000</td>
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<tr>
<td>70</td>
<td>649 1300 2340 4060 6130 11 000 30 500 58 900</td>
</tr>
<tr>
<td>80</td>
<td>603 1210 2180 3780 5700 10 200 28 300 54 800</td>
</tr>
<tr>
<td>90</td>
<td>566 1130 2050 3540 5350 9610 26 600 51 400</td>
</tr>
<tr>
<td>100</td>
<td>535 1070 1930 3350 5050 9080 25 100 48 600</td>
</tr>
<tr>
<td>125</td>
<td>474 949 1710 2970 4480 8050 22 300 43 000</td>
</tr>
<tr>
<td>150</td>
<td>429 860 1550 2690 4060 7290 20 200 39 000</td>
</tr>
<tr>
<td>175</td>
<td>395 791 1430 2470 3730 6710 18 600 35 900</td>
</tr>
<tr>
<td>200</td>
<td>368 736 1330 2300 3470 6240 17 300 33 400</td>
</tr>
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<td>250</td>
<td>326 652 1180 2040 3080 5530 15 300 29 600</td>
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<td>295 591 1070 1850 2790 5010 13 900 26 800</td>
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<td>272 544 981 1700 2570 4610 12 800 24 700</td>
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<td>400</td>
<td>253 506 913 1580 2390 4290 11 900 22 900</td>
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<tr>
<td>450</td>
<td>237 475 856 1480 2240 4020 11 100 21 500</td>
</tr>
<tr>
<td>500</td>
<td>224 448 809 1400 2120 3800 10 500 20 300</td>
</tr>
<tr>
<td>550</td>
<td>213 426 768 1330 2010 3610 9990 19 300</td>
</tr>
<tr>
<td>600</td>
<td>203 406 733 1270 1920 3440 9530 18 400</td>
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<tr>
<td>650</td>
<td>194 389 702 1220 1840 3300 9130 17 600</td>
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<tr>
<td>700</td>
<td>187 374 674 1170 1760 3170 8770 16 900</td>
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<td>750</td>
<td>180 360 649 1130 1700 3050 8450 16 300</td>
</tr>
<tr>
<td>800</td>
<td>174 348 627 1090 1640 2950 8160 15 800</td>
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<tr>
<td>850</td>
<td>168 336 607 1050 1590 2850 7890 15 300</td>
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<tr>
<td>900</td>
<td>163 326 588 1020 1540 2770 7650 14 800</td>
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<tr>
<td>950</td>
<td>158 317 572 990 1500 2690 7430 14 400</td>
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<tr>
<td>1000</td>
<td>154 308 556 963 1450 2610 7230 14 000</td>
</tr>
<tr>
<td>1100</td>
<td>146 293 528 915 1380 2480 6870 13 300</td>
</tr>
<tr>
<td>1200</td>
<td>139 279 504 873 1320 2370 6550 12 700</td>
</tr>
<tr>
<td>1300</td>
<td>134 267 482 836 1260 2270 6270 12 100</td>
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<tr>
<td>1400</td>
<td>128 257 463 803 1210 2180 6030 11 600</td>
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<tr>
<td>1500</td>
<td>124 247 446 773 1170 2100 5810 11 200</td>
</tr>
<tr>
<td>1600</td>
<td>119 239 431 747 1130 2030 5610 10 800</td>
</tr>
<tr>
<td>1700</td>
<td>115 231 417 723 1090 1960 5430 10 500</td>
</tr>
<tr>
<td>1800</td>
<td>112 224 404 701 1060 1900 5260 10 200</td>
</tr>
<tr>
<td>1900</td>
<td>109 218 393 680 1030 1850 5110 9900</td>
</tr>
<tr>
<td>2000</td>
<td>106 212 382 662 1000 1800 4970 9600</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa

* Table entries are rounded to 3 significant digits.
### Table 1215.2(22)
#### Polyethylene Plastic Tubing (NFPA 54: Table 6.2.1(w))

<table>
<thead>
<tr>
<th>Plastic Tubing Size (CTS) (inch)</th>
<th>Nominal Od.</th>
<th>Actual Id.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>⅛</td>
<td>1</td>
</tr>
<tr>
<td><strong>DESIGNATION:</strong></td>
<td>SDR 7</td>
<td>SDR 11</td>
</tr>
<tr>
<td><strong>INLET PRESSURE:</strong></td>
<td>LESS THAN 2.0 psi</td>
<td></td>
</tr>
<tr>
<td><strong>PRESSURE DROP:</strong></td>
<td>0.3 in. w.c.</td>
<td></td>
</tr>
<tr>
<td><strong>SPECIFIC GRAVITY:</strong></td>
<td>0.60</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length (feet)</th>
<th>Capacity in Cubic Feet of Gas per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>54</td>
</tr>
<tr>
<td>20</td>
<td>37</td>
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<tr>
<td>30</td>
<td>30</td>
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<td>40</td>
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<td>175</td>
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<tr>
<td>225</td>
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<tr>
<td>250</td>
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<tr>
<td>275</td>
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<tr>
<td>300</td>
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<tr>
<td>350</td>
<td>NA</td>
</tr>
<tr>
<td>400</td>
<td>NA</td>
</tr>
<tr>
<td>450</td>
<td>NA</td>
</tr>
<tr>
<td>500</td>
<td>NA</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

**Notes:**
1. CTS = Copper tube size.
2. Table entries are rounded to 3 significant digits.
3. NA means a flow of less than 10 ft³/h (0.283 m³/h).

### Table 1215.2(23)
#### Polyethylene Plastic Tubing (NFPA 54: Table 6.2.1(x))

<table>
<thead>
<tr>
<th>Plastic Tubing Size (CTS) (inch)</th>
<th>Nominal Od.</th>
<th>Actual Id.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>⅛</td>
<td>1</td>
</tr>
<tr>
<td><strong>DESIGNATION:</strong></td>
<td>SDR 7</td>
<td>SDR 11</td>
</tr>
<tr>
<td><strong>INLET PRESSURE:</strong></td>
<td>LESS THAN 2.0 psi</td>
<td></td>
</tr>
<tr>
<td><strong>PRESSURE DROP:</strong></td>
<td>0.5 in. w.c.</td>
<td></td>
</tr>
<tr>
<td><strong>SPECIFIC GRAVITY:</strong></td>
<td>0.60</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length (feet)</th>
<th>Capacity in Cubic Feet of Gas per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
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<tr>
<td>20</td>
<td>49</td>
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<tr>
<td>500</td>
<td>NA</td>
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</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound-force per square inch = 6.8947 kPa, 1 inch water column = 0.249 kPa

**Notes:**
1. CTS = Copper tube size.
2. Table entries are rounded to 3 significant digits.
3. NA means a flow of less than 10 ft³/h (0.283 m³/h).
TABLE 1215.2(24)
SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.3.1(a)]*

<table>
<thead>
<tr>
<th>PIPE SIZE (inch)</th>
<th>CAPACITY IN THOUSANDS OF BTU PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTUAL</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.622</td>
</tr>
<tr>
<td>20</td>
<td>320</td>
</tr>
<tr>
<td>30</td>
<td>380</td>
</tr>
<tr>
<td>40</td>
<td>570</td>
</tr>
<tr>
<td>50</td>
<td>950</td>
</tr>
<tr>
<td>60</td>
<td>1260</td>
</tr>
<tr>
<td>70</td>
<td>1160</td>
</tr>
<tr>
<td>80</td>
<td>1080</td>
</tr>
<tr>
<td>90</td>
<td>1010</td>
</tr>
<tr>
<td>100</td>
<td>950</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 pound-force per square inch = 6.8947 kPa

* Table entries are rounded to 3 significant digits.
## TABLE 1215.2(25)

SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.3.1(b)]

<table>
<thead>
<tr>
<th>NOMINAL INSIDE:</th>
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<th>¾</th>
<th>1</th>
<th>1¼</th>
<th>1½</th>
<th>2</th>
<th>2½</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTUAL:</td>
<td>0.622</td>
<td>0.824</td>
<td>1.049</td>
<td>1.380</td>
<td>1.610</td>
<td>2.067</td>
<td>2.469</td>
<td>3.068</td>
<td>4.026</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PIPE SIZE (inch)</th>
<th>CAPACITY IN THOUSANDS OF BTU PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>½</td>
<td>5890 12 300 23 200 47 600 71 300 137 000 219 000 237 800 387 000 789 000</td>
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<tr>
<td>¾</td>
<td>4050 8460 15 900 32 700 49 000 94 400 150 000 266 000 543 000</td>
</tr>
<tr>
<td>1</td>
<td>3250 6790 12 800 26 300 39 400 75 800 121 000 214 000 436 000</td>
</tr>
<tr>
<td>1¼</td>
<td>2780 5810 11 000 22 500 33 700 64 900 103 000 183 000 373 000</td>
</tr>
<tr>
<td>1½</td>
<td>2460 5150 9 710 19 900 29 900 57 500 91 600 162 000 330 000</td>
</tr>
<tr>
<td>2</td>
<td>2230 4670 8 790 18 100 27 100 52 100 83 000 147 000 299 000</td>
</tr>
<tr>
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<td>2050 4300 8 090 16 600 24 900 47 900 76 400 135 000 275 000</td>
</tr>
<tr>
<td>3</td>
<td>1910 4000 7 530 15 500 23 200 44 600 71 100 126 000 256 000</td>
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<tr>
<td>3½</td>
<td>1790 3750 7 060 14 500 21 700 41 800 66 700 118 000 240 000</td>
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<tr>
<td>4</td>
<td>1690 3540 6 670 13 700 20 500 39 500 63 000 111 000 227 000</td>
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<td>1500 3140 5 910 12 100 18 200 35 000 55 800 98 700 201 000</td>
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<tr>
<td>40</td>
<td>1360 2840 5 360 11 000 16 800 31 700 50 600 89 400 182 000</td>
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<tr>
<td>50</td>
<td>1250 2620 4 930 10 100 15 200 29 200 46 500 82 300 167 800</td>
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<tr>
<td>60</td>
<td>1160 2430 4 580 9 410 14 100 27 200 43 300 76 500 156 100</td>
</tr>
<tr>
<td>00</td>
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<tr>
<td>400</td>
<td>860 1800 3 390 6 950 10 400 20 100 32 000 56 500 115 300</td>
</tr>
<tr>
<td>500</td>
<td>800 1670 3 150 6 470 9 690 18 700 29 800 52 600 107 300</td>
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<td>751 1570 2 960 6 070 9 090 17 500 27 900 49 400 100 700</td>
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<td>700</td>
<td>709 1480 2 790 5 730 8 590 16 500 26 400 46 600 95 100</td>
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<tr>
<td>800</td>
<td>673 1410 2 650 5 450 8 160 15 700 25 000 44 300 90 300</td>
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<tr>
<td>900</td>
<td>642 1340 2 530 5 200 7 780 15 000 23 900 42 200 86 200</td>
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<tr>
<td>1000</td>
<td>615 1290 2 420 4 980 7 450 14 400 22 900 40 500 82 500</td>
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<tr>
<td>1100</td>
<td>591 1240 2 330 4 780 7 160 13 800 22 000 38 900 79 300</td>
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<td>569 1190 2 240 4 460 6 900 13 300 21 200 37 400 76 400</td>
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<td>550 1150 2 170 4 450 6 660 12 800 20 500 36 200 73 700</td>
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<td>516 1080 2 030 4 170 6 250 12 000 19 200 33 900 69 200</td>
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</tr>
<tr>
<td>2000</td>
<td>440 930 1 790 3 570 5 300 10 200 16 800 27 400 60 500</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 pound-force per square inch = 6.8947 kPa

* Table entries are rounded to 3 significant digits.
**TABLE 1215.2(26)**  
**SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.3.1(c)]***

<table>
<thead>
<tr>
<th>NOMINAL:</th>
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<th>⅞</th>
<th>1½</th>
<th>2</th>
<th>2½</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTUAL ID:</td>
<td>0.622</td>
<td>0.824</td>
<td>1.049</td>
<td>1.380</td>
<td>1.610</td>
<td>2.067</td>
<td>2.469</td>
<td>3.068</td>
<td>4.026</td>
</tr>
<tr>
<td>LENGTH (feet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAPACITY IN THOUSANDS OF BTU PER HOUR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>2680</td>
<td>5590</td>
<td>10 500</td>
<td>21 600</td>
<td>32 400</td>
<td>62 400</td>
<td>99 500</td>
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<td>11 900</td>
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<td>4410</td>
<td>9060</td>
<td>13 600</td>
<td>26 100</td>
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For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 pound-force per square inch = 6.8947 kPa  
* Table entries are rounded to 3 significant digits.
**FUEL GAS PIPING**

**TABLE 1215.2(27)**
SCHEDULE 40 METALLIC PIPE [NFPA 54: TABLE 6.3.1(d)]

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<th>%</th>
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<th>1¼</th>
<th>1½</th>
<th>2</th>
<th>2½</th>
<th>3</th>
<th>4</th>
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<tr>
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<td>336</td>
<td>632</td>
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**GAS:** UNDILUTED PROPANE

**INLET PRESSURE:** 11.0 in. w.c.

**PRESSURE DROP:** 0.5 in. w.c.

**SPECIFIC GRAVITY:** 1.50

**INTENDED USE:** PIPE SIZING BETWEEN SINGLE- OR SECOND-STAGE (LOW-PRESSURE) REGULATOR AND APPLIANCE

**PIPE SIZE (inch)**

**CAPACITY IN THOUSANDS OF BTU PER HOUR**

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 inch water column = 0.249 kPa

*Table entries are rounded to 3 significant digits.
### TABLE 1215.2(28)

**SEMI-RIGID COPPER TUBING [NFPA 54: TABLE 6.3.1(e)]**

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<th>TUBE SIZE (inch)</th>
<th>OUTSIDE:</th>
<th>INSIDE:</th>
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<tr>
<td>Length (feet)</td>
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<tr>
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<td>0.625</td>
<td>0.562</td>
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| SPECIFIC GRAVITY: | 1.50 |

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<td>¼</td>
</tr>
<tr>
<td></td>
<td>⅛</td>
<td>⅛</td>
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<table>
<thead>
<tr>
<th>CAPACITY IN THOUSANDS OF BTU PER HOUR</th>
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<tr>
<td>10</td>
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<td>20</td>
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<tr>
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</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 pound-force per square inch = 6.8947 kPa

**Notes:**

1. Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.
2. Table entries are rounded to 3 significant digits.
### FUEL GAS PIPING

#### TABLE 1215.2(29)

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<td>PRESSURE DROP: 0.5 in. w.c.</td>
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#### INTENDED USE: TUBE SIZING BETWEEN SINGLE OR SECOND STAGE (LOW PRESSURE) REGULATOR AND APPLIANCE

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<td>%</td>
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<td>0.625</td>
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For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 inch water column = 0.249 kPa

Notes:

¹ Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.

² Table entries are rounded to 3 significant digits.

³ NA means a flow of less than 10 000 Btu/h (2.93 kW).
### TABLE 1215.2(30)
SEMI-RIGID COPPER TUBING [NFPA 54: TABLE 6.3.1(g)]

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<tr>
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<td></td>
<td>⅛%</td>
</tr>
<tr>
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<td>⅛%</td>
</tr>
<tr>
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<td>INSIDE: 1.000</td>
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Notes:
1. Table capacities are based on Type K copper tubing inside diameter (shown), which has the smallest inside diameter of the copper tubing products.
2. Table entries are rounded to 3 significant digits.

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 pound-force per square inch = 6.8947 kPa
FUEL GAS PIPING

TABLE 1215.2(31)
CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54: TABLE 6.3.1(h)]¹, ²

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<th>19</th>
<th>23</th>
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<th>37</th>
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</table>

For SI units: 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 inch water column = 0.249 kPa

Notes:
¹ Table includes losses for four 90 degree (1.57 rad) bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing to the following equation: L = 1.3 n, where L is additional length (ft) of tubing and n is the number of additional fittings, bends, or both.
² Table entries are rounded to 3 significant digits.
³ EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.
TABLE 1215.2(32)
CORRUGATED STAINLESS STEEL TUBING (CSST) [NFPA 54: TABLE 6.3.1(i)]\textsuperscript{1, 2, 3, 4}

GAS: UNDILUTED PROPANE

| INLET PRESSURE: | 2.0 psi |
| PRESSURE DROP:  | 1.0 psi |
| SPECIFIC GRAVITY: | 1.50 |

**INTENDED USE:** CSST SIZING BETWEEN 2 PSIG SERVICE AND LINE PRESSURE REGULATOR

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<th>19</th>
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<th>48</th>
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<tbody>
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</table>

For SI units: 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 pound-force per square inch = 6.8947 kPa

Notes:

1. Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds 0.5 psi (3.4 kPa) [based on 13 inch water column (3.2 kPa) outlet pressure], DO NOT USE THIS TABLE. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across a regulator are capable of varying with flow rate.
2. CAUTION: Capacities shown in table are capable of exceeding the maximum capacity for a selected regulator. Consult with regulator or tubing manufacturer for guidance.
3. Table includes losses for four 90 degree (1.57 rad) bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing to the following equation: \( L = 1.3 n \), where \( L \) is additional length (ft) of tubing and \( n \) is the number of additional fittings, bends, or both.
4. Table entries are rounded to 3 significant digits.
5. EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.
## TABLE 1215.2(33)
CROSSWAVE STAINLESS STEEL TUBING (CSST) [NFPA 54: TABLE 6.3.1(j)]\(^1\), \(^2\), \(^3\), \(^4\)

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<tr>
<td>PRESSURE DROP: 3.5 psi</td>
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<tr>
<td>SPECIFIC GRAVITY: 1.50</td>
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</tbody>
</table>

<table>
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</thead>
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<td>LENGTH (feet)</td>
<td>CAPACITY IN THOUSANDS OF BTU PER HOUR</td>
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</table>

For SI units: 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 pound-force per square inch = 6.8947 kPa

Notes:

1. Table does not include effect of pressure drop across the line regulator. Where regulator loss exceeds 0.5 psi (3.4 kPa) [based on 13 inch water column (3.2 kPa) outlet pressure], DO NOT USE THIS TABLE. Consult with regulator manufacturer for pressure drops and capacity factors. Pressure drops across a regulator are capable of varying with flow rate.

2. CAUTION: Capacities shown in table are capable of exceeding the maximum capacity for a selected regulator. Consult with regulator or tubing manufacturer for guidance.

3. Table includes losses for four 90 degree (1.57 rad) bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing to the following equation: L = 1.3 n, where L is additional length (ft) of tubing and n is the number of additional fittings, bends, or both.

4. Table entries are rounded to 3 significant digits.

5. EHD = Equivalent Hydraulic Diameter, which is a measure of the relative hydraulic efficiency between different tubing sizes. The greater the value of EHD, the greater the gas capacity of the tubing.
### TABLE 1215.2(34)
POLYETHYLENE PLASTIC PIPE [NFPA 54: TABLE 6.3.1(k)]

**INTENDED USE:** PE PIPE SIZING BETWEEN INTEGRAL SECOND-STAGE REGULATOR AT TANK OR SECOND-STAGE (LOW PRESSURE) REGULATOR AND BUILDING

<table>
<thead>
<tr>
<th>NOMINAL OD:</th>
<th>½</th>
<th>⅜</th>
<th>1</th>
<th>⅝</th>
<th>⅞</th>
<th>1</th>
<th>1⅝</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIGNATION:</td>
<td>SDR 9.3</td>
<td>SDR 11</td>
<td>SDR 11</td>
<td>SDR 10</td>
<td>SDR 11</td>
<td>SDR 11</td>
<td>SDR 11</td>
<td>SDR 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACTUAL ID:</td>
<td>0.660</td>
<td>0.860</td>
<td>1.077</td>
<td>1.328</td>
<td>1.554</td>
<td>1.943</td>
<td>2.864</td>
<td>3.682</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LENGTH (feet)</th>
<th>CAPACITY IN THOUSANDS OF BTU PER HOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>340</td>
</tr>
<tr>
<td>20</td>
<td>233</td>
</tr>
<tr>
<td>30</td>
<td>187</td>
</tr>
<tr>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td>50</td>
<td>142</td>
</tr>
<tr>
<td>60</td>
<td>129</td>
</tr>
<tr>
<td>70</td>
<td>119</td>
</tr>
<tr>
<td>80</td>
<td>110</td>
</tr>
<tr>
<td>90</td>
<td>103</td>
</tr>
<tr>
<td>100</td>
<td>98</td>
</tr>
<tr>
<td>125</td>
<td>87</td>
</tr>
<tr>
<td>150</td>
<td>78</td>
</tr>
<tr>
<td>175</td>
<td>72</td>
</tr>
<tr>
<td>200</td>
<td>67</td>
</tr>
<tr>
<td>250</td>
<td>60</td>
</tr>
<tr>
<td>300</td>
<td>54</td>
</tr>
<tr>
<td>350</td>
<td>50</td>
</tr>
<tr>
<td>400</td>
<td>46</td>
</tr>
<tr>
<td>450</td>
<td>43</td>
</tr>
<tr>
<td>500</td>
<td>41</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 inch water column = 0.249 kPa

* Table entries are rounded to 3 significant digits.
TABLE 1215.2(35)
POLYETHYLENE PLASTIC PIPE [NFPA 54: TABLE 6.3.1(l)]*

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 pound-force per square inch = 6.8947 kPa

* Table entries are rounded to 3 significant digits.
### TABLE 1215.2(36)
POLYETHYLENE PLASTIC TUBING [NFPA 54: TABLE 6.3.1(m)]

<table>
<thead>
<tr>
<th>GAS: UNDILUTED PROPANE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INLET PRESSURE: 11.0 in. w.c.</td>
</tr>
<tr>
<td>PRESSURE DROP: 0.5 in. w.c.</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY: 1.50</td>
</tr>
</tbody>
</table>

**INTENDED USE:** SIZING BETWEEN INTEGRAL 2-STAGE REGULATOR AT TANK OR SECOND-STAGE (LOW-PRESSURE REGULATOR) AND THE BUILDING

<table>
<thead>
<tr>
<th>PLASTIC TUBING SIZE (CTS)(^1) (inch)</th>
<th>NOMINAL OD: 1⁄2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIGNATION:</td>
<td>SDR 7</td>
<td>SDR 11</td>
</tr>
<tr>
<td>ACTUAL ID:</td>
<td>0.445</td>
<td>0.927</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LENGTH (feet)</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
<th>200</th>
<th>225</th>
<th>250</th>
<th>275</th>
<th>300</th>
<th>350</th>
<th>400</th>
<th>450</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPACITY IN THOUSANDS OF BTU PER HOUR</td>
<td>121</td>
<td>83</td>
<td>67</td>
<td>57</td>
<td>51</td>
<td>46</td>
<td>42</td>
<td>39</td>
<td>37</td>
<td>35</td>
<td>31</td>
<td>28</td>
<td>26</td>
<td>24</td>
<td>22</td>
<td>21</td>
<td>20</td>
<td>19</td>
<td>18</td>
<td>16</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1000 British thermal units per hour = 0.293 kW, 1 inch water column = 0.249 kPa

**Notes:**

\(^1\) CTS = Copper tube size.

\(^2\) Table entries are rounded to 3 significant digits.
CHAPTER 13
HEALTH CARE FACILITIES AND MEDICAL GAS AND MEDICAL VACUUM SYSTEMS

Part I – General Requirements.

1301.0 General Requirements.

1301.1 Applicability. This chapter applies to the special fixtures and systems in health care facilities; the special plumbing requirements for such facilities; and the installation, testing, and verification of Categories 1, 2, and 3 medical gas and medical vacuum piping systems, except as otherwise indicated in this chapter, from the central supply system to the station outlets or inlets in hospitals, clinics, and other health care facilities. Other plumbing in such facilities shall comply with other applicable sections of this code. For Category 3 medical gas systems, only oxygen and nitrous oxide shall be used.

1301.2 Where Not Applicable. This chapter does not apply to the following except as otherwise addressed in this chapter:

(1) Cylinder and container management, storage, and reserve requirements
(2) Bulk supply systems
(3) Electrical connections and requirements
(4) Motor requirements and controls
(5) Systems having nonstandard operating pressures
(6) Waste anesthetic gas disposal (WAGD) systems
(7) Surface-mounted medical gas rail systems
(8) Breathing air replenishment (BAR) systems
(9) Portable compressed gas systems
(10) Medical support gas systems
(11) Gas-powered device supply systems
(12) Scavenging systems

1301.3 Conflict of Requirements. The requirements of this chapter shall not be interpreted to conflict with the requirements of NFPA 99. For requirements of portions of medical gas and vacuum systems not addressed in this chapter or medical gas and vacuum systems beyond the scope of this chapter refer to NFPA 99.

1301.4 Where Required. Construction and equipment requirements shall be applied only to new construction and new equipment, except as modified in individual sections of this chapter. [NFPA 99:1.3.2]

1301.5 Existing Systems. Only the altered, renovated, or modernized portion of an existing system or component shall be required to meet the installation and equipment requirements stated in this code. If the alteration, renovation, or modernization adversely impacts the existing performance requirements of a system or component, additional upgrading shall be required. An existing system that is not in strict compliance with the provisions of this code shall be permitted to be continued in use, unless the Authority Having Jurisdiction has determined that such use constitutes a distinct hazard to life. [NFPA 99:1.3.2.1 – 1.3.2.3]

1302.0 Design Requirements.

1302.1 Risk Categories. Activities. All activities, as well as systems, or equipment that are new or altered, shall be designed to meet Category 1 through Category 4 requirements, as detailed in this chapter. [NFPA 99:4.1]

1302.1.1 Processes and Operations. The health care facility’s governing body shall establish the processes and operations that are planned for the health care facility. [NFPA 99:4.2.1]

1302.1.1.1 Risk Categories. The governing body shall conduct risk assessments and shall determine risk categories based on the character of the processes and operations conducted in the health care facility. [NFPA 99:4.2.1.1]

1302.1.2 Risk Assessment. Risk categories shall be classified by the health care facility’s governing body by following and documenting a defined risk assessment procedure. [NFPA 99:4.2.2]

1302.1.2.1 Documents to the Authority Having Jurisdiction. Where required by the Authority Having Jurisdiction (AHJ), the risk assessment shall be provided to the AHJ for review based on the character of the processes and operations conducted in the health care facility. [NFPA 99:4.2.2.1]

1302.1.3 Documented Risk Assessment. A documented risk assessment shall not be required where Category 1 is selected. [NFPA 99:4.2.3]

1302.2 Patient Care Spaces. The health care facility’s governing body or its designee shall establish the following areas in accordance with the type of patient care anticipated (see definition of patient care space in Chapter 2):

(1) Category 1 spaces
(2) Category 2 spaces
(3) Category 3 spaces
(4) Category 4 spaces [NFPA 99:1.3.4.1]

1302.3 Anesthesia. It shall be the responsibility of the health care facility’s governing body to designate anesthetizing locations. [NFPA 99:1.3.4.2]

1302.4 Wet Procedure Locations. It shall be the responsibility of the health care facility’s governing body to designate wet procedure locations. [NFPA 99:1.3.4.3]

1303.0 Health Care Facilities.

1303.1 Drinking Fountain Control Valves. Drinking fountain control valves shall be flush-mounted or fully recessed where installed in corridors or other areas where patients are transported on a gurney, bed, or wheelchair.

1303.2 Psychiatric Patient Rooms. Piping and drain traps in psychiatric patient rooms shall be concealed. Fixtures and fittings shall be resistant to vandalism.
1303.3 Locations for Ice Storage. Ice makers or ice storage containers shall be located in nursing stations or similarly supervised areas to minimize potential contamination.

1303.4 Sterilizers and Bedpan Steamers. Sterilizers and bedpan steamers shall be installed in accordance with the manufacturer’s installation instructions and comply with Section 1303.4.1 and Section 1303.4.2.

1303.4.1 Drainage Connections. Sterilizers and bedpan steamers shall be connected to the sanitary drainage system through an air gap in accordance with Section 801.2. The size of indirect waste piping shall be not less than the size of the drain connection on the fixture. Each such indirect waste pipe shall not exceed 15 feet (4572 mm) in length and shall be separately piped to a receptor. Such receptors shall be located in the same room as the equipment served. Except for bedpan steamers, such indirect waste pipes shall not require traps. A trap having a seal of not less than 3 inches (76 mm) shall be provided in the indirect waste pipe for a bedpan steamer.

1303.4.2 Vapor Vents and Stacks. Where a sterilizer or bedpan steamer has provision for a vapor vent and such a vent is required by the manufacturer, the vent shall be extended to the outdoors above the roof. Sterilizer and bedpan steamer vapor vents shall be installed in accordance with the manufacturer’s installation instructions and shall not be connected to a drainage system vent.

1303.5 Aspirators. Provisions for aspirators or other water-supplied suction devices shall be installed with the specific approval of the Authority Having Jurisdiction. Where aspirators are used for removing body fluids, they shall include a collection container to collect liquids and solid particles. Aspirators shall indirectly discharge to the sanitary drainage system through an air gap in accordance with Section 806.1. The potable water supply to an aspirator shall be protected by a vacuum breaker or equivalent backflow protection device in accordance with Section 603.5.9.

1303.6 Drains. Drains shall be installed on dryers, aftercoolers, separators, and receivers.

1303.7 Clinical Sinks. Clinical sinks shall be installed in accordance with the manufacturer’s installation instructions and shall comply with Section 1303.7.1.

1303.7.1 Drainage Connection. Clinical sinks shall be directly connected to the sanitary drainage system and shall be provided with approved flushing devices installed in accordance with Section 413.1.

1303.8 Water Supply for Hospitals. Hospitals shall be provided with not less than two approved potable water sources that are installed in such a manner as to prevent the interruption of water service.

1303.9 Work Performed in Occupied Healthcare Facilities. In existing, occupied, inpatient healthcare facilities, all plumbing systems installation and remodel work shall be performed by personnel certified in accordance with ASSE/IAPMO 12010, ASSE/IAPMO 12030, and ASSE/IAPMO 12040.

1304.0 Medical Gas and Medical Vacuum Piping Systems.

1304.1 General. The installation of medical gas and medical vacuum piping systems shall comply with the requirements of this chapter.

1304.2 Certification of Systems. Certification of medical gas and vacuum systems shall comply with the requirements of Section 1306.0.

1304.3 Construction Documents. Before a medical gas or medical vacuum system is installed or altered in a hospital, medical facility, or clinic, duplicate construction documents shall be filed with the Authority Having Jurisdiction. Approval of the plans shall be obtained before issuance of a permit by the Authority Having Jurisdiction.

1304.3.1 Requirements. Construction documents shall show the following:

(1) Plot plan of the site, drawn to scale, indicating the location of existing or new cylinder storage areas, property lines, driveways, and existing or proposed buildings.

(2) Piping layout of the proposed piping system or alteration, including alarms, valves, the origin of gases, user outlets, and user inlets. The demand and loading of piping, existing or future, shall also be indicated.

(3) Complete specification of materials.

1304.4 Extent of Work. Construction documents submitted to the Authority Having Jurisdiction shall clearly indicate the nature and extent of the work proposed and shall show in detail that such work will be in accordance with the provisions of this chapter.

1304.5 Record. A record of as-built plans and valve identification records shall remain on the site.

1305.0 System Performance.

1305.1 Required Operating Pressures. Medical gas and vacuum systems shall be capable of delivering service in the pressure ranges listed in Table 1305.1.

1305.2 Minimum Flow Rates. Medical gas and vacuum systems shall be capable of supplying the flow rates listed in Table 1305.2.

1305.3 Minimum Station Outlets and Inlets. Station outlets and inlets for medical gas and vacuum systems shall be provided as listed in Table 1305.3.

1306.0 System Certification.

1306.1 Certification. Prior to a medical gas or vacuum system being placed in service, such system shall be certified in accordance with Section 1306.2.

1306.2 Certification Tests. Certification tests, verified and attested to by the certification agency, shall include the following:

(1) Verifying in accordance with the installation requirements.
(2) Testing and checking for leakage, correct zoning, and identification of control valves.

(3) Checking for identification and labeling of pipelines, station outlets, and control valves.

(4) Testing for cross-connection, flow rate, system pressure drop, and system performance.

(5) Functional testing of pressure relief valves and safety valves.

(6) Functional testing of sources of supply.

(7) Functional testing of alarm systems, including accuracy of system components.

(8) Purge flushing of system and filling with specific source gases.

(9) Testing for purity and cleanliness of source gases.

(10) Testing for specific gas identity at each station outlet.

**1306.3 Report Items.** A report that includes the specific items addressed in Section 1306.2, and other information required by this chapter, shall be delivered to the Authority Having Jurisdiction prior to acceptance of the system.

**1306.4 Components.** Functioning of alarm components shall be verified in accordance with the testing and monitoring requirements of the manufacturer and the Authority Having Jurisdiction.

### TABLE 1305.2
**MINIMUM FLOW RATES**
(cubic feet per minute)

<table>
<thead>
<tr>
<th>MEDICAL SYSTEM</th>
<th>FLOW RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>0.71 CFM per outlet¹</td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>0.71 CFM per outlet¹</td>
</tr>
<tr>
<td>Medical Compressed Air</td>
<td>0.71 CFM per outlet¹</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>15 CFM free air per outlet</td>
</tr>
<tr>
<td>Vacuum</td>
<td>1 SCFM per inlet²</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>0.71 CFM per outlet¹</td>
</tr>
<tr>
<td>Helium</td>
<td>0.71 CFM per outlet¹</td>
</tr>
</tbody>
</table>

For SI units: 1 cubic foot per minute (CFM) = 0.47 L/s

Notes:
1 A room designed for a permanently located respiratory ventilator or anesthesia machine shall have an outlet capable of a flow rate of 6.36 CFM (3.0 L/s) at the station outlet.
2 For testing and certification purposes, individual station inlets shall be capable of a flow rate of 3 SCFM (1.4 L/s), while maintaining a system pressure of not less than 12 inches of mercury (41 kPa) at the nearest adjacent vacuum inlet.
TABLE 1305.3
MINIMUM OUTLETS AND INLETS PER STATION

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>OXYGEN</th>
<th>MEDICAL VACUUM</th>
<th>MEDICAL AIR</th>
<th>NITROUS OXIDE</th>
<th>NITROGEN</th>
<th>HELIUM</th>
<th>CARBON DIOXIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient rooms for medical/surgical, obstetrics, and pediatrics</td>
<td>1/bed</td>
<td>1/bed</td>
<td>1/bed</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Examination/treatment for nursing units</td>
<td>1/bed</td>
<td>1/bed</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Intensive care (all)</td>
<td>3/bed</td>
<td>3/bed</td>
<td>2/bed</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Nursery</td>
<td>2/bed</td>
<td>2/bed</td>
<td>1/bed</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>General operating rooms</td>
<td>2/room</td>
<td>3/room</td>
<td>2/room</td>
<td>1/room</td>
<td>1/room</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Cystoscopic and special invasive procedures</td>
<td>2/room</td>
<td>3/room</td>
<td>2/room</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Recovery delivery and labor/recovery rooms</td>
<td>2/bed</td>
<td>2/bed</td>
<td>1/bed</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Labor rooms</td>
<td>1/bed</td>
<td>1/bed</td>
<td>1/bed</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>First aid and emergency treatment</td>
<td>1/bed</td>
<td>1/bed</td>
<td>1/bed</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Autopsy</td>
<td>—</td>
<td>1/station</td>
<td>1/station</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Anesthesia workroom</td>
<td>1/station</td>
<td>—</td>
<td>1/station</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Notes:
1 Includes pediatric nursery.
2 Includes obstetric recovery.
3 Emergency trauma rooms used for surgical procedures shall be classified as general operating rooms.
4 Vacuum inlets required are in addition to inlets used as part of a scavenging system for removal of anesthetizing gases.

Part II – Category 1 Piped Gas and Vacuum Systems.

1307.0 Central Supply Systems.

1307.1 Terms. Where the terms medical gas or medical support gas occur, the provisions shall apply to all piped systems for oxygen, nitrous oxide, medical air, carbon dioxide, helium, nitrogen, instrument air, and mixtures thereof. Wherever the name of a specific gas service occurs, the provision shall apply only to that gas. [NFPA 99:5.1.1.3]

1307.2 Nature of Hazards of Gas and Vacuum Systems. Potential fire and explosion hazards associated with positive pressure gas central piping systems and medical–surgical vacuum systems shall be considered in the design, installation, testing, operation, and maintenance of these systems. [NFPA 99:5.1.2]

1307.3 Permitted Locations for Medical Gases. Central supply systems for oxygen, medical air, nitrous oxide, carbon dioxide, and all other patient medical gases shall be piped only to medical gas outlets complying with Section 1315.0, into areas where the gases will be used under the direction of licensed medical professionals for purposes congruent with the following:

1. Direct respiration by patients.
2. Clinical application of the gas to a patient, such as the use of an insufflator to inject carbon dioxide into patient body cavities during laparoscopic surgery and carbon dioxide used to purge heart-lung machine blood flow ways.
3. Medical device applications directly related to respiration.
4. Power for medical devices used directly on patients.
5. Calibration of medical devices intended for Section 1307.3(1) through Section 1307.3(4).
6. Simulation centers for the education, training, and assessment of health care professionals. [NFPA 99:5.1.3.5.2]

1307.4 Materials. Materials used in central supply systems shall meet the following requirements:

1. In those portions of systems intended to handle oxygen at gauge pressures greater than 350 pounds-force per square inch (psi) (2413 kPa), interconnecting hose shall contain no polymeric materials.
2. In those portions of systems intended to handle oxygen or nitrous oxide material, construction shall be compatible with oxygen under the temperatures and pressures to which the components can be exposed in the containment and use of oxygen, nitrous oxide, mixtures of these gases, or mixtures containing more than 23.5 percent oxygen.
3. If potentially exposed to cryogenic temperatures, materials shall be designed for low temperature service.
4. If intended for outdoor installation, materials shall be installed per the manufacturer’s requirements. [NFPA 99:5.1.3.5.4]

1308.0 Pressure-Regulating Equipment.

1308.1 Where Required. Pressure-regulating equipment shall be installed in the supply main upstream of the final line-pressure valve. Where multiple piping systems for the same gas at different operating pressures are required, separate pressure-regulating equipment, relief valves, and source shut-off valves shall be provided for each pressure.

1308.2 Pressure Relief Valves. All pressure relief valves shall meet the following requirements:
(1) They shall be of brass, bronze, or stainless steel construction.
(2) They shall be designed for the specific gas service.
(3) They shall have a relief pressure setting not higher than the maximum allowable working pressure (MAWP) of the component with the lowest working pressure rating in the portion of the system being protected.
(4) They shall be vented to the outside of the building, except that relief valves for compressed air systems having less than 3000 cubic feet (84,950 L) at STP shall be permitted to be diffused locally by means that will not restrict the flow.
(5) They shall have a vent discharge line that is not smaller than the size of the relief valve outlet or 3/4 NPS (20 mm), whichever is larger.
(6) Where two or more relief valves discharge into a common vent line, the internal cross-sectional area of the common line shall not be less than the aggregate cross-sectional area of all relief valve vent discharge lines served.
(7) They shall not discharge into locations creating potential hazards.
(8) They shall have the discharge terminal turned down and screened to prevent the entry of rain, snow, or vermin.
(9) They shall be designed in accordance with ASME B31.3. [NFPA 99:5.1.3.5.6.1]

1308.3 Pressure-Relief Valve Requirements. Central supply systems for positive pressure gases shall include one or more relief valves, all meeting the following requirements:
(1) They shall be located between each final line regulator and the source valve.
(2) They shall have a relief setting that is 50 percent above the pressure of the component with the lowest working pressure rating in the portion of the system being protected.
(3) They shall have a relief pressure setting not higher than the normal system operating pressure, as indicated in Table 1305.1. [NFPA 99:5.1.3.5.6.4]

1309.0 Oxygen Concentrator Supply Units.

1309.1 Oxygen Requirements. Oxygen concentrator supply units for use with medical gas pipelines shall produce oxygen meeting the requirements of Oxygen USP or Oxygen USP. [NFPA 99:5.1.3.5.11.1.15.1.3.9.1.1]

1309.2 Particulate Size. Output shall have less than or equal to 1.686 x 10^6 pounds per cubic yard (1 mg/m^3) of permanent particulates sized 1 micron or larger at normal atmospheric pressure. [NFPA 99:5.1.3.5.11.2.5.1.3.9.1.2]

1309.3 Suitability. Materials of construction on the air side of the oxygen concentrator unit shall be suitable for the service as determined by the manufacturer. [NFPA 99:5.1.3.5.11.2.5.1.3.9.1.3]

1309.4 Compatible Materials. Materials of construction on the oxygen side of the oxygen concentrator unit shall comply with Section 1307.4. [NFPA 99:5.1.3.5.11.4.5.1.3.9.1.4]

1309.5 Oxygen Concentrator Components. The components that make up the oxygen concentrator unit shall be as follows:
(1) The manufacturer of the concentrator unit shall be permitted to use such components and arrangement of such components as needed to produce oxygen complying with Section 1309.1 in the quantity as required by the facility, except where otherwise specifically defined in this code.
(2) Air receivers and oxygen accumulators, where used, shall comply with Section VIII, “Unfired Pressure Vessels,” of the ASME Boiler and Pressure Vessels Code and be provided with overpressure relief valves. [NFPA 99:5.1.3.5.11.5.1.3.9.1.5]

1309.6 Supply Air Quality. The supply air to the concentrator shall be of a quality to ensure the oxygen concentrator unit can produce oxygen complying with Section 1309.1 and shall not be subject to normally anticipated contamination (e.g., vehicle or other exhausts, gas leakage, discharge from vents, flooding, and so forth). [NFPA 99:5.1.3.5.11.6 5.1.3.9.1.6]

1309.7 Electrical Components. The oxygen concentrator supply unit and any associated electrical equipment shall be provided, with, at a minimum, with the following electrical components:
(1) Either a disconnect switch for each major electrical component or a single disconnect that deactivates all electrical components in the concentrator unit.
(2) Motor starting devices with overload protection for any component with an electrical motor over 2 hp (1.5 kW). [NFPA 99:5.1.3.5.11.7.5.1.3.9.1.7]

1309.8 Vent Valve. A vent valve shall be provided as follows:
(1) Located on the source side of the concentrator outlet isolation valve to permit the operation of the oxygen concentrator unit for validation, calibration, and testing while the unit is isolated from the pipeline system.
(2) Sized to allow for at least 25 percent of the oxygen concentrator unit flow.
(3) Vented to a location compliant with Section 1309.8.1. [NFPA 99:5.1.3.5.11.8.5.1.3.9.1.8]

1309.8.1 Venting of Relief Valves. Indoor supply systems shall have all relief valves vented per Section 1308.2(4) through Section 1308.2(9). [NFPA 99:5.1.3.3.3.2]

1309.9 Valved Sample Port. A DN8 (NPS 1/4) valved sample port shall be provided near the oxygen concentration monitor sensor connection for sampling of the gas from the oxygen concentrator unit. [NFPA 99:5.1.3.5.11.9.5.1.3.9.1.9]

1309.10 Suitable Filter. At least one 0.1 micron filter suitable for oxygen service shall be provided at the outlet of the oxygen concentrator supply unit. [NFPA 99:5.1.3.5.11.10 5.1.3.9.1.10]

1309.11 Check Valve. A check valve shall be provided at the outlet of the oxygen concentrator supply unit to prevent backflow into the oxygen concentrator supply unit and to allow service to the unit. [NFPA 99:5.1.3.5.11.11 5.1.3.9.1.11]

1309.12 Outlet Valve. An outlet valve shall be provided to isolate all components of the oxygen concentrator from the pipeline with the following characteristics:
(1) The valve shall have both manual and automatic actuation with visual indication of open or closed.

(2) The valve shall close automatically whenever the oxygen concentrator unit is not producing oxygen of a concentration equal to that in Section 1309.1.

(3) Continuing operation of the oxygen concentrator supply unit through the vent mode shall be permitted with the isolating valve closed.

(4) The isolating valve, when automatically closed due to low concentration, shall require manual reset to ensure the oxygen concentrator supply unit is examined prior to return to service.

(5) Closing the isolating valve, whether automatically or manually, shall activate an alarm signal at the master alarms (see Section 1317.1.1) indicating that the oxygen concentrator supply unit is disconnected. [NFPA 99:5.1.3.9.1.12]

1309.13 Oxygen Concentration Monitor. The oxygen concentrator supply unit shall be provided with an oxygen concentration monitor with the following characteristics:

(1) The monitor shall be capable of monitoring 99 percent oxygen concentration with 1 percent accuracy.

(2) The monitor shall continuously display the oxygen concentration and shall activate local alarm and master alarms per NFPA 99 when a concentration lower than 91 percent is observed.

(3) The monitor shall continuously display the oxygen concentration.

(4) It shall be permitted to insert the monitor into the pipeline without a demand check. [NFPA 99:5.1.3.9.1.13]

1310.0 Category 1 Medical Air Central Supply Systems.

1310.1 Quality of Medical Air. Medical air shall be required to have the following characteristics:

(1) It shall be supplied from cylinders, bulk containers, or medical air compressor sources, or it shall be reconstituted from oxygen USP and oil-free, dry nitrogen NF.

(2) It shall meet the requirements of medical air USP.

(3) It shall have no detectable liquid hydrocarbons.

(4) It shall have less than 25 ppm gaseous hydrocarbons.

(5) It shall have equal to or less than 1.686 x 10^-6 pounds per cubic yard (1 mg/m³) of permanent particulates sized 1 micron or larger in the air at normal atmospheric pressure. [NFPA 99:5.1.3.6.1.1]

1310.2 Uses of Medical Air. Medical air sources shall be connected to the medical air distribution system only and shall be used only for air in the application of human respiration and calibration of medical devices for respiratory application. [NFPA 99:5.1.3.6.2.2]

1310.3 Medical Air Compressors. Medical air compressors shall be installed in a well-lit, ventilated, and clean location and shall be accessible. The location shall be provided with drainage facilities in accordance with this code. The medical air compressor area shall be located separately from medical gas cylinder system sources, and shall be readily accessible for maintenance.

1310.3.1 Category 1 Medical Air Compressor. Medical air compressors shall be sufficient to serve the peak calculated demand with the largest single compressor out of service. In no case shall there be fewer than two compressors. [NFPA 99:5.1.3.6.3.9(B)]

1310.3.2 Required Components. Medical air compressor systems shall consist of the following:

(1) Components shall be arranged to allow service and a continuous supply of medical air in the event of a single fault failure.

Component arrangement shall be permitted to vary as required by the technology(ies) employed, provided that an equal level of operating redundancy and medical air quality is maintained. [NFPA 99:5.1.3.6.3.9(A)(1), 5.1.3.6.3.9(A)(2)]

(2) Automatic means to prevent backflow from all on-cycle compressors through all off-cycle compressors.

(3) Manual shutoff valve to isolate each compressor from the centrally piped system and from other compressors for maintenance or repair without loss of pressure in the system.

(4) Intake filter-muffler(s) of the dry type.

(5) Pressure relief valve(s) set at 50 percent above line pressure.

(6) Piping and components between the compressor and the source shutoff valve that do not contribute to contaminant levels.

(7) Except as defined in Section 1310.3.2(1) through Section 1310.3.2(6), materials and devices used between the medical air intake and the medical air source valve that are of any design or construction appropriate for the service as determined by the manufacturer. [NFPA 99:5.1.3.6.3.2(2-7)]

1310.4 Medical Air Receivers. Receivers for medical air shall meet the following requirements:

(1) They shall be made of corrosion-resistant materials or otherwise be made corrosion resistant.

(2) They shall comply with Section VIII, “Unfired Pressure Vessels,” of the ASME Boiler and Pressure Vessel Code.

(3) They shall be equipped with a pressure relief valve, automatic drain, manual drain, sight glass, and pressure indicator.

(4) They shall be of a capacity sufficient to prevent the compressors from short-cycling. [NFPA 99:5.1.3.6.3.6]

1310.5 Valves. A medical air receiver(s) shall be provided with proper valves to allow the flow of compressed air to enter and exit out of separate receiver ports during normal operation and allow the receiver to be bypassed during service without shutting down the supply of medical air. [NFPA 99:5.1.3.6.3.9(D)]

1311.0 Compressor Intake.

1311.1 Air Sources. Air sources for medical air compressors shall comply with Section 1311.2 through Section 1311.6.
1311.2 Medical Air Compressor Source. The medical air compressors shall draw their air from a source of clean air. [NFPA 99:5.1.3.6.3.11(A)]

If an air source equal to or better than outside air (e.g., air already filtered for use in operating room ventilating systems) is available, it shall be permitted to be used for the medical air compressors with the following provisions:
1. This alternate source of supply air shall be available on a continuous 24-hours-per-day, 7-day-per-week basis.
2. Ventilating systems having fans with motors or drive belts located in the airstream shall not be used as a source of medical air intake. [NFPA 99:5.1.3.6.3.11(E)]

1311.3 Air Intakes. Compressor intake piping shall be permitted to be made of materials and use a joining technique as permitted under Section 1319.0 and Section 1320.0. [NFPA 99:5.1.3.6.3.11(F)]

1311.4 Location. The medical air intake shall be located as follows:
1. The medical air intake shall be located a minimum of 25 feet (7620 mm) from ventilating system exhausts, fuel storage vents, combustion vents, plumbing vents, and vacuum and WAGD discharges, or areas that can collect vehicular exhausts or other noxious fumes.
2. The medical air intake shall be located a minimum of 20 feet (6096 mm) above ground level.
3. The medical air intake shall be located a minimum of 10 feet (3048 mm) from any door, window, or other opening in the building. [NFPA 99:5.1.3.6.3.11(B-D)]

1311.5 Separate Compressors. Air intakes for separate compressors shall be permitted to be joined together to one common intake where the following conditions are met:
1. The common intake is sized to minimize backpressure in accordance with the manufacturer’s recommendations.
2. Each compressor can be isolated by manual or check valves, blind flange, or tube cap to prevent open inlet piping when the compressor(s) is removed for service from the consequent backflow of room air into the other compressor(s). [NFPA 99:5.1.3.6.3.11(G)]

1311.6 Screening. The end of the intake shall be turned down and screened or otherwise be protected against the entry of vermin, debris, or precipitation by screening fabricated or composed of a noncorroding material. [NFPA 99:5.1.3.6.3.11(H)]

1312.0 Medical Surgical Vacuum Central Supply Systems.

1312.1 General. The vacuum plant shall be installed in a well-lit, ventilated, and clean location with accessibility. The location shall be provided with drainage facilities in accordance with this code. The vacuum plant, where installed as a source, shall be located separately from other medical vacuum system sources and shall be readily accessible for maintenance.

1312.2 Medical-Surgical Vacuum Sources. Medical-surgical vacuum central supply systems shall consist of the following:
1. Two or more vacuum pumps sufficient to serve the peak calculated demand with the largest single vacuum pump out of service.
2. Automatic means to prevent backflow from any on-cycle vacuum pumps through any off-cycle vacuum pumps.
3. Shutoff valve or other isolation means to isolate each vacuum pump from the centrally piped system, and other vacuum pumps for maintenance or repair without loss of vacuum in the system.
4. Vacuum receiver.
5. Piping between the vacuum pump(s), discharge(s), receiver(s), and vacuum source shutoff valve in accordance with Section 1319.0, except brass, galvanized, or black steel pipe, which is permitted to be used as recommended by the manufacturer.
6. Except as defined in Section 1312.2(1) through Section 1312.2(5), materials and devices used between the medical vacuum exhaust and the medical vacuum source that are permitted to be of any design or construction appropriate for the service as determined by the manufacturer.
7. Vacuum filtration per Section 1312.4. [NFPA 99:5.1.3.7.1.1]

1312.3 Vacuum Receivers. Receivers for vacuum shall meet the following requirements:
1. They shall be made of materials deemed suitable by the manufacturer.
2. They shall comply with Section VIII, “Unfired Pressure Vessels,” of the ASME Boiler and Pressure Vessel Code.
3. They shall be capable of withstanding a gauge pressure of 60 psi (414 kPa) and 30 inch (762 mm) gauge HgV.
4. They shall be equipped with a manual drain.
5. They shall be of a capacity based on the technology of the pumps. [NFPA 99:5.1.3.7.3]

1312.4 Vacuum Filtration. Central supply systems for vacuum other than liquid ring pumps shall be provided with inlet filtration with the following characteristics:
1. Filtration shall be at least duplex to allow one filter to be exchanged without impairing the vacuum system.
2. Filtration shall be located on the patient side of the vacuum producer.
3. Filters shall be efficient to 0.3 µ and 99.97 percent HEPA or better, per DOE-STD-3020.
4. Filtration shall be sized for 100 percent of the peak calculated demand while one filter or filter bundle is isolated.
5. It shall be permitted to group multiple filters into bundles to achieve the required capacities.
6. The system shall be provided with isolation valves on the source side of each filter or filter bundle and isolation valves on the patient side of each filter or filter bundle, permitting the filters to be isolated without shutting off flow to the central supply system.
7. A means shall be available to allow the user to observe any accumulations of liquids.
1313.0 Medical-Surgical Vacuum Exhaust.

1313.1 Vacuum Source Exhausts. The medical-surgical vacuum pumps shall exhaust in a manner and location that minimizes the hazards of noise and contamination to the facility and its environment. [NFPA 99:5.1.3.7.7.1]

1313.2 Location. The exhaust shall be located as follows:
(1) Outdoors.
(2) At least 25 feet (7620 mm) from any door, window, air intake, or other openings in buildings or places of public assembly.
(3) At a level different from air intakes.
(4) Where prevailing winds, adjacent buildings, topography, or other influences will not divert the exhaust into occupied areas or prevent dispersion of the exhaust. [NFPA 99: 5.1.3.7.7.2]

1313.3 Screening. The end of the exhaust shall be turned down and screened or otherwise be protected against the entry of vermin, debris, or precipitation by screening fabricated or composed of a noncorroding material. [NFPA 99:5.1.3.7.7.3]

1313.4 Dips and Loops. The exhaust shall be free of dips and loops that might trap condensate or oil or provided with a drip leg and valved drain at the bottom of the low point. [NFPA 99:5.1.3.7.7.4-5.1.3.7.7.5]

1313.5 Multiple Pumps. Vacuum exhausts from multiple pumps shall be permitted to be joined together to one common exhaust where the following conditions are met:
(1) The common exhaust is sized to minimize backpressure in accordance with the pump manufacturer’s recommendations.
(2) Each pump can be isolated by manual or check valve, blind flange, or tube cap to prevent open exhaust piping when the pump(s) is removed for service from consequent flow of exhaust air into the room. [NFPA 99:5.1.3.7.7.5-5.1.3.7.7.6]

1314.0 Valves.

1314.1 Gas and Vacuum Shutoff Valves. Shutoff valves shall be provided to isolate sections or portions of the piped distribution system for maintenance, repair, or planned future expansion need and to facilitate periodic testing. [NFPA 99:5.1.4.1.1]

1314.2 Security. All valves, except valves in zone valve box assemblies, shall be secured by any of the following means:
(1) Located in secured areas.
(2) Locked or latched in their operating position.
(3) Located above ceilings, but remaining accessible and not obstructed. [NFPA 99:5.1.4.1.2]

1314.3 Labeled. All valves shall be labeled as to gas supplied and the area(s) controlled, in accordance with Section 1323.14. [NFPA 99:5.1.4.1.3]

1314.4 Accessibility. Zone valves shall be installed in valve boxes with removable covers large enough to allow manual operation of valves.

Zone valves for use in certain areas, such as psychiatric or pediatric areas, shall be permitted to be secured with the approval of the Authority Having Jurisdiction to prevent inappropriate access. [NFPA 99:5.1.4.1.4]

1314.4.1 Flammable Gases. Valves for nonflammable medical gases shall not be installed with valves for flammable gases in the same zone valve box assembly with flammable gases. [NFPA 99:5.1.4.1.5]

1314.5 Valve Types. New or replacement valves shall be permitted to be of any type as long as they meet the following conditions:
(1) They have a minimum Cv factor in accordance with Table 1314.5(a) or Table 1314.5(b).
(2) They use a quarter turn to off.
(3) They are constructed of materials suitable for the service.
(4) They are provided with copper tube extensions by the manufacturer for brazing or with corrugated medical tubing (CMT) fittings.
(5) They indicate to the operator if the valve is open or closed.
They permit in-line serviceability.

They are cleaned for oxygen service by the manufacturer if used for any positive-pressure service.

They have threaded purge ports on the patient side and the source side.

They have a minimum working pressure equal to or greater than the relief valve protecting the piping system on which the valve is installed for any positive-pressure service. [NFPA 99:5.1.4.1.6]

### TABLE 1314.5(a)

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For SI units: 1 inch = 25.4 mm

### TABLE 1314.5(b)

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</table>

For SI units: 1 inch = 25.4 mm

### 1314.6 Source Valves

A shutoff valve shall be placed at the immediate connection of each central supply system to the piped distribution system to allow the entire central supply system, including all accessory devices (e.g., air dryers, final line regulators), to be isolated from the facility. [NFPA 99:5.1.4.2.1]

### 1314.6.1 Location

The source valve shall be located in the immediate vicinity of the central supply system. [NFPA 99:5.1.4.2.2]

### 1314.7 Main Line Valve

A shutoff valve shall be provided in the main supply line inside of the buildings being served, except where one or more of the following conditions exist:

1. The source and source valve are located inside the building served.
2. The source system is physically mounted to the wall of the building served, and the pipeline enters the building in the immediate vicinity of the source valve. [NFPA 99:5.1.4.3.1]

### 1314.7.1 Location

The main line valve shall be located on the facility side of the source valve and outside of the source room, the enclosure, or where the main line first enters the building. [NFPA 99:5.1.4.3.2]

### 1314.8 Riser Valves

Each riser supplied from the main line shall be provided with a shutoff valve in the riser adjacent to the main line. [NFPA 99:5.1.4.4]

### 1314.9 Service Valves

Service valves shall be installed to allow servicing or modification of lateral branch piping from a main or riser without shutting down the entire main, riser, or facility. [NFPA 99:5.1.4.5.1]

### 1314.9.1 Branch Piping

Only one service valve shall be required for each branch off of a riser, regardless of how many zone valve boxes are installed on that lateral.

### 1314.10 Zone Valves

All station outlets/inlets shall be supplied through a zone valve, which shall be placed as follows:

1. It is installed so that a wall intervenes between the valve and the outlets/inlets that it controls.
2. It is readily operable from a standing position.
3. It is installed where it is visible and accessible at all times.
4. It is not installed where it can be hidden from plain view, such as behind normally open or normally closed doors.
5. It is not installed in a room with the station outlets/inlets that it controls.
6. It is not installed in rooms, areas, or closets that can be closed or locked. [NFPA 99:5.1.4.6.1]

### 1314.10.1 Readily Accessible

A zone valve in each medical gas or vacuum line shall be provided for each Category 1 space and anesthetizing location for moderate sedation, deep sedation, or general anesthesia specific for the occupancy. These zone valves shall be located as follows:

1. They are installed immediately outside the area controlled.
2. They are readily installed where they are visible and accessible in an emergency at all times. [NFPA 99:5.1.4.6.2]

### 1314.10.2 Arrangement

Piping on the patient side of zone valves shall be arranged to provide the following:

1. Shutting off the supply of medical gas or vacuum to one zone will not affect the supply of medical gas or vacuum to another zone or the rest of the system.
2. Service will only be to outlets/inlets located on that same story.
3. All gas delivery columns, hose reels, ceiling tracks, control panels, pendants, booms, or other special...
installations are located on the patient side of the zone valve. [NFPA 99:5.1.4.6.3]

1314.10.3 Indicators. A pressure/vacuum indicator shall be provided on the station outlet/inlet side of each zone valve. [NFPA 99:5.1.4.6.4]

1314.11 In-Line Shutoff Valves. Optional in-line valves shall be permitted to be installed to isolate or shut off piping for servicing of individual rooms or areas. [NFPA 99:5.1.4.7]

1315.12 Valves for Future Connections. Future connection valves shall be labeled as to gas content. [NFPA 99:5.1.4.8.1]

1314.12.1 Downstream Piping. Downstream piping shall be closed with a brazed cap with tubing allowance for cutting and rebrazing. [NFPA 99:5.1.4.8.2]

1315.0 Station Outlets and Inlets.

1315.1 General. Each station outlet/inlet for medical gases or vacuums shall be gas-specific, whether the outlet/inlet is threaded or is a noninterchangeable quick coupler. [NFPA 99:5.1.5.1]

1315.2 Required Valves. Each station outlet shall consist of a primary and a secondary valve (or assembly). Each station inlet shall consist of a primary valve (or assembly) and shall be permitted to include a secondary valve (or assembly). [NFPA 99:5.1.5.2, 5.1.5.3]

1315.3 Secondary Valve. The secondary valve (or assembly) shall close automatically to stop the flow of gas (or vacuum, if provided) when the primary valve (or assembly) is removed. [NFPA 99:5.1.5.4]

1315.4 Identification. Each outlet/inlet shall be legibly identified in accordance with Section 1323.15. [NFPA 99:5.1.5.5]

1315.5 Threaded Outlets/Fittings. Threaded outlets/inlets shall be noninterchangeable connections complying with the mandatory requirements of CGA V-5. [NFPA 99:5.1.5.6]

1315.6 Gas-Specific Station Outlet/Inlet. Each station outlet/inlet, including those mounted in columns, hose reels, ceiling tracks, or other special installations, shall be designed so that parts or components that are required to be gas-specific for compliance with Section 1315.1 and Section 1315.8 cannot be interchanged between the station outlet/inlet for different gases. [NFPA 99:5.1.5.7]

1315.7 Common Parts. The use of common parts in outlets/inlets, such as springs, O-rings, fasteners, seals, and shut-off poppets, shall be permitted. [NFPA 99:5.1.5.8]

1315.8 Marking of Components. Components of a vacuum station inlet necessary for the maintenance of vacuum specificity shall be legibly marked to identify them as components or parts of a vacuum or suction system. [NFPA 99:5.1.5.9]

1315.9 Components Not Specific to a Vacuum. Components of inlets not specific to a vacuum shall not be required to be marked. [NFPA 99:5.1.5.10]

1315.10 Factory-Installed Copper Inlet Tubes. Factory-installed copper inlet tubes on station outlets extending no further than 8 inches (203 mm) from the body of the terminal shall be not less than DN8 (NPS ½) (¼ inch O.D.) size, with 0.3 inch (7.6 mm) minimum inside diameter. [NFPA 99:5.1.5.11]

1315.11 Factory-Installed Copper Outlet Tubes. Factory-installed copper outlet tubes on station inlets extending no further than 8 inches (203 mm) from the body of the terminal shall be not less than DN10 (NPS ¾) (½ in. O.D.) size, with 0.4 inch (10.2 mm) minimum inside diameter. [NFPA 99:5.1.5.12]

1315.12 Protection from Damage. Station outlets/inlets shall be permitted to be recessed or otherwise protected from damage. [NFPA 99:5.1.5.13]

1315.13 Multiple Wall Outlets/Inlets. When multiple wall outlets/inlets are installed, they shall be spaced to allow the simultaneous use of adjacent outlets/inlets with any of the various types of therapy equipment. [NFPA 99:5.1.5.14]

1315.14 Nonstandard Operation Pressures. Station outlets in systems having nonstandard operating pressures shall meet the following additional requirements:

1. They shall be gas-specific.
2. They shall be pressure-specific where a single gas is piped at more than one operating pressure [e.g., a station outlet for oxygen at 80 psi (552 kPa) shall not accept an adapter for oxygen at 50 psi (345 kPa)].
3. If operated at a pressure in excess of 80 psi (552 kPa), they shall be either D.I.S.S. connectors or comply with Section 1315.14(4).
4. If operated at a gauge pressure between 200 psi and 300 psi (1379 kPa and 2068 kPa), the station outlet shall be designed so as to prevent the removal of the adapter until the pressure has been relieved to prevent the adapter injuring the user or others when removed from the outlet. [NFPA 99:5.1.5.15]

1315.15 Post Installation. After installation of the piping, but before installation of the station outlets and inlets and other medical gas and medical gas system components (e.g., pressure-actuating switches for alarms, manifolds, pressure gauges, or pressure relief valves), the line shall be blown clear using oil-free, dry nitrogen NF.

1316.0 Pressure and Vacuum Indicator Locations.

1316.1 Isolation. A pressure-relief valve shall not be isolated from its intended use by a valve.

1316.2 Pressure and Vacuum Indicator Locations. Pressure/vacuum indicators shall be readable from a standing position. Pressure/vacuum indicators shall be provided at the following locations, as a minimum:

1. Adjacent to the alarm-initiating device for source main line pressure and vacuum alarms in the master alarm system.
2. At or in area alarm panels to indicate the pressure/vacuum at the alarm activating device for each system that is monitored by the panel.
3. On the station outlet/inlet side of zone valves. [NFPA 99:5.1.8.2.1, 5.1.8.2.2]
1317.0 Warning Systems.

1317.1 Category 1. All master, area, and local alarm systems used for medical gas and vacuum systems shall include the following:

1. Separate visual indicators for each condition monitored, except as permitted in Section 1317.1.2 for local alarms that are displayed on master alarm panels.

2. Visual indicators that remain in alarm until the situation that has caused the alarm is resolved.

3. Cancelable audible indication of each alarm condition that produces a sound with a minimum level of 80 dBA at 3 feet (914 mm).

4. Means to indicate a lamp or LED failure and audible failure.

5. Visual and audible indication that the communication with an alarm-initiating device is disconnected.

6. Labeling of each indicator, indicating the condition monitored.

7. Labeling of each alarm panel for its area of surveillance.

8. Reinitiation of the audible signal if another alarm condition occurs while the audible alarm is silenced.

9. Power for master alarms, area alarms, sensors, and switches from the life safety branch of the essential electrical system as described in NFPA 99.

10. Power for local alarms, dew point sensors, and carbon monoxide sensors permitted to be from the same essential electrical branch as is used to power the air compressor system.

11. Where used for communications, wiring from switches or sensors that is supervised or protected as required by NFPA 70 for life safety and critical branches circuits in which protection is any of the following types:
   (a) Conduit
   (b) Free air
   (c) Wire
   (d) Cable tray
   (e) Raceways

12. Communication devices that do not use electrical wiring for signal transmission will be and are supervised such that failure of communication shall initiate an alarm.

13. Assurance by the responsible authority of the facility that the labeling of alarms, where room numbers or designations are used, is accurate and up-to-date.

14. Provisions for automatic restart after a power loss of 10 seconds (e.g., during generator start-up) without giving false signals or requiring manual reset.

15. Alarm switches/sensors installed so as to be removable and accessible for service and testing. [NFPA 99:5.1.9.1.1]

1317.1.1 Master Alarms. A master alarm system shall be provided to monitor the operation and condition of the source of supply, the reserve source (if any), and the pressure in the main lines of each medical gas and vacuum piping system. [NFPA 99:5.1.9.2]

1317.2 Master Alarm Signal. The master alarm shall include at least one signal from the source equipment to indicate a problem with the source equipment at this location. This master alarm signal shall activate when any of the required local alarm signals for this source equipment activates. [NFPA 99:5.1.9.5.2]

1318.0 Piping Materials for Field-Installed Positive Pressure Medical Gas Systems.

1318.1 General. The provisions of this section shall apply to field-installed piping for the distribution of medical gas systems.

1318.2 Cleaning. Tubes, valves, fittings, station outlets, and other piping components in medical gas systems shall have been cleaned for oxygen service by the manufacturer prior to installation in accordance with the mandatory requirements of CGA G-4.1, except that fittings shall be permitted to be cleaned by a supplier or agency other than the manufacturer. [NFPA 99:5.1.10.1.1]

1318.3 Delivery. Each length of tube shall be delivered sealed and labeled and kept sealed until prepared for installation. Fittings, valves, and other components shall be delivered sealed and labeled and kept sealed until prepared for installation. [NFPA 99:5.1.10.1.2, 5.1.10.1.3]

1318.4 Tubes for Medical Gas Systems. Tubes shall be hard-drawn seamless copper in accordance with ASTM B819, medical gas tube, Type L, except Type K shall be used where operating pressures are above a gauge pressure of 185 psi (1276 kPa) and the pipe sizes are larger than DN80 (3/4 inches O.D.). [NFPA 99:5.1.10.1.4]

1318.5 Manufacturer Markings. ASTM B819, medical gas tube shall be identified by the manufacturer’s markings “OXY,” “MED,” “OXY/MED,” “OXY/ACR,” or “ACR/MED” in blue (Type L) or green (Type K). [NFPA 99:5.1.10.1.7]

1318.6 Documentation. The installer shall furnish documentation certifying that all installed piping materials comply with the requirements of Section 1318.2. [NFPA 99:5.1.10.1.8]

1319.0 Piping Materials for Field-Installed Medical-Surgical Vacuum Systems.

1319.1 Tubes for Medical Vacuum Systems. Piping for vacuum systems shall be constructed of any of the following:

1. Hard-drawn seamless copper tube in accordance with the following:
   (a) ASTM B88, copper tube (Type K, Type L, or Type M)
   (b) ASTM B280, copper ACR tube
   (c) ASTM B819, copper medical gas tubing (Type K or Type L)

2. Stainless steel tube in accordance with the following:
   (a) ASTM A269 TP304L or 316L
   (b) ASTM A312 TP304L or 316L
1319.1 Where Not Required. If medical gas tube in accordance with ASTM B819, Standard Specification for Seamless Copper Tube for Medical Gas Systems, is used for vacuum piping, such special marking shall not be required. [NFPA 99:5.1.10.2.2.2]

1320.0 Joints and Connections.

1320.1 General. This section sets forth the requirements for pipe joint installations for a medical gas or vacuum system.

1320.2 Changes in Direction. Positive pressure patient gas systems, medical support gas systems, and vacuum systems constructed of hard-drawn seamless copper or stainless steel tubing shall have all turns, offsets, and other changes in direction made using fittings or techniques appropriate to any of the following acceptable joining methods:

1. Brazing, as described in Section 1321.0.
2. Welding, as described in Section 1322.2.1.
3. Memory metal fittings, as described in Section 1322.3.
4. Axially swaged, elastic preload fittings, as described in Section 1322.4.
5. Threaded, as described in Section 1322.5. [NFPA 99:5.1.10.3.3]

1320.2.1 Medical Vacuum Systems. Vacuum systems and WAGD systems fabricated from copper tubing shall be permitted to have branch connections made using mechanically formed, drilled, and extruded tee-branch connections that are formed in accordance with the tool manufacturer’s instructions. Such branch connections shall be joined by brazing, as described in Section 1321.0. [NFPA 99:5.1.10.3.3]

1321.0 Brazed Joints.

1321.1 Brazed Joints and Fittings. Fittings shall be wrought-copper capillary fittings complying with ASME B16.22, or brazed fittings complying with ASME B16.50. Cast copper alloy fittings shall not be permitted.

Brazed joints shall be made using a brazing alloy that exhibits a melting temperature in excess of 1000°F (538°C) to retain the integrity of the piping system in the event of fire exposure. [NFPA 99:5.1.10.4.1.1 – 5.1.10.4.1.3]

1321.2 Tube Joints. Brazed tube joints shall be the socket type. [NFPA 99:5.1.10.4.1.4]

1321.3 Filler Metals. Filler metals shall bond with and be metallurgically compatible with the base metals being joined.

Filler metals shall comply with AWS A5.8. [NFPA 99:5.1.10.4.1.5, 5.1.10.4.1.6]

1321.4 Copper-to-Copper Joints. Copper-to-copper joints shall be brazed using a copper-phosphorus or copper-phosphorus-silver brazing filler metal (BCuP series) without flux. [NFPA 99:5.1.10.4.1.7]

1321.5 Accessible. Joints to be brazed in place shall be accessible for necessary preparation, assembly, heating, filler application, cooling, cleaning, and inspection. [NFPA 99:5.1.10.4.1.9]

1321.6 Purging. Braze joints shall be continuously purged with nitrogen NF. [NFPA 99:5.1.10.4.1.10]

1321.7 Tube Ends. Tube ends shall be cut square using a sharp tubing cutter to avoid deforming the tube. [NFPA 99:5.1.10.4.2.1]

1321.7.1 Cutting Wheels. The cutting wheels on tubing cutters shall be free from grease, oil, or other lubricant not suitable for oxygen service. [NFPA 99:5.1.10.4.2.2]

1321.7.2 Cut Ends. The cut ends of the tube shall be permitted to be rolled smooth or deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube. [NFPA 99:5.1.10.4.2.3]

1321.8 Cleaning Procedures. The interior surfaces of tubes, fittings, and other components that are cleaned for oxygen service shall be stored and handled to avoid contamination prior to assembly and brazing. [NFPA 99:5.1.10.4.3.1]

1321.8.1 Exterior Surfaces. The exterior surfaces of tube ends shall be cleaned prior to brazing to remove any surface oxides. When cleaning the exterior surfaces of tube ends, no matter shall be allowed to enter the tube. [NFPA 99:5.1.10.4.3.2, 5.1.10.4.3.3]

1321.8.2 Interior Surfaces. If the interior surfaces of fitting sockets become contaminated prior to brazing, they shall be reclaned for oxygen in accordance with Section 1321.8.7 and be cleaned for brazing with a clean, oil-free, stainless steel or brass wire brush. [NFPA 99:5.1.10.4.3.4]

1321.8.3 Abrasive Pads. Clean, nonshedding, abrasive pads shall be used to clean the exterior surfaces of the tube ends. [NFPA 99:5.1.10.4.3.5]

1321.8.4 Prohibited. The use of steel wool or sand cloth shall be prohibited. The cleaning process shall not result in grooving of the surfaces to be joined. [NFPA 99:5.1.10.4.3.6, 5.1.10.4.3.7]

1321.8.5 Wiped. After being abraded, the surfaces shall be wiped using a clean, lint-free white cloth. [NFPA 99:5.1.10.4.3.8]

1321.8.6 Examination. Tubes, fittings, valves, and other components shall be visually examined internally before being joined to verify that they have not become contaminated for oxygen service and that they are free of obstructions or debris. [NFPA 99:5.1.10.4.3.9]

1321.8.7 On-Site Reclancing. The interior surfaces of tube ends, fittings, and other components that were cleaned for oxygen service by the manufacturer, but that became contaminated prior to being installed, shall be permitted to be reclaned on-site by the installer by thoroughly scrubbing the interior surfaces with a clean, hot water–alkaline solution, such as sodium carbonate or trisodium phosphate, using a solution of 1 pound (0.5 kg) of sodium carbonate or trisodium phosphate to 3 gallons (11 L) of potable water, and thoroughly rinsing them with clean, hot, potable water.
Other aqueous cleaning solutions shall be permitted to be used for on-site recleaning permitted in this section, provided that they are recommended in accordance with the mandatory requirements of CGA G-4.1. [NFPA 99:5.1.10.4.3.10, 5.1.10.4.3.11]

1321.8.8 Contaminated Materials. Material that has become contaminated internally and is not clean for oxygen service shall not be installed. [NFPA 99:5.1.10.4.12]

1321.8.9 Timeframe for Brazing. Joints shall be brazed within 8 hours after the surfaces are cleaned for brazing. [NFPA 99:5.1.10.4.13]

1321.9 Brazing Dissimilar Metals. Flux shall only be used when brazing dissimilar metals, such as copper and bronze or brass, using a silver (BAg series) brazing filler metal. [NFPA 99:5.1.10.4.4.1]

1321.9.1 Surface Cleaning. Surfaces shall be cleaned for brazing in accordance with Section 1321.8. [NFPA 99:5.1.10.4.4.2]

1321.9.2 Flux. Flux shall be applied sparingly to minimize contamination of the inside of the tube with flux. The flux shall be applied and worked over the cleaned surfaces to be brazed using a stiff bristle brush to ensure complete coverage and wetting of the surfaces with flux. [NFPA 99:5.1.10.4.4.3, 5.1.10.4.4.4]

1321.9.3 Short Sections of Copper. Where possible, short sections of copper tube shall be brazed onto the non-copper component, and the interior of the sub-assembly shall be cleaned of flux prior to installation in the piping system. [NFPA 99:5.1.10.4.4.5]

1321.9.4 Flux-Coated Brazing Rods. On joints DN20 (NPS ½) (½ inch O.D.) size and smaller, flux-coated brazing rods shall be permitted to be used in lieu of applying flux to the surfaces being joined. [NFPA 99:5.1.10.4.4.6]

1321.10 Nitrogen Purge. When brazing, joints shall be continuously purged with oil-free, dry nitrogen NF to prevent the formation of copper oxide on the inside surfaces of the joint. [NFPA 99:5.1.10.4.5.1]

1321.10.1 Source. The source of the purge gas shall be monitored, and the installer shall be audibly alerted when the source content is low. [NFPA 99:5.1.10.4.5.2]

1321.10.2 Flow Rate Control. The purge gas flow rate shall be controlled by the use of a pressure regulator and flowmeter, or combination thereof.

Pressure regulators alone shall not be used to control purge gas flow rates. [NFPA 99:5.1.10.4.5.3, 5.1.10.4.5.4]

1321.10.3 Oxygen Analyzer. In order to ensure that all ambient air has been removed from the pipeline prior to brazing, an oxygen analyzer shall be used to verify the effectiveness of the purge. The oxygen analyzer shall read below 1 percent oxygen concentration before brazing begins. [NFPA 99:5.1.10.4.5.5]

1321.10.4 During Installation. During and after installation, openings in the piping system shall be kept sealed to maintain a nitrogen atmosphere within the piping to prevent debris or other contaminants from entering the system. [NFPA 99:5.1.10.4.5.6]

1321.10.5 Discharge Opening. While a joint is being brazed, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced. [NFPA 99:5.1.10.4.5.7]

1321.10.6 Temperature of Joint. The flow of purge gas shall be maintained until the joint is cool to the touch. [NFPA 99:5.1.10.4.5.8]

1321.10.7 Opening to Be Sealed. After the joint has cooled, the purge discharge opening shall be sealed to prevent contamination of the inside of the tube and maintain the nitrogen atmosphere within the piping system. [NFPA 99:5.1.10.4.5.9]

1321.10.8 Final Brazed Connection. The final brazed connection of new piping to an existing pipeline containing the system gas shall be permitted to be made without the use of a nitrogen purge. [NFPA 99:5.1.10.4.5.10]

1321.10.9 Final Tie-In Test. After a final brazed connection in a positive pressure medical gas pipeline is made without a nitrogen purge, an outlet in the immediate downstream zone of the affected portion(s) of both the new and existing piping shall be tested in accordance with the final tie-in test in Section 1324.5.9 through Section 1324.5.9.4. [NFPA 99:5.1.10.4.5.11]

1321.10.10 Autogenous Orbital Welding Process. When using the autogenous orbital welding process, joints shall be continuously purged inside and outside with inert gas(es) in accordance with the qualified welding procedure. [NFPA 99:5.1.10.4.5.12]

1321.11 Assembling and Heating Brazed Joints. Tube ends shall be inserted into the socket, either fully or to a mechanically limited depth that is not less than the minimum cup depth (overlap) specified by ASME B16.50. [NFPA 99:5.1.10.4.6.1]

1321.11.1 Heating of Joint. Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. After flux is liquefied, or where flux is not permitted to be used, the joint shall be heated quickly to the brazing temperature, taking care not to overheat the joint. [NFPA 99:5.1.10.4.6.2, 5.1.10.4.6.3]

1321.12 Inspection of Brazed Joints. After brazing, the outside of all joints shall be cleaned by washing with water and a wire brush to remove any residue and allow clear visual inspection of the joint. [NFPA 99:5.1.10.4.7.1]

1321.12.1 Where Flux Is Used. Where flux has been used, the wash water shall be hot. [NFPA 99:5.1.10.4.7.2]

1321.12.2 Visually Inspected. Each brazed joint shall be visually inspected after cleaning the outside surfaces. [NFPA 99:5.1.10.4.7.3]

1321.12.3 Prohibited Brazed Joints. Joints exhibiting the following conditions shall not be permitted:

(1) Flux or flux residue (when flux or flux-coated BAg series rods are used with dissimilar metals).

(2) Base metal melting or erosion.

(3) Unmelted filler metal.
(4) Failure of the filler metal to be clearly visible all the way around the joint at the interface between the socket and the tube.

(5) Cracks in the tube or component.

(6) Cracks in the braze filler metal.

(7) Failure of the joint to hold the test pressure under the installer-performed initial pressure test (see Section 1324.5 through Section 1324.5.1.2) and standing pressure test (see Section 1324.5.4 or Section 1324.5.5). [NFPA 99:5.1.10.4.7.4]

1321.12.4 Defective Brazed Joints. Brazed joints that are identified as defective under the conditions of Section 1321.12.3(2) or Section 1321.12.3(3) shall be replaced. [NFPA 99:5.1.10.4.7.5]

Brazed joints that are identified as defective under the conditions of Section 1321.12.3(1), Section 1321.12.3(3), Section 1321.12.3(4), Section 1321.12.3(6) or Section 1321.12.3(7) shall be permitted to be repaired, except that no joint shall be reheated more than once before being replaced. [NFPA 99:5.1.10.4.7.6]

1322.0 Welded Joints.

1322.1 Welded Joints Procedure. Welded joints for medical gas and medical-surgical vacuum systems shall be permitted to be made using a tungsten arc welding (GTAW) autogenous orbital procedure. [NFPA 99:5.1.10.5.1.1]

1322.1.1 Welder Qualification Procedure. The GTAW autogenous orbital procedure and the welder qualification procedure shall be qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Welder qualification procedures shall include a bend test and a tensile test in accordance with Section IX of the ASME Boiler and Pressure Vessel Code on each tube size diameter. [NFPA 99:5.1.10.5.1.2, 5.1.10.5.1.3]

1322.1.2 Welding Procedure Specification. Each welder shall qualify to a welding procedure specification (WPS) for each tube diameter. [NFPA 99:5.1.10.5.1.4]

1322.1.3 Purging of Joints. GTAW autogenous orbital welded joints shall be purged during welding with a commercially available mixture of 75 percent helium (+/- 5 percent) and 25 percent argon (+/- 5 percent). [NFPA 99:5.1.10.5.1.5]

1322.1.4 Shield Gas. The shield gas shall be as required in Section 1322.1.3. [NFPA 99:5.1.10.5.1.6]

1322.1.5 Test Coupons. Test coupons shall be welded and inspected, as a minimum, at the start of work and every 4 hours thereafter, or when the machine is idle for more than 30 minutes, and at the end of the work period. Test coupons shall be inspected on the I.D. and O.D. by a qualified quality control inspector. Test coupons shall also be welded at change of operator, weld head, welding power supply, or gas source. [NFPA 99:5.1.10.5.1.7 – 5.1.10.5.1.9]

1322.2 Welding for Stainless Tube. Stainless tube shall be welded using metal inert gas (MIG) welding, tungsten inert gas (TIG) welding, or other welding techniques suited to joining stainless tube. [NFPA 99:5.1.10.5.2.1]

1322.2.1 Qualifications. Welders shall be qualified to Section IX of the ASME Boiler and Pressure Vessel Code. [NFPA 99:5.1.10.5.2.2]

1322.3 Memory Metal Fittings. Memory metal fittings having a temperature rating not less than 1000°F (538°C) and a pressure rating not less than 300 psi (2068 kPa) shall be permitted to be used to join copper or stainless steel tube. Memory metal fittings shall be installed by qualified technicians in accordance with the manufacturer’s instructions. [NFPA 99:5.1.10.6.1, 5.1.10.6.2]

1322.4 Axially Swaged Fittings. Axially swaged, elastic strain preload fittings providing metal-to-metal seals, having suitable for service at 300 psig (2070 kPa) and able to withstand a temperature rating not less than of 1000°F (538°C) and a pressure rating not less than 300 psi (2068 kPa), and that, when complete, are permanent and nonseparable shall be permitted to be used to join copper or stainless steel tube. Axially swaged, elastic strain preload fittings shall be installed by qualified technicians in accordance with the manufacturer’s instructions. [NFPA 99:5.1.10.7.1, 5.1.10.7.2]

1322.5 Threaded Fittings. Threaded fittings shall meet the following criteria:

(1) They shall be limited to connections for pressure and vacuum indicators, alarm devices, gas-specific demand check fittings, and source equipment on the source side of the source valve.

(2) They shall be tapered pipe threads complying with ASME B1.20.1.

(3) They shall be made up with polytetrafluoroethylene (PTFE) tape or other thread sealant recommended for oxygen service, with sealant applied to the male threads only and care taken to ensure sealant does not enter the pipe. [NFPA 99:5.1.10.8]

1322.6 Other Types of Fittings. Listed or approved metallic gas tube fittings that, when made up, provide a permanent joint having the mechanical, thermal, and sealing integrity of a brazed joint shall be permitted to be used. [NFPA 99:5.1.10.9.1]

1322.6.1 Dielectric Fittings. Dielectric fittings that comply with the following shall be permitted only where required by the manufacturer of special medical equipment to electrically isolate the equipment from the system distribution piping:

(1) They shall be of brass or copper construction with an approved dielectric.

(2) They shall be permitted to be a union.

(3) They shall be clean for oxygen where used for medical gases and medical support gases. [NFPA 99:5.1.10.9.2]

1322.7 Prohibited Joints. The following joints shall be prohibited throughout medical gas and vacuum distribution pipeline systems:

(1) Flared and compression-type connections, including connections to station outlets and inlets, alarm devices, and other components.

(2) Other straight-threaded connections, including unions.

(3) Pipe-crimping tools used to permanently stop the flow of medical gas and vacuum piping.
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(4) Removable and nonremovable push-fit fittings that employ a quick assembly push fit connector. [NFPA 99:5.1.10.10]

1323.0 Installation of Piping and Equipment.

1323.1 Required Pipe Sizing. Piping systems shall be designed and sized to deliver the required flow rates at the utilization pressures. [NFPA 99:5.1.10.11.1.1]

1323.1.1 Mains and Branches. Mains and branches in medical gas piping systems shall be not less than DN15 (NPS ½) (5/8 inch O.D.) size. Mains and branches in medical-surgical vacuum systems shall be not less than DN20 (NPS ¾) (9/16 inch O.D.) size. [NFPA 99:5.1.10.11.1.2, 5.1.10.11.1.3]

1323.1.2 Drops to Individual Stations. Drops to individual station outlets and inlets shall be not less than DN15 (NPS ½) (5/8 inch O.D.) size. [NFPA 99:5.1.10.11.1.4]

1323.1.3 Runouts and Connecting Tubing. Runouts to alarm panels and connecting tubing for gauges and alarm devices shall be permitted to be DN8 (NPS ¼) (5/32 inch O.D.) size. [NFPA 99:5.1.10.11.1.5]

1323.1.4 Maximum Demand. Where the maximum demand for each medical gas or vacuum system does not exceed the values in Table 1323.1.4(1) through Table 1323.1.4(6), the size of pipe of each section of the system shall be determined in accordance with Section 1323.1.5. The size for systems beyond the range of Table 1323.1.4(1) through Table 1323.1.4(6) shall be determined in accordance with Section 1323.1.6.

1323.1.5 Sizing Procedures. The size of each section of pipe in a system within the range of Table 1323.1.4(1) through Table 1323.1.4(6) shall be determined in accordance with the following:

1. Determine the total flow rate and number of outlets or inlets for each section of pipe in accordance with Table 1305.2 and Table 1305.3.

2. Measure the length of the section of pipe to each station outlet or inlet on the system. Multiply the measured pipe length by 1.5 (150 percent), to account for the number of fittings in the system, to determine the pipe equivalent length.

3. Beginning with the most remote outlet or inlet, multiply the total flow rate by the diversity factor specified in Table 1323.1.5(1) for each section of pipe to determine the sizing flow rate for the piping.

4. Select Table 1323.1.4(1) through Table 1323.1.4(6) based on the medical gas or vacuum being transported through the piping.

5. Select an estimated pipe size for determining the system pressure loss. Multiply the pipe equivalent length, for a given section of pipe, by the pressure loss for the sizing flow rate in the applicable table. Divide that number by 100 to determine the system pressure loss for the section of pipe.

6. Add the pressure loss for each section of piping, from the source equipment location to the outlet or inlet, to determine the total system pressure loss to each outlet or inlet. The total system pressure loss in the piping to each outlet or inlet shall not exceed the values specified in Table 1323.1.5(2).

### TABLE 1323.1.5(1)

<table>
<thead>
<tr>
<th>NUMBER OF OUTLETS AND INLETS TERMINAL UNITS PER FACILITY</th>
<th>DIVERSITY PERCENTAGE OF AVERAGE FLOW PER OUTLETS AND INLETS TERMINAL UNITS</th>
<th>MINIMUM PERMISSIBLE SYSTEM FLOW OF ALL PRESSURIZED MEDICAL GAS SYSTEMS1 (standard cubic feet per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–10</td>
<td>100%</td>
<td>Actual Demand</td>
</tr>
<tr>
<td>11–25</td>
<td>75%</td>
<td>7.0</td>
</tr>
<tr>
<td>26–50</td>
<td>50%</td>
<td>13.1</td>
</tr>
<tr>
<td>51–100</td>
<td>50%</td>
<td>17.5</td>
</tr>
</tbody>
</table>

Notes:

1 Flow rates of station outlets and inlets in accordance with Table 1305.2.
2 The minimum system flow is the average outlets and inlets flow times the number of station outlets and inlets times the diversity percentage.

### TABLE 1323.1.5(2)

<table>
<thead>
<tr>
<th>TYPE OF SYSTEM</th>
<th>MAXIMUM ALLOWABLE SYSTEM PRESSURE LOSS (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Air</td>
<td>5</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>15</td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>5</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>5</td>
</tr>
<tr>
<td>Oxygen</td>
<td>5</td>
</tr>
<tr>
<td>Medical Vacuum</td>
<td>4 inches of mercury</td>
</tr>
</tbody>
</table>

For SI units: 1 pound-force per square inch = 6.8947 kPa, 1 inch of mercury = 3.386 kPa

1323.1.6 Engineering Methods. For conditions other than those covered by Section 1323.1.4, such as longer runs of greater gas or vacuum demands, the size of each medical gas or vacuum piping system shall be determined by standard engineering methods acceptable to the Authority Having Jurisdiction, and each system shall be so designed that the total pressure drop or gain between the source equipment and an outlet or inlet shall not exceed the allowable pressures shown in Table 1305.1.

1323.2 Pipe Protection. Piping shall be protected against freezing, corrosion, and physical damage. [NFPA 99:5.1.10.11.1.2]

1323.2.1 Exposed Piping. Piping exposed in corridors and other areas where subject to physical damage from the movement of carts, stretchers, portable equipment, or vehicles shall be protected. [NFPA 99:5.1.10.11.2.1]

1323.2.2 Underground Piping. Piping underground within buildings or embedded in concrete floors or walls shall be installed in a continuous conduit. [NFPA 99:5.1.10.11.2.2]
### Table 1323.1.4(1) Pressure Loss for Medical Air

<table>
<thead>
<tr>
<th>Flow Rate (SCFM)</th>
<th>Pressure Drop (psi) per 100 Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/2 Inch Pipe</td>
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<tr>
<td>0.35</td>
<td>0.004</td>
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<tr>
<td>0.71</td>
<td>0.012</td>
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<td>1.06</td>
<td>0.023</td>
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<td>1.41</td>
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<td>1.77</td>
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<tr>
<td>2.12</td>
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<td>2.47</td>
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<tr>
<td>3.53</td>
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Notes:
1. Based on the pressure of 14.7 psig (101 kPa) at 68°F (20°C).
2. Based on the pressure of 55 psig (379 kPa) at 68°F (20°C).

### Table 1323.1.4(2) Pressure Loss for Nitrogen

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Notes:
1. Based on the pressure of 14.7 psig (101 kPa) at 68°F (20°C).
2. Based on the pressure of 55 psig (379 kPa) at 68°F (20°C).

For SI units: 1 standard cubic foot per minute = 28.32 SLPM, 1 inch = 25 mm, 1 foot = 304.8 mm, 1 pound-force per square inch = 6.8947 kPa.
### TABLE 1323.1.4(3) PRESSURE LOSS FOR NITROUS OXIDE AND CARBON DIOXIDE

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<tr>
<th>FLOW RATE (SCFM)&lt;sup&gt;1&lt;/sup&gt;</th>
<th>PRESSURE DROP (psi) PER 100 FEET&lt;sup&gt;2&lt;/sup&gt;</th>
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<th>3/4 INCH PIPE</th>
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For SI units: 1 standard cubic foot per minute = 28.32 SLPM, 1 inch = 25 mm, 1 foot = 304.8 mm, 1 pound-force per square inch = 6.8947 kPa

**Notes:**
1. Based on the pressure of 14.7 psig (101 kPa) at 68°F (20°C).
2. Based on the pressure of 55 psig (379 kPa) at 68°F (20°C).

### TABLE 1323.1.4(4) PRESSURE LOSS FOR OXYGEN

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For SI units: 1 standard cubic foot per minute = 28.32 SLPM, 1 inch = 25 mm, 1 foot = 304.8 mm, 1 pound-force per square inch = 6.8947 kPa

**Notes:**
1. Based on pressure of 14.7 psig (101 kPa) at 68°F (20°C).
2. Based on pressure of 55 psig (379 kPa) at 68°F (20°C).
### TABLE 1323.1.4(5)
**PRESSURE LOSS FOR VACUUM**

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<td>4.94</td>
<td>1.669</td>
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<tr>
<td>5.65</td>
<td>2.106</td>
</tr>
<tr>
<td>6.36</td>
<td>2.586</td>
</tr>
<tr>
<td>7.06</td>
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<tr>
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<td>8.47</td>
<td>4.280</td>
</tr>
<tr>
<td>9.18</td>
<td>4.927</td>
</tr>
<tr>
<td>9.89</td>
<td>–</td>
</tr>
<tr>
<td>10.59</td>
<td>–</td>
</tr>
<tr>
<td>11.30</td>
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<td>12.01</td>
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<td>12.71</td>
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<td>13.42</td>
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<td>14.83</td>
<td>–</td>
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<td>15.54</td>
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<td>17.66</td>
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<td>18.36</td>
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<td>19.07</td>
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<td>19.77</td>
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</tr>
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<td>20.48</td>
<td>–</td>
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<td>21.19</td>
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<td>24.72</td>
<td>–</td>
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<td>28.25</td>
<td>–</td>
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<tr>
<td>31.78</td>
<td>–</td>
</tr>
<tr>
<td>35.31</td>
<td>–</td>
</tr>
<tr>
<td>38.84</td>
<td>–</td>
</tr>
<tr>
<td>42.37</td>
<td>–</td>
</tr>
<tr>
<td>45.90</td>
<td>–</td>
</tr>
</tbody>
</table>

### Notes:
1 Based on the pressure of 14.7 psig (101 kPa) at 68°F (20°C).
2 Based on the pressure of 19 inches of mercury gauge vacuum (64 kPa) at 68°F (20°C).

### TABLE 1323.1.4(5)
**PRESSURE LOSS FOR VACUUM (continued)**

<table>
<thead>
<tr>
<th>FLOW RATE (SCFM)¹</th>
<th>VACUUM LOSS (inch of mercury) PER 100 FEET FOR COPPER TUBE²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3⁄4 INCH TUBE</td>
</tr>
<tr>
<td>49.43</td>
<td>–</td>
</tr>
<tr>
<td>52.97</td>
<td>–</td>
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<tr>
<td>56.50</td>
<td>–</td>
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<tr>
<td>63.56</td>
<td>–</td>
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<tr>
<td>70.62</td>
<td>–</td>
</tr>
<tr>
<td>77.68</td>
<td>–</td>
</tr>
<tr>
<td>84.74</td>
<td>–</td>
</tr>
<tr>
<td>91.81</td>
<td>–</td>
</tr>
<tr>
<td>98.87</td>
<td>–</td>
</tr>
<tr>
<td>105.93</td>
<td>–</td>
</tr>
<tr>
<td>112.99</td>
<td>–</td>
</tr>
</tbody>
</table>

For SI units: 1 standard cubic foot per minute = 28.32 SLPM, 1 inch = 25 mm, 1 foot = 304.8 mm, 1 inch of mercury = 3.36 kPa.

### TABLE 1323.1.4(6)
**PRESSURE LOSS FOR VACUUM (CATEGORY 3)**

<table>
<thead>
<tr>
<th>FLOW RATE (SCFM)¹</th>
<th>VACUUM LOSS (inch of mercury) PER 100 FEET FOR PLASTIC TUBE²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3⁄4 INCH TUBE</td>
</tr>
<tr>
<td>0.35</td>
<td>0.005</td>
</tr>
<tr>
<td>0.71</td>
<td>0.010</td>
</tr>
<tr>
<td>1.06</td>
<td>0.015</td>
</tr>
<tr>
<td>1.41</td>
<td>0.021</td>
</tr>
<tr>
<td>1.77</td>
<td>0.026</td>
</tr>
<tr>
<td>2.12</td>
<td>0.060</td>
</tr>
<tr>
<td>2.47</td>
<td>0.077</td>
</tr>
<tr>
<td>2.82</td>
<td>0.096</td>
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<tr>
<td>3.48</td>
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<td>3.53</td>
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<td>4.24</td>
<td>0.192</td>
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<td>4.94</td>
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<tr>
<td>5.65</td>
<td>0.313</td>
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<td>6.36</td>
<td>0.383</td>
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<td>8.47</td>
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<tr>
<td>9.18</td>
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<td>9.89</td>
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<tr>
<td>10.59</td>
<td>0.925</td>
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<tr>
<td>11.30</td>
<td>1.035</td>
</tr>
<tr>
<td>12.01</td>
<td>1.131</td>
</tr>
<tr>
<td>12.71</td>
<td>1.270</td>
</tr>
</tbody>
</table>

For SI units: 1 standard cubic foot per minute = 28.32 SLPM, 1 inch = 25 mm, 1 foot = 304.8 mm, 1 inch of mercury = 3.36 kPa.

Notes:
1 Based on the pressure of 14.7 psig (101 kPa) at 68°F (20°C).
2 Based on the pressure of 19 inches of mercury gauge vacuum (64 kPa) at 68°F (20°C).
### Table 1323.1.4(6)

<table>
<thead>
<tr>
<th>FLOW RATE (SCFM)</th>
<th>VACUUM LOSS (inch of mercury) PER 100 FEET FOR PLASTIC TUBE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>³⁄₄ INCH TUBE</td>
</tr>
<tr>
<td>13.42</td>
<td>1.936</td>
</tr>
<tr>
<td>14.12</td>
<td>1.525</td>
</tr>
<tr>
<td>14.83</td>
<td>1.662</td>
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<tr>
<td>15.54</td>
<td>1.803</td>
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<td>16.24</td>
<td>1.948</td>
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<td>16.95</td>
<td>2.099</td>
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<tr>
<td>17.66</td>
<td>2.256</td>
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<tr>
<td>18.36</td>
<td>2.415</td>
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<td>2.581</td>
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<tr>
<td>19.77</td>
<td>2.750</td>
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<td>20.48</td>
<td>2.925</td>
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<tr>
<td>21.19</td>
<td>3.106</td>
</tr>
<tr>
<td>24.72</td>
<td>4.074</td>
</tr>
<tr>
<td>28.25</td>
<td>–</td>
</tr>
<tr>
<td>31.78</td>
<td>–</td>
</tr>
<tr>
<td>35.31</td>
<td>–</td>
</tr>
<tr>
<td>38.84</td>
<td>–</td>
</tr>
<tr>
<td>42.37</td>
<td>–</td>
</tr>
<tr>
<td>45.90</td>
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<tr>
<td>49.43</td>
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<td>52.97</td>
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<td>56.50</td>
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<td>63.56</td>
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<td>70.62</td>
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<td>77.68</td>
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<td>84.74</td>
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<tr>
<td>91.81</td>
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<tr>
<td>98.87</td>
<td>–</td>
</tr>
<tr>
<td>105.93</td>
<td>–</td>
</tr>
<tr>
<td>112.99</td>
<td>–</td>
</tr>
</tbody>
</table>

For SI units: 1 standard cubic foot per minute = 28.32 SLPM, 1 inch = 25 mm, 1 foot = 304.8 mm, 1 inch of mercury = 3.386 kPa

Notes:
1 Based on the pressure of 14.7 psig (101 kPa) at 68°F (20°C).
2 Based on the pressure of 19 inches of mercury gauge vacuum (64 kPa) at 68°F (20°C).

#### 1323.3 Location of Piping

Piping risers shall be permitted to be installed in pipe shafts if protected from physical damage, effects of excessive heat, corrosion, or contact with oil. [NFPA 99:5.1.10.11.3.1]

#### 1323.3.1 Prohibited Locations

Piping shall not be installed in kitchens, stairwells, elevator shafts, elevator machine rooms, areas with open flames, electrical service equipment over 600 volts, and areas prohibited under NFPA 70 except for the following locations:

1. Room locations for medical air compressor supply systems and medical-surgical vacuum pump supply systems

2. Room locations for secondary distribution circuit panels and breakers having a maximum voltage rating of 600 volts [NFPA 99:5.1.10.11.3.2]

#### 1323.3.2 Approved Locations

Medical gas piping shall be permitted to be installed in the same service trench or tunnel with fuel gas lines, fuel oil lines, electrical lines, steam lines, and similar utilities, provided that the space is ventilated (naturally or mechanically) and the ambient temperature around the medical gas piping is limited to 130°F (54°C) maximum. [NFPA 99:5.1.10.11.3.3]

#### 1323.3.3 Prohibited Contact with Oil

Medical gas piping shall not be located where subject to contact with oil, including a possible flooding area in the case of a major oil leak. [NFPA 99:5.1.10.11.3.4]

#### 1323.4 Pipe Support

Piping shall be supported from the building structure. [NFPA 99:5.1.10.11.4.1]

#### 1323.4.1 Hangers and Supports

Hangers and supports shall comply with and be installed in accordance with MSS SP-58. [NFPA 99:5.1.10.11.4.2]

#### 1323.4.2 Copper Tube

Supports for copper tube shall be sized for copper tube. [NFPA 99:5.1.10.11.4.3]

#### 1323.4.3 Damp Locations

In potentially damp locations, copper tube hangers or supports that are in contact with the tube shall be plastic-coated or otherwise be electrically insulated from the tube by a material that will not absorb moisture. [NFPA 99:5.1.10.11.4.5]

#### 1323.4.4 Maximum Spacing

Maximum support spacing shall be in accordance with Table 1323.4.4. [NFPA 99:5.1.10.11.4.6]

#### Table 1323.4.4

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>HANGER SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN8 (NPS ¾)</td>
<td>⅞ of an inch O.D.</td>
</tr>
<tr>
<td>DN10 (NPS ⅓)</td>
<td>⅞ of an inch O.D.</td>
</tr>
<tr>
<td>DN15 (NPS ⅐)</td>
<td>⅞ of an inch O.D.</td>
</tr>
<tr>
<td>DN20 (NPS ⅑)</td>
<td>⅞ of an inch O.D.</td>
</tr>
<tr>
<td>DN25 (NPS ⅐)</td>
<td>⅞ of an inch O.D.</td>
</tr>
<tr>
<td>DN32 (NPS ⅕)</td>
<td>⅞ of an inch O.D.</td>
</tr>
<tr>
<td>DN40 and larger (NPS ⅘)</td>
<td>⅞ of an inch O.D.</td>
</tr>
</tbody>
</table>

Vertical risers, all sizes, every floor, but not to exceed 15 feet

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

#### 1323.4.5 Seismic Provisions

Where required, medical gas and vacuum piping shall be seismically restrained against earthquakes in accordance with the applicable building code. [NFPA 99:5.1.10.11.4.7]

#### 1323.5 Frost Protection

Buried piping outside of buildings shall be installed below the local level of frost penetration. [NFPA 99:5.1.10.11.5.1]
1323.5.1 Backfilling and Trenching. The installation procedure for underground piping shall protect the piping from physical damage while being backfilled. [NFPA 99:5.1.10.11.5.2]

1323.5.2 Conduit, Cover, or Enclosure. If underground piping is protected by a conduit, cover, or other enclosure, the following requirements shall be met:
(1) Access shall be provided at the joints for visual inspection and leak testing.
(2) The conduit, cover, or enclosure shall be self-draining and not retain groundwater in prolonged contact with the pipe. [NFPA 99:5.1.10.11.5.3]

1323.5.3 Excessive Stresses. Buried piping that will be subject to surface loads shall be buried at a depth that will protect the piping or its enclosure from excessive stresses. [NFPA 99:5.1.10.11.5.4]

1323.5.4 Minimum Backfill. The minimum backfilled cover above the top of the pipe or its enclosure for buried piping outside of buildings shall be 36 inches (914 mm), except that the minimum cover shall be permitted to be reduced to 18 inches (457 mm) where there is no potential for damage from surface loads or surface conditions. [NFPA 99:5.1.10.11.5.5]

1323.5.5 Trenches. Trenches shall be excavated so that the pipe or its enclosure has firm, substantially continuous bearing on the bottom of the trench. [NFPA 99:5.1.10.11.5.6]

1323.5.6 Composition of Backfill. Backfill shall be clean, free from material that can damage the pipe, and compacted. [NFPA 99:5.1.10.11.5.7]

1323.5.7 Marker. A continuous tape or marker placed immediately above the pipe or its enclosure shall clearly identify the pipeline by specific name. [NFPA 99:5.1.10.11.5.8]

1323.5.8 Warning. A continuous warning means shall also be provided above the pipeline at approximately one-half the depth of burial. [NFPA 99:5.1.10.11.5.9]

1323.5.9 Wall Sleeve. Where underground piping is installed through a wall sleeve, the outdoor end of the sleeve shall be sealed to prevent the entrance of groundwater into the building. [NFPA 99:5.1.10.11.5.10]

1323.6 Connectors. Hose and flexible connectors, both metallic and nonmetallic, shall be no longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions. [NFPA 99:5.1.10.11.6.1]

1323.6.1 Flexible Connectors. Flexible connectors, metallic or nonmetallic, shall have a minimum burst pressure, with a gauge pressure of 1000 psi (6895 kPa). [NFPA 99:5.1.10.11.6.2]

1323.6.2 Metallic Flexible Joints. Metallic flexible joints shall be permitted in the pipeline where required for expansion joints, seismic protection, thermal expansion, or vibration control and shall be as follows:
(1) For all wetted surfaces, made of bronze, copper, or stainless steel.
(2) Cleaned at the factory for oxygen service and received on the job site with certification of cleanliness.
(3) Suitable for service at 300 psig (2068 kPa) or above and able to withstand temperatures of 1000°F (538°C).
(4) Provided with brazing extensions to allow brazing into the pipeline per Section 1321.0.
(5) Supported with pipe hangers and supports as required for their additional weight. [NFPA 99:5.1.10.11.6.3]

1323.7 Prohibited System Interconnections. Two or more medical gas or vacuum piping systems shall not be interconnected for installation, testing, or any other reason except as permitted by Section 1323.7.1. [NFPA 99:5.1.10.11.7.1]

1323.7.1 Medical Gas and Medical Vacuum. Medical gas and vacuum systems with the same contents shall be permitted to be interconnected with an inline valve installed between the systems. [NFPA 99:5.1.10.11.7.2]

1323.7.2 Leak Testing. Leak testing shall be accomplished by separately charging and testing each individual piping system. [NFPA 99:5.1.10.11.7.3]

1323.8 Manufacturer’s Instructions. The installation of individual components shall be made in accordance with the instructions of the manufacturer. Manufacturer’s instructions shall include directions and information deemed by the manufacturer to be adequate for attaining proper operation, testing, and maintenance of the medical gas and vacuum systems. Copies of the manufacturer’s instructions shall be left with the system owner. [NFPA 99:5.1.10.11.8.1 – 5.1.10.11.8.3]

1323.9 Changes in System Use. Where a positive-pressure medical gas piping distribution system originally used or constructed for use at one pressure and for one gas is converted for operation at another pressure or for another gas, all provisions of Section 1318.0 through Section 1323.12 shall apply as if the system were new. [NFPA 99:5.1.10.11.9.1]

1323.9.1 Medical Vacuum System. A vacuum system shall not be permitted to be converted for use as a gas system. [NFPA 99:5.1.10.11.9.2]

1323.10 Qualifications of Installers. The installation of medical gas and vacuum systems shall be made by qualified, competent technicians who are experienced in performing such installations, including all personnel who actually install the piping system. Installers of medical gas and vacuum piped distribution systems, all appurtenant piping supporting pump and compressor source systems, and appurtenant piping supporting source gas manifold systems not including permanently installed bulk source systems, shall be certified in accordance with ASSE 6010. [NFPA 99:5.1.10.11.10.1, 5.1.10.11.10.2]

1323.10.1 Brazing. Brazing shall be performed by individuals who are qualified in accordance with Section 1323.11. [NFPA 99:5.1.10.11.10.5]

1323.10.2 Documentation. Prior to any installation work, the installer of medical gas and vacuum piping shall provide and maintain documentation on the job site.
for the qualification of braze- ing procedures and individual brazers that is required under Section 1323.11. [NFPA 99:5.1.10.11.10.6]

**1323.10.3 Health Care Organization Personnel.** Health care organization personnel shall be permitted to install piping systems if all of the requirements of Section 1323.10 are met during the installation. [NFPA 99:5.1.10.11.10.7]

**1323.11 Qualification of Brazing Procedures and Brazing.** Brazing procedures and brazer performance for the installation of medical gas and vacuum piping shall be qualified in accordance with either Section IX, “Welding and Brazing Qualifications,” of the ASME Boiler and Pressure Vessel Code, or AWS B2.2, both as modified by Section 1323.11 through Section 1323.11.4. [NFPA 99:5.1.10.11.11.1]

**1323.11.1 Examination.** Brazers shall be qualified by visual examination of the test coupon followed by sectioning. [NFPA 99:5.1.10.11.11.2]

**1323.11.2 Brazing Procedure Specification.** The brazing procedure specification shall address cleaning, joint clearance, overlap, internal purge gas, purge gas flow rate, and filler metal. [NFPA 99:5.1.10.11.11.3]

**1323.11.3 Documentation.** The brazing procedure qualification record and the record of brazer performance qualification shall document filler metal used, base metals, cleaning, joint clearance, overlap, internal purge gas, and absence of internal oxidation in the completed coupon. [NFPA 99:5.1.10.11.11.4]

**1323.11.4 Procedures.** Brazing procedures qualified by a technically competent group or agency shall be permitted under the following conditions:

1. The brazing procedure specification and the procedure qualification records meet the requirements of this code.
2. The employer obtains a copy of both the brazing procedure specification and the supporting qualification records from the group or agency and signs and dates these records, thereby accepting responsibility for the qualifications that were performed by the group or agency.
3. The employer qualifies at least one brazer following each brazing procedure specification used. [NFPA 99:5.1.10.11.11.5]

**1323.11.5 Conditions of Acceptance.** An employer shall be permitted to accept brazer qualification records of a previous employer under the following conditions:

1. The brazer has been qualified following the same or an equivalent procedure that the new employer uses.
2. The new employer obtains a copy of the record of brazer performance qualification tests from the previous employer and signs and dates these records, thereby accepting responsibility for the qualifications performed by the previous employer. [NFPA 99:5.1.10.11.11.6]

**1323.11.6 Qualifications.** Performance qualifications of brazers shall remain in effect indefinitely, unless the brazer does not braze with the qualified procedure for a period exceeding 6 months or there is a specific reason to question the ability of the brazer. [NFPA 99:5.1.10.11.11.7]

**1323.12 Breaching or Penetrating Medical Gas Piping.** Positive pressure patient medical gas piping and medical support gas piping shall not be breached or penetrated by any means or process that will result in residual copper particles or other debris remaining in the piping or affect the oxygen-clean interior of the piping. The breaching or penetrating process shall ensure that any debris created by the process remains contained within the work area. [NFPA 99:5.1.10.11.12.1, 5.1.10.11.12.2]

**1323.13 Labeling, Identification and Operating Pressure.** Color and pressure requirements shall be in accordance with Table 1305.1. [NFPA 99:5.1.11]

**1323.13.1 Pipe Labeling.** Piping shall be labeled by stenciling or adhesive markers that identify the patient medical gas, the medical support gas, or the vacuum system and include the following:

1. Name of the gas or vacuum system or the chemical symbol per Table 1305.1.
2. Gas or vacuum system color code per Table 1305.1.
3. Where positive pressure gas piping systems operate at pressures other than the standard gauge pressure in Table 1305.1, the operating pressure in addition to the name of the gas. [NFPA 99:5.1.11.1.1]

**1323.13.2 Pipe Pressure Labeling.** Where positive pressure gas piping systems operate at pressures other than the standard gauge pressure in Table 1305.1, the operating pressure in addition to the name of the gas shall be labeled. [NFPA 99:5.1.11.1.2]

**1323.13.3-1323.13.4 Location of Pipe Labeling.** Pipe labels shall be located as follows:

1. At intervals of not more than 20 feet (6096 mm).
2. At least once in or above every room.
3. On both sides of walls or partitions penetrated by the piping.
4. At least once in every story height traversed by risers. [NFPA 99:5.1.11.1.4, 5.1.11.1.5]

**1323.14 Identification of Shutoff Valves.** Shutoff valves shall be identified with the following:

1. Name or chemical symbol for the specific medical gas or vacuum system.
2. Gas or vacuum system color code in accordance with Table 1305.1
3. Room or areas served.
4. Caution to not close or open the valve except in emergency. [NFPA 99:5.1.11.2.1]

**1323.14.1 Nonstandard Operating Pressures.** Where positive pressure gas piping systems operate at pressures other than the standard gauge pressure of 50
Gas or vacuum system color code in accordance with the name of the gas or vacuum system or the chemical symbol for the specific gas identified as to the name or chemical symbol for the specific gas. Station outlets and inlets shall be labeled in substance as follows:

**Source Valves**

Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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SOURCE VALVE
FOR THE (SOURCE NAME)
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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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FOR THE (SOURCE NAME)
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FOR THE (SOURCE NAME)
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FOR THE (SOURCE NAME)
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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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FOR THE (SOURCE NAME)
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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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FOR THE (SOURCE NAME)
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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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FOR THE (SOURCE NAME)
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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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FOR THE (SOURCE NAME)
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[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

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FOR THE (SOURCE NAME)
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FOR THE (SOURCE NAME)
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SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALVE
FOR THE (SOURCE NAME)
```

[NFPA 99:5.1.11.2.4] 1323.14.2 Source Valves. Source valves shall be labeled in substance as follows:

```
SOURCE VALUE
1324.5.1 Shutoff Valve. The source shutoff valve shall remain closed during tests specified in Section 1324.5 through Section 1324.5.1.2. [NFPA 99:5.1.12.2.3.3]

1324.5.1.1 Required Test Pressure. The test pressure for pressure gases and vacuum systems shall be 1.5 times the system operating pressure but not less than a gauge pressure of 150 psi (1034 kPa). The test pressure shall be maintained until each joint has been examined for leakage by means of a leak detector that is safe for use with oxygen and does not contain ammonia. [NFPA 99:5.1.12.2.3.4, 5.1.12.2.3.5]

1324.5.1.2 Leaks. Leaks, if any, shall be located, repaired (if permitted), replaced (if required), and retested. [NFPA 99:5.1.12.2.3.6]

1324.5.2 Initial Cross-Connection Test. It shall be determined that no cross-connections exist between the various medical gas and vacuum piping systems. [NFPA 99:5.1.12.2.4]

1324.5.2.1 Atmospheric Pressure. All piping systems shall be reduced to atmospheric pressure. [NFPA 99:5.1.12.2.4.1]

1324.5.2.2 Sources of Test Gas. Sources of test gas shall be disconnected from all piping systems, except for the one system being tested. [NFPA 99:5.1.12.2.4.2]

1324.5.2.3 System to Be Charged. The system under test shall be charged with oil-free, dry nitrogen NF to a gauge pressure of 50 psi (345 kPa). [NFPA 99:5.1.12.2.4.3]

1324.5.2.4 Check Outlets and Inlets. After the installation of the individual faceplates with appropriate adapters matching outlet/inlet labels, each individual outlet/inlet in each installed medical gas and vacuum piping system shall be checked to determine that the test gas is being dispensed only from the piping system being tested. [NFPA 99:5.1.12.2.4.4]

1324.5.2.5 Repeat Test. The cross-connection test referenced in Section 1324.5.2 shall be repeated for each installed medical gas and vacuum piping system. [NFPA 99:5.1.12.2.4.5]

1324.5.2.6 Identification of System. The proper labeling and identification of system outlets/inlets shall be confirmed during these tests. [NFPA 99:5.1.12.2.4.6]

1324.5.3 Initial Piping Purge Tests. The outlets in each medical gas piping system shall be purged to remove any particulate matter from the distribution piping. [NFPA 99:5.1.12.2.5]

1324.5.3.1 Procedure. Using appropriate adapters, each outlet shall be purged with an intermittent high-volume flow of test gas until the purge produces no discoloration in a clean white cloth. [NFPA 99:5.1.12.2.5.1]

1324.5.3.2 Location. The purging required in Section 1324.5.3.1 shall be started at the closest outlet/inlet to the zone valve and continue to the furthest outlet/inlet within the zone. [NFPA 99:5.1.12.2.5.2]

1324.5.4 Standing Pressure Tests – for Positive Pressure Medical Gas Piping Systems. After successful completion of the initial pressure tests under Section 1324.5 through Section 1324.5.1.2, medical gas distribution piping shall be subjected to a standing pressure test. [NFPA 99:5.1.12.2.6]

1324.5.4.1 Time Frame for Testing. Tests shall be conducted after the final installation of station outlet valve bodies, faceplates, and all other distribution system components (e.g., pressure alarm devices, pressure indicators, line pressure relief valves, manufactured assemblies, hoses). [NFPA 99:5.1.12.2.6.1]

1324.5.4.2 Source Valve. The source valve shall be closed during this test. [NFPA 99:5.1.12.2.6.2]

1324.5.4.3 Length of Testing. The piping systems shall be subjected to a 24 hour standing pressure test using oil-free, dry nitrogen NF. [NFPA 99:5.1.12.2.6.3]

1324.5.4.4 Test Pressure. Test pressures shall be 20 percent above the normal system operating line pressure. [NFPA 99:5.1.12.2.6.4]

1324.5.4.5 Conclusion of Test. The leakage over the 24 hour test shall not exceed 0.5 percent of the starting pressure [e.g. 0.3 psi (2 kPa) starting at 60 psig (414 kPa) - 0.125 inch (3.2 mm) HgV starting at 25 inches (635 mm) HgV], except that attributed to specific changes in ambient temperature. [NFPA 99:5.1.12.2.6.5]

1324.5.4.6 Leaks. Leaks, if any, shall be located, repaired (if permitted) or replaced (if required), and retested. [NFPA 99:5.1.12.2.6.6]

1324.5.4.7 Proof of Testing. The 24 hour standing pressure test of the positive pressure system shall be witnessed by an ASSE 6020 inspector, an ASSE 6030 verifier, or the Authority Having Jurisdiction or its designee. A form indicating that this test has been performed and witnessed shall be provided to the verifier at the start of the tests required in Section 1324.5 through Section 1324.5.11. [NFPA 99:5.1.12.2.6.7]

1324.5.5 Standing Pressure Tests – Medical Vacuum Piping Systems. After successful completion of the initial pressure tests under Section 1324.5 through Section 1324.5.1.2, vacuum distribution piping shall be subjected to a standing vacuum test. [NFPA 99:5.1.12.2.7]

1324.5.5.1 Timeframe for Testing. Tests shall be conducted after installation of all components of the vacuum system. [NFPA 99:5.1.12.2.7.1]

1324.5.5.2 Length of Testing. The piping systems shall be subjected to a 24 hour standing vacuum test. [NFPA 99:5.1.12.2.7.2]
1324.5.5.3 Test Pressure. Test pressure shall be between 12 inches (305 mm) HgV and full vacuum. [NFPA 99:5.1.12.2.7.3]

1324.5.5.4 Disconnection of Testing Source. During the test, the source of test vacuum shall be disconnected from the piping system. [NFPA 99:5.1.12.2.7.4]

1324.5.5.5 Conclusion of Test. At the conclusion of the test, there shall be no change in the vacuum other than the leakage over the 24-hour test shall not exceed 0.5 percent of the starting pressure [e.g., 0.125 inch (0.3 mm) HgV starting at 25 inches (635 mm) HgV] except that attributed to specific changes of system pressure. [NFPA 99:5.1.12.2.7.5]

1324.5.5.6 Proof of Testing. The 24-hour standing pressure test of the vacuum system shall be witnessed by the Authority Having Jurisdiction or its designee. A form indicating that this test has been performed and witnessed shall be provided to the verifier at the start of the tests required in Section 1324.5.7 through Section 1324.5.11. [NFPA 99:5.1.12.2.7.6]

1324.5.5.7 Leaks. Leaks, if any, shall be located, repaired (if permitted) or replaced (if required), and retested. [NFPA 99:5.1.12.2.7.7]

1324.5.6 System Inspection. System inspections shall be performed prior to concealing piping distribution systems in walls, ceilings, chases, trenches, underground, or otherwise hidden from view. [NFPA 99:5.1.12.3.1.1]

1324.5.6.1 Test Gas. The test gas shall be nitrogen NF. [NFPA 99:5.1.12.3.1.2]

1324.5.6.2 Inspection Qualification. Inspections shall be conducted by a party technically competent and experienced in the field of medical gas and vacuum pipeline inspections and testing and meeting the requirements of ASSE 6030, or ASSE 6035, in accordance with the mandatory requirements in CGA M-1. [NFPA 99:5.1.12.3.1.3]

1324.5.6.3 Inspection Personnel. Inspections shall be performed by a party other than the installing contractor. [NFPA 99:5.1.12.3.1.4]

1324.5.6.4 Qualifications. Where systems have not been installed by in-house personnel, inspections shall be permitted by personnel of the organization who meet the requirements of Section 1324.5.6.2. [NFPA 99:5.1.12.3.1.5]

1324.5.6.5 Inspections. The initial pressure tests performed by the installing contractor shall be witnessed by an ASSE 6020 inspector, an ASSE 6030 verifier, or the Authority Having Jurisdiction or its designee. A form indicating that this test has been performed and witnessed shall be provided to the verifier at the start of the tests required in Section 1324.5.7 through Section 1324.5.11. The presence and correctness of labeling and valve tagging required by this code for all concealed components and piping distribution systems shall be inspected. [NFPA 99:5.1.12.3.2–5.1.12.3.2.2]

1324.5.7 System Verification. Verification tests shall be performed only after all tests required in Section 1324.3 through Section 1324.5.7. Installer Performed Tests, have been completed. [NFPA 99:5.1.12.4.1.1]

1324.5.7.1 Test Gas. The test gas shall be oil-free, dry nitrogen NF or the system gas where permitted. [NFPA 5.1.12.4.1.2]

1324.5.7.2 Approved Tester. Testing shall be conducted by a party technically competent and experienced in the field of medical gas and vacuum pipeline testing and meeting the requirements of ASSE 6030, except as required by Section 1324.5.7.3. [NFPA 99:5.1.12.4.1.3]

Testing shall be performed by a party other than the installing contractor. [NFPA 99:5.1.12.4.1.5]

Where systems have not been installed by in-house personnel, testing shall be permitted by personnel of that organization who meet the requirements of Section 1324.5.7.2. [NFPA 99:5.1.12.4.1.6]

1324.5.7.3 Cryogenic Fluid Testing. Testing of the cryogenic fluid central supply system shall be conducted by a party technically competent and experienced in the field of cryogenic fluid systems and meeting the requirements of ASSE 6035, in accordance with the mandatory requirements in CGA M-1. [NFPA 99:5.1.12.4.1.4]

1324.5.8 Particulate Matter. In order to remove any traces of particulate matter deposited in the pipelines as a result of construction, a heavy, intermittent purging of the pipeline shall be done. [NFPA 99:5.1.12.4.6]

1324.5.9 Final Tie-In Test. Each joint in the final connection between the new work and the existing system shall be leak-tested with the gas of system designation at a test vacuum of 25 inches (635 mm) HgV, except as required by Section 1324.5.9.3. [NFPA 99:5.1.12.4.9.2]

1324.5.9.1 Vacuum Joints. Vacuum joints shall be tested using an ultrasonic leak detector or other means that will allow detection of leaks in an active vacuum system. [NFPA 99:5.1.12.4.9.3]

1324.5.9.2 Pressure Gases. For pressure gases, immediately after the final brazed connection is made and leak-tested, an outlet in the new piping and an outlet in the existing piping that are immediately downstream from the point or area of intrusion shall be purged in accordance with the applicable requirements of Section 1324.5.8. [NFPA 99:5.1.12.4.9.4]

1324.5.9.3 Positive Pressure Gases. Before the new work is used for patient care, positive pressure gases shall be tested for operational pressure and gas concentration in accordance with Section 1324.5.10 and Section 1324.5.11. [NFPA 99:5.1.12.4.9.5]
1324.5.9.4 Permanent Records. Permanent records of these tests shall be maintained in accordance with NFPA 99. [NFPA 99:5.1.12.4.9.6]

1324.5.10 Operational Flow Pressure Drop Test. Operational flow pressure drop tests shall be performed at each station outlet/inlet or terminal where the user makes connections and disconnections. [NFPA 99:5.1.12.4.10]

1324.5.10.1 Medical-Surgical Vacuum Inlets. Medical-surgical vacuum inlets shall draw 3 SCFM (85 NL/min) without reducing the vacuum pressure below 12 inch (305 mm) gauge HgV at any adjacent station inlet. [NFPA 99:5.1.12.4.10.4]

1324.5.10.2 Oxygen and Medical Air Outlets. Oxygen and medical air outlets serving Category 1 space shall allow a transient flow rate of 6 SCFM (170 SLPM) for 3 seconds. [NFPA 99:5.1.12.4.10.5]

1324.5.11 Medical Gas Concentration Test. After purging each system with the gas of system designation, the following shall be performed:

(1) Each pressure gas source and outlet shall be analyzed for concentration of gas, by volume.

(2) Analysis shall be conducted with instruments designed to measure the specific gas dispensed.

(3) Allowable concentrations shall be as indicated in Table 1324.5.11. [NFPA 99:5.1.12.4.11]

<table>
<thead>
<tr>
<th>MEDICAL GAS</th>
<th>CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen USP</td>
<td>≥99% oxygen</td>
</tr>
<tr>
<td>Oxygen 93 USP</td>
<td>≥90% oxygen ≤96%</td>
</tr>
<tr>
<td>Nitrous oxide USP</td>
<td>≤99% nitrous oxide</td>
</tr>
<tr>
<td>Nitrogen NF</td>
<td>≤1% oxygen or ≥99% nitrogen</td>
</tr>
<tr>
<td>Medical air USP</td>
<td>19.5% - 23.5% oxygen</td>
</tr>
<tr>
<td>Other gases</td>
<td>Named gases by ±1%, or per specification</td>
</tr>
</tbody>
</table>

Part III – Category 2 Piped Gas and Vacuum Systems.

1325.0 Category 2 Piped Gas and Vacuum Systems.

1325.1 General. Category 2 piped gas or piped vacuum system requirements shall be permitted when all of the following criteria are met:

(1) Only moderate sedation (as defined in Chapter 2), minimal sedation (as defined in Chapter 2); or no sedation is performed. Deep sedation and general anesthesia shall not be permitted.

(2) The loss of the piped gas or piped vacuum systems is likely to cause minor injury to patients, staff, or visitors. (3) The facility piped gas or piped vacuum systems are intended for Category 2 patient care space as defined in Chapter 2. [NFPA 99:5.2.1.2]

1325.2 Nature of Hazards of Gas and Vacuum Systems. The requirement of Section 1307.2 shall apply to the nature of hazards of gas and vacuum systems. [NFPA 99:5.2.2]

1325.3 Central Supply Systems. Category 2 systems shall comply with Section 1307.3 through Section 1309.13. [NFPA 99:5.2.3.4]

1325.4 Category 2 Medical Air Supply Systems. Category 2 systems shall comply with Section 1310.0 through Section 1311.6, except as follows:

(1) Medical air compressors, dryers, aftercoolers, filters, and regulators shall be permitted to be simplex.

(2) The facility staff shall develop their emergency plan to deal with the loss of medical air. [NFPA 99:5.2.3.5]

1325.5 Oxygen Concentrators. Oxygen supply systems using concentrators shall be permitted to consist of two sources, one of which shall be a cylinder header with sufficient cylinder connections for one average day’s supply. [NFPA 99:5.2.3.6]

1325.6 Category 2 Medical-Surgical Vacuum. Category 2 systems shall comply with Section 1312.0 through Section 1313.5, except as follows:

(1) Medical-surgical vacuum systems shall be permitted to be simplex.

(2) The facility staff shall develop their emergency plan to deal with the loss of medical-surgical vacuum. [NFPA 99:5.2.3.7]

1325.7 Valves. Category 2 systems shall comply with Section 1314.0 through Section 1314.12.1. [NFPA 99:5.2.4]

1325.8 Station Outlets and Inlets. Category 2 systems shall comply with Section 1315.0. [NFPA 99:5.2.5]

1325.9 Pressure and Vacuum Indicators. Category 2 systems shall comply with Section 1316.2. [NFPA 99:5.2.8]

1325.10 Warning Systems (Category 2). Warning systems associated with Category 2 systems shall provide the master, area, and local alarm functions of a Category 1 system as required in Section 1317.0, except as follows:

(1) Warning systems shall be permitted to be a single alarm panel.

(2) The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.

(3) Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel. [NFPA 99:5.2.9]

1325.11 Category 2 Distribution. Level Category 2 systems shall comply with Section 1318.0 through Section 1323.12. [NFPA 99:5.2.10]

1325.12 Labeling and Identification. Category 2 systems shall comply with Section 1323.13 through Section 1323.15. [NFPA 99:5.2.11]
HEALTH CARE FACILITIES AND MEDICAL GAS AND MEDICAL VACUUM SYSTEMS

1325.13 Performance Criteria and Testing — Category 2 (Gas, Medical–Surgical and Vacuum, and WAGD). Category 2 systems shall comply with Section 1324.0. [NFPA 99:5.2.12]

Part IV – Category 3 Piped Gas and Vacuum Systems.

1326.0 Category 3 Piped Gas and Vacuum Systems.

1326.1 General. Category 3 piped gas and vacuum systems shall be permitted when all of the following criteria are met:

(1) Only moderate sedation; minimal sedation, as defined in Chapter 2; or no sedation is performed. Deep sedation, moderate sedation, and general anesthesia are not performed.

(2) The loss of the piped gas and vacuum systems is not likely to cause injury to patients, staff, or visitors, but can cause discomfort.

(3) The facility piped gas and vacuum systems are intended for Category 3 or Category 4 patient care rooms as defined in Chapter 2. [NFPA 99:5.3.1.2]

1326.2 Nature of Hazards of Gas and Vacuum Systems. The requirement of Section 1307.2 shall apply to the nature of hazards of gas and vacuum systems. [NFPA 99:5.3.2]

1326.3 Medical Air Supply Systems. Category 3 central supply systems shall comply with Section 1310.0 through Section 1311.6, except as follows be permitted to consist of the following:

(1) Medical air compressors, dryers, after coolers, filters, and regulators shall be permitted to be simplex.

(2) The facility staff shall develop their emergency plan to deal with the loss of medical–surgical vacuum.

(3) Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel.

1326.4 Oxygen Central Supply Systems Using Concentrators. Category 3 oxygen supply systems using concentrators shall be permitted to consist of two sources, one of which shall be a cylinder header with sufficient cylinder connections for one average day’s supply. [NFPA 99:5.3.4.6]

1326.5-1326.4 Medical–Surgical Vacuum Systems. Category 3 systems shall comply with Section 1307.3 through Section 1309.13 and Section 1312.0 through Section 1313.5, except as follows:

(1) Medical–surgical vacuum systems shall be permitted to be simplex.

(2) The facility staff shall develop their emergency plan to deal with the loss of medical–surgical vacuum.

(3) Emergency electrical service shall conform to the requirements of Section 6.6 of NFPA 99 and NFPA 70. [NFPA 99:5.3.7]

1326.6-1326.5 Valves. Category 3 systems shall comply with Section 1314.0. [NFPA 99:5.3.4]

1326.7-1326.6 Station Outlets and Inlets. Category 3 systems shall comply with Section 1315.0. [NFPA 99:5.3.5]

1326.8-1326.7 Pressure and Vacuum Indicators. Category 3 systems shall comply with Section 1316.2. [NFPA 99:5.3.8]

1326.9-1326.8 Warning Systems. Warning systems associated with Category 3 systems shall provide the master, area, and local alarm functions of a Category 1 system as required in Section 1317.0, except as follows:

(1) Warning systems shall be permitted to be a single alarm panel (i.e., a combination master/area alarm panel).

(2) The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.

(3) Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel.

(4) Electrical power for warning systems shall be in accordance with Section 6.6 of NFPA 99 for Category 3 and Category 4 spaces. [NFPA 99:5.3.9]

1326.10-1326.9 Distribution. Category 3 systems shall comply with Section 1318.0 through Section 1323.12. [NFPA 99:5.3.10]

1326.11-1326.10 Labeling and Identification. Category 3 systems shall comply with Section 1323.13 through Section 1323.15. [NFPA 99:5.3.11]

Part V – Dental Gas and Vacuum Systems.

1327.0 Dental Gas and Vacuum Systems.

1327.1 General. Dental gas and vacuum systems shall comply with this code and NFPA 99.

1327.2 Emergency Shutoff Valves (Oxygen and Nitrous Oxide). Emergency shutoff valves shall be provided in accordance with the following:
(1) Where a central medical gas supply system supplies two treatment facilities, each facility shall be provided with an emergency shutoff valve located in that treatment facility so as to be accessible from all use-point locations in an emergency.

(2) Where a central medical gas supply system supplies two treatment facilities, each facility shall be provided with an emergency shutoff valve located in that treatment facility so as to be accessible from all use-point locations in an emergency.

(3) Emergency shutoff valves shall be labeled to indicate the gas controlled by the shutoff valve and shall shut off only the gas to the treatment facility that they serve.

(4) A remotely activated shutoff valve at a gas supply manifold shall not be used for emergency shutoff. For clinical purposes, such a remote valve actuator shall not fail-close in the event of loss of electric power. Where remote actuators are the type that fail-open, it shall be mandatory that cylinder shutoff valves be closed whenever the system is not in use. [NFPA 99:15.4.2.6.1 – 15.4.2.6.4.2]

**1327.3 Warning Systems (Oxygen and Nitrous Oxide).** Category 2 warning systems shall comply with Section 1325.10 except as follows:

1. Warning systems shall be permitted to be a single alarm panel.
2. The alarm panel shall be located in an area of continuous surveillance while the facility is in operation.
3. Pressure and vacuum switches/sensors shall be mounted at the source equipment with a pressure indicator at the master alarm panel.
4. Warning systems for medical gas systems shall provide the following alarms:
   a. Oxygen main line pressure low.
   b. Oxygen main line pressure high.
   c. Oxygen changeover to secondary bank or about to changeover (if automatic).
   d. Nitrous oxide main line pressure low.
   e. Nitrous oxide main line pressure high.
   f. Nitrous oxide changeover to secondary bank or about to changeover (if automatic).
5. Audible and noncancelable alarm visual signals shall indicate if the pressure in the main line increases or decreases 20 percent from the normal operating pressure.
6. Visual indications shall remain until the situation that caused the alarm is resolved.
7. Pressure switches/sensors shall be installed downstream of any emergency shutoff valves and any other shutoff valves in the system and shall cause an alarm for the medical gas if the pressure decreases or increases 20 percent from the normal operating pressure.
8. A cancelable audible indication of each alarm condition that produces a sound at the alarm panel shall reactivate the audible signal if another alarm condition occurs while the audible signal is silenced. [NFPA 99:15.4.2.10]

**1327.4 Initial Pressure Test.** Each section of the piping in positive-pressure gas systems and copper vacuum systems shall be pressure tested. Plastic vacuum and plastic scavenging piping shall not be pressure tested. [NFPA 99:15.4.7.4.4.1]

**1327.4.1 Pressure Test.** Initial pressure tests shall be conducted as follows:

1. After blowdown of the distribution piping
2. After installation of station outlet/inlet rough-in assemblies
3. Prior to the installation of components of the distribution piping system that would be damaged by the test pressure (e.g., pressure/vacuum alarm devices, pressure/vacuum indicators, and line pressure relief valves) [NFPA 99:15.4.7.4.4.2]

**1327.4.2 Source Shutoff Valve.** The source shutoff valve shall remain closed during the pressure tests. [NFPA 99:15.4.7.4.4.3]

**1327.4.3 Test Pressure.** The test pressure for oxygen and nitrous oxide piping shall be 1.5 times the system operating pressure but not less than a gauge pressure of 150 psi (1035 kPa). [NFPA 99:15.4.7.4.4.4]

**1327.4.4 Examine for Leaks.** The test pressure shall be maintained until each joint has been examined for leakage by means of a leak detector that is safe for use with oxygen and does not contain ammonia. [NFPA 99:15.4.7.4.4.5]

**1327.4.5 Leaks Located.** Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested. [NFPA 99:15.4.7.4.4.6]

**1327.5 Maximum Copper Tube Support Spacing.** The maximum support spacing for copper tube shall be in accordance with Table 1327.5. [NFPA 99:15.4.5.6.5]

**TABLE 1327.5**

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>HANGER SPACING (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN8</td>
<td>(NPS 1/8)</td>
</tr>
<tr>
<td>DN10</td>
<td>(NPS 1/4)</td>
</tr>
<tr>
<td>DN15</td>
<td>(NPS 1/2)</td>
</tr>
<tr>
<td>DN20</td>
<td>(NPS 3/8)</td>
</tr>
<tr>
<td>DN25</td>
<td>(NPS 1)</td>
</tr>
<tr>
<td>DN32</td>
<td>(NPS 1/4)</td>
</tr>
<tr>
<td>DN40 and larger</td>
<td>(NPS 1/2)</td>
</tr>
</tbody>
</table>

| Vertical risers, all sizes, every floor, but not to exceed | 15 |

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

**1327.6 Maximum Plastic Pipe Support Spacing.** The maximum support spacing for plastic pipe shall be in accordance with Table 1327.6. [NFPA 99:15.4.5.6.6]
1327.7 **Standing Pressure Tests for Oxygen and Nitrous Oxide Piping.** After successful completion of the initial pressure tests in Section 1327.4, the gas distribution piping shall be subject to a standing pressure test. [NFPA 99:15.4.7.4.6.1]

1327.7.1 **Tests Required.** Tests shall be conducted after the final installation of station outlet valve bodies, faceplates, and other distribution system components (e.g., pressure alarm devices, pressure indicators, line pressure relief valves, manufactured assemblies, and hoses). [NFPA 99:15.4.7.4.6.2]

1327.7.2 **Source Valve.** The source valve shall be closed during this test. [NFPA 99:15.4.7.4.6.3]

1327.7.3 **Piping Systems.** The piping systems shall be subjected to 24-hour standing pressure tests using oil-free, dry nitrogen NF. [NFPA 99:15.4.7.4.6.4]

1327.7.4 **Test Pressure.** Test pressures shall be 20 percent above the normal system operating line pressure. [NFPA 99:15.4.7.4.6.5]

1327.7.5 **Change in Test Pressure.** At the conclusion of the tests, there shall be no change in the test pressure except that attributed to specific changes in ambient temperature. [NFPA 99:15.4.7.4.6.6]

1327.7.6 **Leaks.** Any leaks shall be located, repaired (if permitted), or replaced (if required) by the installer, and retested. [NFPA 99:15.4.7.4.6.7]

1327.8 **Verifier Operational Pressure Test.** Operational pressure tests shall be performed at each station outlet or terminal where the user makes connections and disconnections. [NFPA 99:15.4.7.5.8.1]

1327.8.1 **Test Gas.** Tests shall be performed with the gas of system designation. [NFPA 99:15.4.7.5.8.2]

1327.8.2 **Medical Gas Outlets.** All medical gas outlets with a gauge pressure of 50 psi (345 kPa), including oxygen and nitrous oxide, shall deliver 1.8 standard cubic feet per minute (SCFM) (50 SLPM) with a pressure drop of not more than 5 psi (34 kPa) and static pressure of 50 psi (345 kPa) to 55 psi (379 kPa). [NFPA 99:15.4.7.5.8.3]
CHAPTER 14
FIRESTOP PROTECTION

1401.0 General.

1401.1 Applicability. Piping penetrations of required fire-resistance-rated walls, partitions, floors, floor/ceiling assemblies, roof/ceiling assemblies, or shaft enclosures shall be protected in accordance with the requirements of the building code, and this chapter.

1402.0 Construction Documents.

1402.1 Penetrations. Construction documents shall indicate with sufficient detail how penetrations of fire-resistance-rated assemblies shall be firestopped prior to obtaining design approval.

1403.0 Installation.

1403.1 Materials. Firestop systems shall be installed in accordance with this chapter, the building code, and the manufacturer’s installation instructions.

1404.0 Combustible Piping Installations.

1404.1 General Requirements. Combustible piping installations shall be protected in accordance with the appropriate fire resistance rating requirements in the building code that list the acceptable area, height, and type of construction for use in specific occupancies to ensure compliance and integrity of the fire resistance rating prescribed.

1404.2 Fire-Resistance Rating. Where penetrating a fire-resistance-rated wall, partition, floor, floor-ceiling assembly, roof-ceiling assembly, or shaft enclosure, the fire-resistance rating of the assembly shall be restored to its original rating.

1404.3 Firestop Systems. Penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E119, ASTM E814, UL 263, or UL 1479 with a positive pressure differential of not less than 0.01 of an inch of water (0.002 kPa). Systems shall have an F rating of not less than 1 hour but not less than the required fire-resistance rating of the assembly being penetrated. Systems protecting floor penetrations shall have a T rating of not less than 1 hour but not less than the required fire-resistance rating of the floor being penetrated. Floor penetrations contained within the cavity of a wall at the location of the floor penetration do not require a T rating. No T rating shall be required for floor penetrations by piping that is not in direct contact with combustible material.

1404.4 Connections. Where piping penetrates a rated assembly, the combustible piping shall not connect to non-combustible piping unless it is capable of being demonstrated that the transition is in accordance with Section 1404.3.

1404.5 Insulation and Coverings. Insulation and coverings on or in the penetrating item shall not be permitted unless the specific insulating or covering material has been tested as part of the penetrating firestop system.

1404.6 Sleeves. Where sleeves are used, the sleeves shall be securely fastened to the fire-resistance-rated assembly. The (inside) annular space between the sleeve and the penetrating item and the (outside) annular space between the sleeve and the fire-resistance-rated assembly shall be firestopped in accordance with this chapter.

1405.0 Noncombustible Piping Installations.

1405.1 General Requirements. Noncombustible piping installations shall be protected in accordance with the appropriate fire resistance rating requirements in the building code that list the acceptable area, height, and type of construction for use in specific occupancies to ensure compliance and integrity of the fire-resistance rating prescribed.

1405.2 Fire-Resistance Rating. Where penetrating a fire-resistance-rated wall, partition, floor, floor-ceiling assembly, roof-ceiling assembly, or shaft enclosure, the fire-resistance rating of the assembly shall be restored to its original rating.

Exceptions:

1. Concrete, mortar, or grout shall be permitted to be used to fill the annular spaces around cast-iron, copper, copper alloy, or steel piping that penetrates concrete or masonry fire-resistant-rated assemblies. The nominal diameter of the penetrating item shall not exceed 6 inches (150 mm), and the opening size shall not exceed 144 square inches (0.093 m²).

   The thickness of concrete, mortar, or grout shall be the full thickness of the assembly or the thickness necessary to provide a fire-resistance rating not less than the required fire-resistance rating of the assembly penetrated.

2. The material used to fill the annular space shall prevent the passage of flame and hot gases capable of igniting cotton waste for the time period equivalent to the fire-resistance rating of the assembly, where tested to standard(s) referenced in Section 1405.3.

1405.3 Firestop Systems. Penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E119, ASTM E814, UL 263, or UL 1479 with a positive pressure differential of not less than 0.01 of an inch of water (0.002 kPa). Systems shall have an F rating of not less than 1 hour but not less than the required fire-resistance rating of the assembly being penetrated. Systems protecting floor penetrations shall have a T rating of not less than 1 hour but not less than the required fire-resistance rating of the floor being penetrated. Floor penetrations contained within the cavity of a wall at the location of the floor penetration do not require a T rating. No T rating shall be required for floor penetrations by piping that is not in direct contact with combustible material.

1405.4 Connections. Where piping penetrates a rated assembly, the combustible piping shall not connect to non-combustible piping unless it is capable of being demonstrated.
that the transition is in accordance with the requirements of Section 1405.3.

**1405.5 Unshielded Couplings.** Unshielded couplings shall not be used to connect noncombustible piping unless it is capable of being demonstrated that the fire-resistant integrity of the penetration is maintained.

**1405.6 Sleeves.** Where sleeves are used, the sleeves shall be securely fastened to the fire-resistance-rated assembly. The (inside) annular space between the sleeve and the penetrating item and the (outside) annular space between the sleeve and the fire-resistance-rated assembly shall be firestopped in accordance with this chapter.

**1405.7 Insulation and Coverings.** Insulation and coverings on or in the penetrating item shall not be permitted unless the specific insulating or covering material has been tested as part of the penetrating firestop system.

**1406.0 Required Inspection.**

**1406.1 General.** Prior to being concealed, piping penetrations shall be inspected by the Authority Having Jurisdiction to verify compliance with the fire-resistance rating prescribed in the building code.

**1406.2 Examination.** The Authority Having Jurisdiction shall conduct a thorough examination of sufficient representative installations, including destructive inspection, to provide verification of satisfactory compliance with this chapter, the appropriate manufacturer’s installation instructions applied by the installer, construction documents, specifications, and applicable manufacturer’s product information.

**1406.3 Penetrations.** The Authority Having Jurisdiction shall determine the type, size, and quantity of penetrations to be inspected.

**1406.4 Field Installations.** The Authority Having Jurisdiction shall compare the field installations with the documentation supplied by the installer to determine the following:

(1) The required F ratings (1 hour, 2 hour, 3 hour, or 4 hour) and T ratings (0 hour, 1 hour, 2 hour, 3 hour, or 4 hour) of the penetration firestop systems are at least the same as the hourly rating of the assembly being penetrated.

(2) The penetrating firestop system includes the penetrating item as documented through testing of the systems conducted by an independent testing agency.

(3) The penetrating firestop system is installed as tested.
CHAPTER 15
ALTERNATE WATER SOURCES FOR NONPOTABLE APPLICATIONS

1501.0 General.
1501.1 Applicability. The provisions of this chapter shall apply to the construction, alteration, and repair of alternate water source systems for nonpotable applications.

1501.1.1 Allowable Use of Alternate Water. Where approved or required by the Authority Having Jurisdiction, alternate water sources [reclaimed (recycled) water, gray water, and on-site treated nonpotable water] shall be permitted to be used instead of potable water for the applications identified in this chapter.

1501.2 System Design. Alternate water source systems shall be designed in accordance with this chapter by a licensed plumbing contractor or a registered design professional. Components, piping, and fittings used in any alternate water source system shall be listed.

Exceptions:
(1) A registered design professional is not required to design gray water systems having a maximum discharge capacity of 250 gallons per day (gal/d) (0.011 L/s) for single-family and multi-family dwellings.

(2) A registered design professional is not required to design an on-site treated nonpotable water system for single-family dwellings having a maximum discharge capacity of 250 gal/d (0.011 L/s).

1501.3 Permit. It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered an alternate water source system in a building or on a premise without first obtaining a permit to do such work from the Authority Having Jurisdiction.

1501.4 Component Identification. System components shall be properly identified as to the manufacturer.

1501.5 Maintenance and Inspection. Alternate water source systems and components shall be inspected and maintained in accordance with Section 1501.5.1 through Section 1501.5.3.

1501.5.1 Frequency. Alternate water source systems and components shall be inspected and maintained in accordance with Table 1501.5 unless more frequent inspection and maintenance are required by the manufacturer.

1501.5.2 Maintenance Log. A maintenance log for gray water and on-site treated nonpotable water systems is required to have a permit in accordance with Section 1501.3 and shall be maintained by the property owner and be available for inspection. The property owner or designated appointee shall ensure that a record of testing, inspection, and maintenance in accordance with Table 1501.5 is maintained in the log. The log will indicate the frequency of inspection and maintenance for each system.

1501.5.3 Maintenance Responsibility. The required maintenance and inspection of alternate water source systems shall be the responsibility of the property owner unless otherwise required by the Authority Having Jurisdiction.

**TABLE 1501.5**
MINIMUM ALTERNATE WATER SOURCE TESTING, INSPECTION, AND MAINTENANCE FREQUENCY

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MINIMUM FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect and clean filters and screens, and replace (where necessary).</td>
<td>Every 3 months</td>
</tr>
<tr>
<td>Inspect and verify that disinfection, filters, and water quality treatment devices and systems are operational and maintaining minimum water quality requirements as determined by the Authority Having Jurisdiction.</td>
<td>In accordance with manufacturer's instructions, and the Authority Having Jurisdiction.</td>
</tr>
<tr>
<td>Inspect pumps and verify operation.</td>
<td>After initial installation and every 12 months thereafter</td>
</tr>
<tr>
<td>Inspect valves and verify operation.</td>
<td>After initial installation and every 12 months thereafter</td>
</tr>
<tr>
<td>Inspect pressure tanks and verify operation.</td>
<td>After initial installation and every 12 months thereafter</td>
</tr>
<tr>
<td>Clear debris from and inspect storage tanks, locking devices, and verify operation.</td>
<td>After initial installation and every 12 months thereafter</td>
</tr>
<tr>
<td>Inspect caution labels and marking.</td>
<td>After initial installation and every 12 months thereafter</td>
</tr>
<tr>
<td>Inspect and maintain mulch basins for gray water irrigation systems.</td>
<td>As needed to maintain mulch depth and prevent ponding and runoff.</td>
</tr>
<tr>
<td>Cross-connection inspection and test*</td>
<td>After initial installation and every 12 months thereafter</td>
</tr>
</tbody>
</table>

* The cross-connection test shall be performed in the presence of the Authority Having Jurisdiction in accordance with the requirements of this chapter.

1501.6 Operation and Maintenance Manual. An operation and maintenance manual for gray water and on-site treated water systems required to have a permit in accordance with Section 1501.3 shall be supplied to the building owner by the system designer. The operation and maintenance manual shall include the following:
(1) Detailed diagram of the entire system and the location of system components.
(2) Instructions for operating and maintaining the system.
(3) Details on maintaining the required water quality for on-site nonpotable water systems.
(4) Details on deactivating the system for maintenance, repair, or other purposes.
(5) Applicable testing, inspection, and maintenance frequencies in accordance with Table 1501.5.

(6) A method of contacting the manufacturer(s).

1501.7 Minimum Water Quality Requirements. The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, for on-site treated nonpotable systems, the water quality requirements of IAPMO IGC 324 or NSF/ANSI 350 shall apply. The EPA/625/R-04/108 contains recommended water reuse guidelines to assist regulatory agencies to develop, revise, or expand alternate water source water quality standards.

Exception: Water treatment is not required for gray water used for subsurface irrigation.

1501.8 Material Compatibility. Alternate water source systems shall be constructed of materials that are compatible with the type of pipe and fitting materials, water treatment, and water conditions in the system.

1501.9 Commercial, Industrial, and Institutional Restroom Signs. A sign shall be installed in restrooms in commercial, industrial, and institutional occupancies using reclaimed (recycled) water and on-site treated water, for water closets, urinals, or both. Each sign shall contain ½ of an inch (12.7 mm) letters of a highly visible color on a contrasting background. The location of the sign(s) shall be such that the sign(s) are visible to users. The location of the sign(s) shall be approved by the Authority Having Jurisdiction and shall contain the following text:

TO CONSERVE WATER, THIS BUILDING USES *__________* TO FLUSH TOILETS AND URINALS.

1501.9.1 Equipment Room Signs. Each room containing reclaimed (recycled) water and on-site treated water system shall have a sign posted in a location that is visible to anyone working on or near nonpotable water equipment with the following wording in 1 inch (25.4 mm) letters:

CAUTION: NONPOTABLE *__________*, DO NOT DRINK. DO NOT CONNECT TO DRINKING WATER SYSTEM. NOTICE: CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM.

*__________* Shall indicate RECLAIMED (RECYCLED) WATER or ON-SITE TREATED WATER, accordingly.

1501.10 System Controls. Controls for pumps, valves, and other devices that contain mercury that come in contact with alternate water source water supply shall not be permitted.

1502.0 Inspection and Testing.

1502.1 General. Alternate water source systems shall be inspected and tested in accordance with Section 1502.2 through Section 1502.3.4.

1502.2 Supply System Inspection and Test. Alternate water source systems shall be inspected and tested in accordance with this code for testing of potable water piping.

1502.3 Annual Cross-Connection Inspection and Testing. An initial and subsequent annual inspection and test shall be performed on both the potable and alternate water source systems. The potable and alternate water source system shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection in accordance with Section 1502.3.1 through Section 1502.3.4.

1502.3.1 Visual System Inspection. Before commencing the cross-connection testing, a dual system inspection shall be conducted by the Authority Having Jurisdiction and other authorities having jurisdiction as follows:

(1) Meter locations of the alternate water source and potable water lines shall be checked to verify that no modifications were made and that no cross-connections are visible.

(2) Pumps and equipment, equipment room signs and exposed piping in equipment room shall be checked.

(3) Valves shall be checked to ensure that the valve lock seals are still in place and intact. Valve control door signs shall be checked to verify that no signs have been removed.

1502.3.2 Cross-Connection Test. The procedure for determining cross-connection shall be followed by the applicant in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction to determine whether a cross-connection has occurred as follows:

(1) The potable water system shall be activated and pressurized. The alternate water source system shall be shut down, depressurized, and drained.

(2) The potable water system shall remain pressurized for a minimum period specified by the Authority Having Jurisdiction while the alternate water source system is empty. The minimum period the alternate water source system is to remain depressurized shall be determined on a case-by-case basis, taking into account the size and complexity of the potable and the alternate water source distribution systems, but in no case shall that period be less than 1 hour.

(3) The drain on the alternate water source system shall be checked for flow during the test and fixtures, potable and alternate water source, shall be tested and inspected for flow. Flow from an alternate water source system outlet indicates a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the alternate water source system.

(4) The potable water system shall then be depressurized and drained.

(5) The alternate water source system shall then be activated and pressurized.

(6) The alternate water source system shall remain pressurized for a minimum period specified by the Authority Having Jurisdiction while the potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than 1 hour.
(7) Fixtures, potable, and alternate water source shall be tested and inspected for flow. Flow from a potable water system outlet indicates a cross-connection. No flow from an alternate water source outlet will indicate that it is connected to the potable water system.

(8) The drain on the potable water system shall be checked for flow during the test and at the end of the test.

(9) Where there is no flow detected in the fixtures which would indicate a cross-connection, the potable water system shall be repressurized.

1502.3.3 Discovery of Cross-Connection. If a cross-connection is discovered, the following procedure, in the presence of the Authority Having Jurisdiction, shall be activated immediately:

(1) The alternate water source piping to the building shall be shutdown at the meter, and the alternate water source riser shall be drained.

(2) Potable water piping to the building shall be shutdown at the meter.

(3) The cross-connection shall be uncovered and disconnected.

(4) The building shall be retested in accordance with Section 1502.3.1 and Section 1502.3.2.

(5) The potable water system shall be chlorinated with 50 parts-per-million (ppm) chlorine for 24 hours.

(6) The potable water system shall be flushed after 24 hours, and a standard bacteriological test shall be performed. Where test results are acceptable, the potable water system shall be permitted to be recharged.

1502.3.4 Annual Inspection. An annual inspection of the alternate water source system, following the procedures listed in Section 1502.3.1 shall be required. Annual cross-connection testing, following the procedures listed in Section 1502.3.2 shall be required by the Authority Having Jurisdiction, unless site conditions do not require it. In no event shall the test occur less than once in 4 years. Alternate testing requirements shall be permitted by the Authority Having Jurisdiction.

1502.4 Separation Requirements. Underground alternate water source service piping other than gray water shall be separated from the building sewer in accordance with this code. Treated nonpotable water piping carrying treated nonpotable water shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where horizontal piping materials do not comply with this requirement, the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the treated nonpotable water piping.

1502.5 Abandonment. Alternate water source systems that are no longer in use or fail to be maintained in accordance with Section 1501.5 shall be abandoned. Abandonment shall comply with Section 1502.5.1 and Section 1502.5.2.

1502.5.1 General. An abandoned system or part thereof covered under the scope of this chapter shall be disconnected from remaining systems, drained, plugged, and capped in an approved manner.

1502.5.2 Underground Tank. An underground water storage tank that has been abandoned or otherwise discontinued from use in a system covered under the scope of this chapter 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.

1502.6 Sizing. Unless otherwise provided for in this chapter, alternate water source piping shall be sized in accordance with Chapter 6 for sizing potable water piping.

1503.0 Gray Water Systems.

1503.1 General. The provisions of this section shall apply to the construction, alteration, and repair of gray water systems.

1503.2 System Requirements. Gray water shall be permitted to be diverted away from a sewer or private sewage disposal system, and discharge to a subsurface irrigation or subsoil irrigation system. The gray water shall be permitted to discharge to a mulch basin for single-family and multi-family dwellings. Gray water shall not be used to irrigate root crops or food crops intended for human consumption that comes in contact with soil.

1503.2.1 Surge Capacity. Gray water systems shall be designed to have the capacity to accommodate peak flow rates and distribute the total amount of estimated gray water on a daily basis to a subsurface irrigation field, subsoil irrigation field, or mulch basin without surface, ponding, or runoff. A surge tank is required for systems that are unable to accommodate peak flow rates and distribute the total amount of gray water by gravity drainage. The water discharge for gray water systems shall be determined in accordance with Section 1503.8.1 or Section 1503.8.2.

1503.2.2 Diversion. The gray water system shall connect to the sanitary drainage system downstream of fixture traps and vent connections through a gray water diverter valve. The gray water diverter valve shall comply with IAPMO PS 59 and be installed in an accessible location and clearly indicate the direction of flow.

1503.2.3 Backwater Valves. Gray water drains subject to backflow shall be provided with a backwater valve so located as to be accessible for inspection and maintenance.

1503.3 Connections to Potable and Reclaimed (Recycled) Water Systems. Gray water systems shall have no direct connection to a potable water supply, on-site treated nonpotable water supply, or reclaimed (recycled) water systems. Potable, on-site treated nonpotable, or reclaimed (recycled) water is permitted to be used as makeup water for a non-pressurized storage tank provided the connection is protected by an air gap in accordance with this code.
1503.4 Location. No gray water system or part thereof shall be located on a lot other than the lot that is the site of the building or structure that discharges the gray water, nor shall a gray water system or part thereof be located at a point having less than the minimum distances indicated in Table 1503.4.

<table>
<thead>
<tr>
<th>MINIMUM HORIZONTAL DISTANCE IN CLEAR REQUIRED FROM</th>
<th>SURGE TANK (feet)</th>
<th>SUBSURFACE AND SUBSOIL IRRIGATION FIELD AND MULCH BED (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building structures(^1)</td>
<td>5(^{1,9})</td>
<td>2(^{1,8})</td>
</tr>
<tr>
<td>Property line adjoining private property</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Water supply wells(^4)</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Streams and lakes(^4)</td>
<td>50</td>
<td>50(^{6})</td>
</tr>
<tr>
<td>Sewage pits or cesspools</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Sewage disposal field(^{10})</td>
<td>5</td>
<td>4(^{6})</td>
</tr>
<tr>
<td>Septic tank</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>On-site domestic water service line</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Pressurized public water main</td>
<td>10</td>
<td>10(^{7})</td>
</tr>
</tbody>
</table>

For SI units: 1 foot = 304.8 mm

Notes:
1. Including porches and steps, whether covered or uncovered, breezeways, roofed carports, roofed patios, carports, covered walks, covered driveways, and similar structures or appurtenances.
2. The distance shall be permitted to be reduced to 0 feet for aboveground tanks where first approved by the Authority Having Jurisdiction.
3. Reference to a 45 degree (0.79 rad) angle from the foundation.
4. Where special hazards are involved, the distance required shall be increased as directed by the Authority Having Jurisdiction.
5. These minimum clear horizontal distances shall apply between the irrigation or disposal field and the ocean mean high water line.
6. Add 2 feet (610 mm) for each additional foot of depth more than 1 foot (305 mm) below the bottom of the drain line.
7. For parallel construction or crossings, approval by the Authority Having Jurisdiction shall be required.
8. The distance shall be permitted to be reduced to 1½ feet (457 mm) for drip and mulch basin irrigation systems.
9. The distance shall be permitted to be reduced to 0 feet for surge tanks of 75 gallons (284 L) or less.
10. Where irrigation or disposal fields are installed in the sloping ground, the minimum horizontal distance between a part of the distribution system and the ground surface shall be 15 feet (4572 mm).

1503.5 Plot Plan Submission. No permit for a gray water system shall be issued until a plot plan with data satisfactory to the Authority Having Jurisdiction has been submitted and approved.

1503.6 Prohibited Location. Where there is insufficient lot area or inappropriate soil conditions for adequate absorption to prevent the ponding, surfacing, or runoff of the gray water, as determined by the Authority Having Jurisdiction, no gray water system shall be permitted. A gray water system is not permitted on a property in a geologically sensitive area as determined by the Authority Having Jurisdiction.

1503.7 Drawings and Specifications. The Authority Having Jurisdiction shall require the following information to be included with or in the plot plan before a permit is issued for a gray water system, or at a time during the construction thereof:

1. Plot plan drawn to scale and completely dimensioned, showing lot lines and structures, direction and approximate slope of surface, location of present or proposed retaining walls, drainage channels, water supply lines, wells, paved areas and structures on the plot, number of bedrooms and plumbing fixtures in each structure, location of private sewage disposal system and expansion area or building sewer connecting to the public sewer, and location of the proposed gray water system.
2. Details of construction necessary to ensure compliance with the requirements of this chapter, together with a full description of the complete installation, including installation methods, construction, and materials in accordance with the Authority Having Jurisdiction.
3. Details for holding tanks shall include dimensions, structural calculations, bracings, and such other pertinent data as required.
4. A log of soil formations and groundwater level as determined by approved percolation tests.
5. The Authority Having Jurisdiction shall permit the use of Table 1504.2 instead of percolation tests.
6. Distance between the plot and surface waters such as lakes, ponds, rivers or streams, and the slope of the plot and the surface water, wherein close proximity.

1503.8 Procedure for Estimating Gray Water Discharge. Gray water systems shall be designed to distribute the total amount of estimated gray water on a daily basis. The water discharge for gray water systems shall be determined in accordance with Section 1503.8.1 or Section 1503.8.2.

1503.8.1 Single Family Dwellings and Multi-Family Dwellings. The gray water discharge for single family and multi-family dwellings shall be calculated by means of calculations, records, calculations of local daily per person interior water use, or the following procedure:

1. The number of occupants of each dwelling unit shall be calculated as follows:
   - First bedroom: 2 occupants
   - Each additional bedroom: 1 occupant

2. The estimated gray water flows of each occupant shall be calculated as follows:
   - Showers, bathtubs, and lavatories: 25 gallons (95 L) per day/occupant
   - Laundry: 15 gallons (57 L) per day/occupant
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(3) The total number of occupants shall be multiplied by the applicable estimated gray water discharge as provided above and the type of fixtures connected to the gray water system.

1503.8.2 Commercial, Industrial, and Institutional Occupancies. The gray water discharge for commercial, industrial, and institutional occupancies shall be calculated by utilizing the procedure in Section 1503.8.1, water use records or other documentation to estimate gray water discharge.

1503.9 Gray Water System Components. Gray water system components shall comply with Section 1503.9.1 through Section 1503.9.7.

1503.9.1 Surge Tanks. Where installed, surge tanks shall be in accordance with the following:

(1) Surge tanks shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight. Surge tanks constructed of steel shall be approved by the Authority Having Jurisdiction, provided such tanks are in accordance with approved applicable standards.

(2) Each surge tank shall be vented in accordance with this code. The vent size shall be determined based on the total gray water fixture units as outlined in this code.

(3) Each surge tank shall have an access opening with lockable gasketed covers or approved equivalent to allow for inspection and cleaning.

(4) Each surge tank shall have its rated capacity permanently marked on the unit. Also, a sign stating GRAY WATER, DANGER — UNSAFE WATER shall be permanently marked on the holding tank.

(5) Each surge tank shall have an overflow drain. The overflow drains shall have permanent connections to the building drain or building sewer, upstream of septic tanks. The overflow drain shall not be equipped with a shutoff valve.

(6) The overflow drainpipes shall not be less in size than the inlet pipe. Unions or equally effective fittings shall be provided for piping connected to the surge tank.

(7) Surge tank shall be structurally designed to withstand anticipated earth or other loads. Surge tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²) (1465 kg/m²) where the tank is designed for underground installation.

(8) Where a surge tank is installed underground, the system shall be designed so that the tank overflow will gravity drain to the existing sewer line or septic tank. The tank shall be protected against sewer line backflow by a backwater valve installed in accordance with this code.

(9) Surge tanks shall be installed on dry, level, well-compacted soil where underground or on a level 3 inch (76 mm) thick concrete slab where aboveground.

(10) Surge tanks shall be anchored to prevent against overturning where installed aboveground. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground where empty. The combined weight of the tank and hold down system shall meet or exceed the buoyancy forces of the tank.

1503.9.2 Gray Water Pipe and Fitting Materials. Aboveground and underground building drainage and vent pipe and fittings for gray water systems shall comply with the requirements for aboveground and underground sanitary building drainage and vent pipe and fittings in this code. These materials shall extend not less than 2 feet (610 mm) outside the building.

1503.9.3 Subsoil Irrigation Field Materials. Subsoil irrigation field piping shall be constructed of perforated high-density polyethylene pipe, perforated ABS pipe, perforated PVC pipe, or other approved materials, provided that sufficient openings are available for distribution of the gray water into the trench area. Material, construction, and perforation of the pipe shall be in accordance with the appropriate absorption field drainage piping standards and shall be approved by the Authority Having Jurisdiction.

1503.9.4 Subsurface Irrigation Field and Mulch Basin Supply Line Materials. Materials for gray water piping outside the building shall be polyethylene or PVC. Drip feeder lines shall be PVC or polyethylene tubing.

1503.9.5 Valves. Valves shall be accessible.

1503.9.6 Trap. Gray water piping discharging into the surge tank or having a direct connection to the sanitary drain or sewer piping shall be downstream of an approved water seal type trap(s). Where no such trap(s) exists, an approved vented running trap shall be installed upstream of the connection to protect the building from possible waste or sewer gases.

1503.9.7 Backwater Valve. A backwater valve shall be installed on gray water drain connections to the sanitary drain or sewer.

1504.0 Subsurface Irrigation System Zones.

1504.1 General. Irrigation or disposal fields shall be permitted to have one or more valved zones. Each zone shall be of a size to receive the gray water anticipated in that zone.

1504.2 Required Area of Subsurface Irrigation Fields, Subsoil Irrigation Fields, and Mulch Basins. The minimum effective irrigation area of subsurface irrigation fields, subsoil irrigation fields, and mulch basins shall be determined by Table 1504.2 for the type of soil found in the excavation, based upon a calculation of estimated gray water discharge under Section 1503.8. For a subsoil irrigation field, the area shall be equal to the aggregate length of the perforated pipe sections within the valved zone multiplied by the width of the proposed subsoil irrigation field.

1504.3 Determination of Maximum Absorption Capacity. The irrigation field and mulch basin size shall be based on the maximum absorption capacity of the soil and
determined using Table 1504.2. For soils not listed in Table 1504.2, the maximum absorption capacity for the proposed site shall be determined by percolation tests or another method acceptable to the Authority Having Jurisdiction. A gray water system shall not be permitted, where the percolation test shows the absorption capacity of the soil is unable to accommodate the maximum discharge of the proposed gray water irrigation system.

1504.4 Groundwater Level. No excavation for an irrigation field, disposal field, or mulch basin shall extend within 3 feet (914 mm) vertical of the highest known seasonal groundwater level, nor to a depth where gray water contaminates the groundwater or surface water. The applicant shall supply evidence of groundwater depth to the satisfaction of the Authority Having Jurisdiction.

### Table 1504.2

<table>
<thead>
<tr>
<th>TYPE OF SOIL</th>
<th>MINIMUM SQUARE FEET OF IRRIGATION AREA PER 100 GALLONS OF ESTIMATED GRAY WATER DISCHARGE PER DAY</th>
<th>MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FOOT OF IRRIGATION/LEACHING AREA FOR A 24-HOUR PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse sand or gravel</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Fine sand</td>
<td>25</td>
<td>4.0</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>40</td>
<td>2.5</td>
</tr>
<tr>
<td>Sandy clay</td>
<td>60</td>
<td>1.7</td>
</tr>
<tr>
<td>Clay with considerable sand or gravel</td>
<td>90</td>
<td>1.1</td>
</tr>
<tr>
<td>Clay with small amounts of sand or gravel</td>
<td>120</td>
<td>0.8</td>
</tr>
</tbody>
</table>

For SI units: 1 square foot = 0.0929 m², 1 gallon per day = 0.000043 L/s

1504.5 Subsurface and Subsoil Irrigation Field Design and Construction. Subsurface and subsoil irrigation field design and construction shall be in accordance with Section 1504.5.1 through Section 1504.7.3. Where a gray water irrigation system design is predicated on soil tests, the subsurface or subsoil irrigation field or mulch basin shall be installed at the same location and depth as the tested area.

1504.5.1 Subsurface Irrigation Field. A subsurface irrigation field shall comply with Section 1504.5.2 through Section 1504.5.7.

1504.5.2 Minimum Depth. Supply piping, including drip feeders, shall be not less than 2 inches (51 mm) below finished grade and covered with mulch or soil.

1504.5.3 Filter. Not less than 140 mesh (105 microns) filter with a capacity of 25 gallons per minute (gpm) (1.58 L/s), or equivalent shall be installed. Where a filter backwash is installed, the backwash and flush discharge shall discharge into the building sewer or private sewage disposal system. Filter backwash and flush water shall not be used.

1504.4.4 Emitter Size. Emitters shall be installed in accordance with the manufacturer’s installation instructions. Emitters shall have a flow path of not less than 1200 microns (µ) (1200 µm) and shall not have a coefficient of manufacturing variation (Cv) exceeding 7 percent. Irrigation system design shall be such that emitter flow variation shall not exceed 10 percent.

1504.5.5 Number of Emitters. The minimum number of emitters and the maximum discharge of each emitter in an irrigation field shall be in accordance with Table 1504.5.5.

1504.5.6 Controls. The system design shall provide user controls, such as valves, switches, timers, and other controllers, to rotate the distribution of gray water between irrigation zones.

1504.5.7 Maximum Pressure. Where pressure at the discharge side of the pump exceeds 20 pounds-force per square inch (psi) (138 kPa), a pressure-reducing valve able to maintain downstream pressure not exceeding 20 psi (138 kPa) shall be installed downstream from the pump and before an emission device.

### Table 1504.5.5

<table>
<thead>
<tr>
<th>TYPE OF SOIL</th>
<th>MAXIMUM EMMITTER DISCHARGE (gallons per day)</th>
<th>MINIMUM NUMBER OF EMITTERS PER GALLON OF ESTIMATED GRAY WATER DISCHARGE PER DAY* (gallons per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>1.8</td>
<td>0.6</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>1.4</td>
<td>0.7</td>
</tr>
<tr>
<td>Loam</td>
<td>1.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Clay loam</td>
<td>0.9</td>
<td>1.1</td>
</tr>
<tr>
<td>Silty clay</td>
<td>0.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Clay</td>
<td>0.5</td>
<td>2.0</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per day = 0.000043 L/s

* The estimated gray water discharge per day shall be determined in accordance with Section 1503.8 of this code.

1504.6 Mulch Basin Design and Construction. A mulch basin shall comply with Section 1504.6.1 through Section 1504.6.4.

1504.6.1 Single Family and Multi-Family Dwellings. The gray water discharge to a mulch basin is limited to single family and multi-family dwellings.

1504.6.2 Size. Mulch basins shall be of sufficient size to accommodate peak flow rates and distribute the total amount of estimated gray water on a daily basis without surfacing, ponding or runoff. Mulch basins shall have a depth of not less than 10 inches (254 mm) below finished grade. The mulch basin size shall be based on the maximum absorption capacity of the soil and determined using Table 1504.2.

1504.6.3 Minimum Depth. Gray water supply piping, including drip feeders, shall be not less than 2 inches (51 mm) below finished grade and covered with mulch.
1504.6.4 Maintenance. The mulch basin shall be maintained periodically to retain the required depth and area, and to replenish the required mulch cover.

1504.7 Subsoil Irrigation Field. Subsoil irrigation fields shall comply with Section 1504.7.1 through Section 1504.7.3.

1504.7.1 Minimum Pipe Size. Subsoil irrigation field distribution piping shall be not less than 3 inches (80 mm) diameter.

1504.7.2 Filter Material and Backfill. Filter material, clean stone, gravel, slag, or similar material acceptable to the Authority Having Jurisdiction, varying in size from ⁴⁄₉ of an inch (19.1 mm) to 2 ½ inches (64 mm) shall be placed in the trench to the depth and grade in accordance with Table 1504.7.3. The perforated section of subsoil irrigation field distribution piping shall be laid on the filter material in an approved manner. The perforated section shall then be covered with filter material to the minimum depth in accordance with Table 1504.7.3. The filter material shall then be covered with porous material to prevent the closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspection and acceptance.

1504.7.3 Subsoil Irrigation Field Construction. Subsoil irrigation fields shall be constructed in accordance with Table 1504.7.3. Where necessary on sloping ground to prevent excessive line slopes, irrigation lines shall be stepped. The lines between each horizontal leaching section shall be made with approved watertight joints and installed on the natural or unfilled ground.

<table>
<thead>
<tr>
<th>TABLE 1504.7.3</th>
<th>SUBSOIL IRRIGATION FIELD CONSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESCRIPTION</td>
<td>MINIMUM</td>
</tr>
<tr>
<td>Number of drain lines per valved zone</td>
<td>1</td>
</tr>
<tr>
<td>Length of each perforated line</td>
<td>–</td>
</tr>
<tr>
<td>Bottom width of trench</td>
<td>12 inches</td>
</tr>
<tr>
<td>Spacing of lines, center to center</td>
<td>4 feet</td>
</tr>
<tr>
<td>Depth of earth covers of lines</td>
<td>10 inches</td>
</tr>
<tr>
<td>Depth of filter material cover of lines</td>
<td>2 inches</td>
</tr>
<tr>
<td>Depth of filter material beneath lines</td>
<td>3 inches</td>
</tr>
<tr>
<td>Grade of perforated lines level</td>
<td>level</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m

1504.8 Gray Water System Color and Marking Information. Pressurized gray water distribution systems shall be identified as containing nonpotable water in accordance with Section 601.3 of this code.

1504.9 Other Collection and Distribution Systems. Other collection and distribution systems shall be approved by the local Authority Having Jurisdiction, as allowed by Section 301.3 of this code.

1504.9.1 Higher Requirements. Nothing contained in this chapter shall be construed to prevent the Authority Having Jurisdiction from requiring compliance with higher requirements than those contained herein, where such higher requirements are essential to maintaining a safe and sanitary condition.

1504.10 Testing. Building drains and vents for gray water systems shall be tested in accordance with this code. Surge tanks shall be filled with water to the overflow line prior to and during the inspection. Seams and joints shall be left exposed, and the tank shall remain watertight. A flow test shall be performed through the system to the point of gray water discharge. Lines and components shall be watertight up to the point of the irrigation perforated and drip lines.

1504.11 Maintenance. Gray water systems and components shall be maintained in accordance with Table 1501.5.

1505.0 Reclaimed (Recycled) Water Systems.

1505.1 General. The provisions of this section shall apply to the installation, construction, alteration, and repair of reclaimed (recycled) water systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, aboveground and subsurface irrigation, industrial or commercial cooling or air conditioning and other uses approved by the Authority Having Jurisdiction.

1505.2 Permit. It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered a reclaimed (recycled) water system within a building or on premises without first obtaining a permit to do such work from the Authority Having Jurisdiction.

1505.2.1 Plumbing Plan Submission. No permit for a reclaimed (recycled) water system shall be issued until complete plumbing plans, with data satisfactory to the Authority Having Jurisdiction, have been submitted and approved.

1505.3 System Changes. No changes or connections shall be made to either the reclaimed (recycled) water system or the potable water system within site containing a reclaimed (recycled) water system without approval by the Authority Having Jurisdiction.

1505.4 Connections to Potable or Reclaimed (Recycled) Water Systems. Reclaimed (recycled) water systems shall have no connection to a potable water supply or alternate water source system. Potable water is permitted to be used as makeup water for a reclaimed (recycled) water storage tank provided the water supply inlet is protected by an air gap or reduced-pressure principle backflow preventer in accordance with this code.

1505.5 Water Pressure. Reclaimed (recycled) water systems supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than 15 pounds-force per square inch (psi) (103 kPa) residual pressure at the highest and most remote outlet served. Where the water pressure in the reclaimed water supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve reducing the pressure to 80 psi (552 kPa) or less to water outlets in the building shall be installed.
1505.5-1505.6 Initial Cross-Connection Test. A cross-connection test is required in accordance with Section 1502.3. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

1505.6-1505.7 Reclaimed (Recycled) Water System Materials. Reclaimed (recycled) water supply and distribution system materials shall comply with the requirements of this code for potable water supply and distribution systems unless otherwise provided for in this section.

1505.7-1505.8 Reclaimed (Recycled) Water System Color and Marking Information. Reclaimed (recycled) water systems shall have a colored background and marking information in accordance with Section 601.3 of this code.

1505.8-1505.9 Valves. Valves, except fixture supply control valves, shall be equipped with a locking feature.

1505.9-1505.10 Hose Bibbs. Hose bibbs shall not be allowed on reclaimed (recycled) water piping systems located in areas accessible to the public. Access to reclaimed (recycled) water at points in the system accessible to the public shall be through a quick-disconnect device that differs from those installed on the potable water system. Hose bibbs supplying reclaimed (recycled) water shall be marked with the words: “CAUTION: NONPOTABLE RECLAIMED WATER, DO NOT DRINK.” and the symbol in Figure 1505.9-1505.10.

1506.0 On-Site Treated Nonpotable Water Systems.

1506.1 General. The provisions of this section shall apply to the installation, construction, alteration, and repair of on-site treated nonpotable water systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, above and belowground irrigation, and other uses approved by the Authority Having Jurisdiction.

1506.2 Plumbing Plan Submission. No permit for an on-site treated nonpotable water system shall be issued until complete plumbing plans, with data satisfactory to the Authority Having Jurisdiction, have been submitted and approved.

1506.3 System Changes. No changes or connections shall be made to either the on-site treated nonpotable water system or the potable water system within a site containing an on-site treated nonpotable water system without approval by the Authority Having Jurisdiction.

1506.4 Connections to Potable or Reclaimed (Recycled) Water Systems. On-site treated nonpotable water systems shall have no connection to a potable water supply or reclaimed (recycled) water source system. Potable or reclaimed (recycled) water is permitted to be used as makeup water for a non-pressurized storage tank provided the makeup water supply is protected by an air gap in accordance with this code.

1506.5 Water Pressure. On-site treated non-potable water systems supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than 15 pounds-force per square inch (psi) (103 kPa) residual pressure at the highest and most remote outlet served. Where the water pressure in the on-site treated non-potable water supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve reducing the pressure to 80 psi (552 kPa) or less to water outlets in the building shall be installed.

1506.6 Initial Cross-Connection Test. A cross-connection test is required in accordance with Section 1502.3. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.
1506.6-1506.7 On-Site Treated Nonpotable Water System Materials. On-site treated nonpotable water supply, and distribution system materials shall comply with the requirements of this code for potable water supply and distribution systems unless otherwise provided for in this section.

1506.7-1506.8 On-Site Treated Nonpotable Water Devices and Systems. Devices or equipment used to treat on-site treated nonpotable water to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed and labeled (third-party certified) by a listing agency (accredited conformity assessment body) or approved for the intended application. Devices or equipment used to treat on-site treated nonpotable water for use in the water closet and urinal flushing, surface irrigation, and similar applications shall comply with IAPMO IGC 324, NSF/ANSI 350 or approved by the Authority Having Jurisdiction.

1506.8-1506.9 On-Site Treated Nonpotable Water System Color and Marking Information. On-site treated water systems shall have a colored background and marking information in accordance with Section 601.3 of this code.

1506.9-1506.10 Design and Installation. The design and installation of on-site treated nonpotable systems shall be in accordance with Section 1506.9.1-1506.10.1 through Section 1506.9.5-1506.10.5.

1506.9.1-1506.10.1 Listing Terms and Installation Instructions. On-site treated nonpotable water systems shall be installed in accordance with the terms of its listing and the manufacturer’s installation instructions.

1506.9.2-1506.10.2 Minimum Water Quality. On-site treated nonpotable water supplied to toilets or urinals or for other uses in which it is sprayed or exposed shall be disinfected. Acceptable disinfection methods shall include chlorination, ultraviolet sterilization, ozone, or other methods as approved by the Authority Having Jurisdiction. The minimum water quality for on-site treated nonpotable water systems shall meet the applicable water quality requirements for the intended applications as determined by the public health Authority Having Jurisdiction.

1506.9.3-1506.10.3 Deactivation and Drainage. The on-site treated nonpotable water system and the potable water system within the building shall be provided with the required appurtenances (e.g., valves, air/vacuum relief valves, etc.) to allow for deactivation or drainage as required for a cross-connection test in accordance with Section 1502.3.

1506.9.4-1506.10.4 Near Underground Potable Water Pipe. On-site treated nonpotable water pipes shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where piping materials do not meet this requirement the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the on-site treated nonpotable water piping.

1506.9.5-1506.10.5 Required Filters. A filter permitting the passage of particulates no larger than 100 microns (100 µm) shall be provided for on-site treated nonpotable water supplied to water closets, urinals, trap primers, and drip irrigation system.

1506.10-1506.11 Valves. Valves, except fixture supply control valves, shall be equipped with a locking feature.

1506.11-1506.12 Signs. Signs in buildings using on-site treated nonpotable water shall comply with Section 1501.9 and Section 1501.9.1.

1506.12-1506.13 Inspection and Testing. On-site treated nonpotable water systems shall be inspected and tested in accordance with Section 1502.1.
CHAPTER 16
NONPOTABLE RAINWATER CATCHMENT SYSTEMS

1601.0 General.

1601.1 Applicability. The provisions of this chapter shall apply to the installation, construction, alteration, and repair of nonpotable rainwater catchment systems.

1601.1.1 Allowable Use of Alternate Water. Where approved or required by the Authority Having Jurisdiction, rainwater shall be permitted to be used instead of potable water for the applications identified in this chapter.

1601.2 System Design. Rainwater catchment systems shall be designed in accordance with this chapter by a licensed plumbing contractor or registered design professional. Components, piping, and fittings used in a rainwater catchment system shall be listed.

Exceptions:

(1) A person registered or licensed to perform plumbing design work is not required to design rainwater catchment systems used for irrigation with a maximum storage capacity of 360 gallons (1363 L).

(2) A person registered or licensed to perform plumbing design work is not required to design rainwater catchment systems for single family dwellings where outlets, piping, and system components are located on the exterior of the building.

1601.3 Permit. It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered a rainwater catchment system in a building or on a premise without first obtaining a permit to do such work from the Authority Having Jurisdiction.

Exceptions:

(1) A permit is not required for exterior rainwater catchment systems used for outdoor drip and subsurface irrigation with a maximum storage capacity of 360 gallons (1363 L).

(2) A plumbing permit is not required for rainwater catchment systems for single family dwellings where outlets, piping, and system components are located on the exterior of the building. This does not exempt the need for permits where required for electrical connections, tank supports, or enclosures.

1601.4 Component Identification. System components shall be properly identified as to the manufacturer.

1601.5 Maintenance and Inspection. Rainwater catchment systems and components shall be inspected and maintained in accordance with Section 1601.5.1 through Section 1601.5.3.

1601.5.1 Frequency. Rainwater catchment systems and components shall be inspected and maintained in accordance with Table 1601.5 unless more frequent inspection and maintenance are required by the manufacturer.

| TABLE 1601.5 MINIMUM ALTERNATE WATER SOURCE TESTING, INSPECTION, AND MAINTENANCE FREQUENCY |
|---|---|
| DESCRIPTION | MINIMUM FREQUENCY |
| Inspect and clean filters and screens, and replace (where necessary). | Every 3 months |
| Inspect and verify that disinfection, filters, and water quality treatment devices and systems are operational and maintaining minimum water quality requirements as determined by the Authority Having Jurisdiction. | In accordance with manufacturer’s instructions and the Authority Having Jurisdiction. |
| Inspect and clear debris from rainwater gutters, downspouts, and roof washers. | Every 6 months |
| Inspect and clear debris from the roof of another aboveground rainwater collection surfaces. | Every 6 months |
| Remove tree branches and vegetation overhanging a roof or other aboveground rainwater collection surfaces. | As needed |
| Inspect pumps and verify operation. | After initial installation and every 12 months thereafter |
| Inspect valves and verify operation. | After initial installation and every 12 months thereafter |
| Inspect pressure tanks and verify operation. | After initial installation and every 12 months thereafter |
| Clear debris from and inspect storage tanks, locking devices, and verify operation. | After initial installation and every 12 months thereafter |
| Inspect caution labels and marking. | After initial installation and every 12 months thereafter |
| Cross-connection inspection and test.* | After initial installation and every 12 months thereafter |
| Test water quality of rainwater catchment systems required by Section 4603.5-1601.3 to maintain a minimum water quality. | Every 12 months. After system renovation or repair. |

* The cross-connection test shall be performed in the presence of the Authority Having Jurisdiction in accordance with the requirements of this chapter.

1601.5.2 Maintenance Log. A maintenance log for rainwater catchment systems is required to have a permit in accordance with Section 1601.3 and shall be maintained by the property owner and be available for inspection. The property owner or designated appointee shall ensure that a record of testing, inspection, and main-
tenance in accordance with Table 1601.5 is maintained in the log. The log will indicate the frequency of inspection and maintenance for each system.

1601.5.3 Maintenance Responsibility. The required maintenance and inspection of rainwater catchment systems shall be the responsibility of the property owner unless otherwise required by the Authority Having Jurisdiction.

1601.6 Operation and Maintenance Manual. An operation and maintenance manual for rainwater catchment systems required to have a permit in accordance with Section 1601.3, shall be supplied to the building owner by the system designer. The operating and maintenance manual shall include the following:

1. Detailed diagram of the entire system and the location of system components.
2. Instructions for operating and maintaining the system.
3. Details on maintaining the required water quality as determined by the Authority Having Jurisdiction.
4. Details on deactivating the system for maintenance, repair, or other purposes.
5. Applicable testing, inspection, and maintenance frequencies in accordance with Table 1601.5.
6. A method of contacting the manufacturer(s).

1601.7 Minimum Water Quality Requirements. The minimum water quality for rainwater catchment systems shall comply with the applicable water quality requirements for the intended application as determined by the Authority Having Jurisdiction. Water quality for nonpotable rainwater catchment systems shall comply with Section 1603.5.1603.4.

Exceptions:

1. Water treatment is not required for rainwater catchment systems used for aboveground irrigation with a maximum storage capacity of 360 gallons (1363 L).
2. Water treatment is not required for rainwater catchment systems used for subsurface or drip irrigation.

1601.8 Material Compatibility. Rainwater catchment systems shall be constructed of materials that are compatible with the type of pipe and fitting materials, water treatment, and water conditions in the system.

1601.9 System Controls. Controls for pumps, valves, and other devices that contain mercury that come in contact with water shall comply with Section 1603.5.1603.4.

1601.10 Separation Requirements. Underground rainwater catchment service piping shall be separated from the building sewer in accordance with Section 609.2. Treated nonpotable water pipes shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) vertical minimum and horizontal separation where both pipe materials are approved for use within a building. Where horizontal piping materials do not meet this requirement, the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the treated nonpotable water piping.

1601.11 Abandonment. Rainwater catchment systems that are no longer in use, or fail to be maintained in accordance with Section 1601.5, shall be abandoned. Abandonment shall comply with Section 1601.11.1 and Section 1601.11.2.

1601.11.1 General. An abandoned system or part thereof covered under the scope of this chapter shall be disconnected from remaining systems, drained, plugged, and capped in an approved manner.

1601.11.2 Underground Tank. An underground water storage tank that has been abandoned or otherwise discontinued from use in a system covered under the scope of this chapter 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.

1601.12 Sizing. Unless otherwise provided for in this chapter, rainwater catchment piping shall be sized in accordance with Chapter 6 for sizing potable water piping.

1602.0 Nonpotable Rainwater Catchment Systems.

1602.1 General. The installation, construction, alteration, and repair of rainwater catchments systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, irrigation, industrial processes, water features, cooling tower makeup and other uses shall be approved by the Authority Having Jurisdiction. Rainwater catchment systems for collecting precipitation from rooftops shall comply with ARCSA/ASPE 63.

1602.2 Plumbing Plan Submission. No permit for a rainwater catchment system shall be issued until complete plumbing plans, with data satisfactory to the Authority Having Jurisdiction, have been submitted and approved.

1602.3 System Changes. No changes or connections shall be made to either the rainwater catchment system or the potable water system within a site containing a rainwater catchment system requiring a permit without approval by the Authority Having Jurisdiction.

1602.4 Connections to Potable or Reclaimed (Recycled) Water Systems. Rainwater catchment systems shall have no direct connection to a potable water supply or alternate water source system. Potable or reclaimed (recycled) water is permitted to be used as makeup water for a rainwater catchment system provided the potable or reclaimed (recycled) water supply connection is protected by an air gap or reduced-pressure principle backflow preventer in accordance with this code.

1602.5 Initial Cross-Connection Test. Where a portion of a rainwater catchment system is installed within a building, a cross-connection test is required in accordance with Section 1605.3. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction. The test shall be ruled successful by the Authority Having Jurisdiction before final approval is granted.

1602.6 Sizing. The design and size of rainwater drains, gutters, conductors, and leaders shall comply with Chapter 11 of this code.
1602.7 Rainwater Catchment System Materials. Rainwater catchment system materials shall comply with Section 1602.7.1 through Section 1602.7.4.

1602.7.1 Water Supply and Distribution Materials. Rainwater catchment water supply and distribution materials shall comply with the requirements of this code for potable water supply and distribution systems unless otherwise provided for in this section.

1602.7.2 Rainwater Catchment System Drainage Materials. Materials used in rainwater catchment drainage systems, including gutters, downspouts, conductors, and leaders shall be in accordance with the requirements of this code for storm drainage.

1602.7.3 Storage Tanks. Rainwater storage tanks shall comply with Section 1603.6 through Section 1603.5.

1602.7.4 Collections Surfaces. The collection surface shall be constructed of a hard, impervious material.

1602.8 Rainwater Catchment System Color and Marking Information. Rainwater catchment systems shall have a colored background in accordance with Section 601.3. Rainwater catchment systems shall be marked, in lettering in accordance with Section 601.3.3, with the words: “CAUTION: NONPOTABLE RAINWATER, DO NOT DRINK.”

1602.9 Deactivation and Drainage for Cross-Connection Test. The rainwater catchment system and the potable water system within the building shall be provided with the required appurtenances (e.g., valves, air or vacuum relief valves, etc.) to allow for deactivation or drainage as required for a cross-connection test in accordance with Section 1603.3.

1603.0 Design and Installation.

1603.1 Rainwater Catchment Systems. The design and installation of nonpotable rainwater catchment systems shall be in accordance with Section 1603.2 through Section 1603.7 through Section 1603.3.

1603.2 Outside Hose Bibbs. Outside hose bibbs shall be allowed on rainwater piping systems. Hose bibbs supplying rainwater shall be marked with the words: “CAUTION: NONPOTABLE RAINWATER, DO NOT DRINK” and in accordance with Figure 1603.2.

1603.3 Construction. Rainwater storage tanks shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight.

1603.4 Rainwater Catchment Collection Surfaces. Rainwater shall be collected from roof surfaces or other manmade, aboveground collection surfaces.

1603.4.1.1603.3.1 Other Surfaces. Natural precipitation collected from surface water runoff, vehicular parking surfaces, or manmade surfaces at or below grade shall be in accordance with the stormwater requirements for on-site treated nonpotable water systems in Section 1056.0.

1603.4.2.1603.3.2 Prohibited Discharges. Overflows and bleed-off pipes from roof-mounted equipment and appliances shall not discharge onto roof surfaces that are intended to collect rainwater without prior approval from the Authority Having Jurisdiction.

1603.5.1603.4 Minimum Water Quality. The minimum water quality for harvested rainwater shall meet the applicable water quality requirements for the intended applications as determined by the Authority Having Jurisdiction. In the absence of water quality requirements determined by the Authority Having Jurisdiction, the minimum treatment and water quality shall be in accordance with Table 1603.5.

1603.5.1 Treatment. If the quality of the treated water cannot consistently be maintained at the minimum levels specified in Table 1603.5, then the system shall be equipped with an appropriate treatment device meeting applicable NSF standards referenced in Chapter 17.

1603.6.1603.5 Rainwater Storage Tanks. Rainwater storage tanks shall be constructed-comply with IAPMO Z1002 and be installed in accordance with Section 1603.3.1 and Section 1603.7 through Section 1603.12.

1603.7.1603.6 Location. Rainwater storage tanks shall be permitted to be installed above or below grade.

1603.8.1603.7 Above Grade. Above grade, storage tanks shall be of an opaque material, approved for aboveground use in direct sunlight or shall be shielded from direct sunlight. Tanks shall be installed in an accessible location to allow for inspection and cleaning. The tank shall be installed on a foundation or platform that is constructed to accommodate loads in accordance with the building code.

1603.8.1603.8 Below Grade. Rainwater storage tanks installed below grade shall be structurally designed to withstand anticipated earth or other loads. Holding tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²) (1465 kg/m²) where the tank is designed for underground installation. Below grade rainwater tanks installed underground shall be provided with manholes. The manhole opening shall be not less than 20 inches (508 mm) in diameter and located not less than 4

FIGURE 1603.2

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inches (102 mm) above the surrounding grade. The surrounding grade shall be sloped away from the manhole. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground where empty. The combined weight of the tank and hold down system shall meet or exceed the buoyancy force of the tank.

### TABLE 1603.4

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<td>Car washing</td>
<td>Debris excluder or other approved means in accordance with Section 1603.18-1603.17 and 100 microns in accordance with Section 1603.19-1603.18 for drip irrigation.</td>
<td>N/A</td>
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<tr>
<td>Spray irrigation where the maximum storage volume is less than 360 gallons</td>
<td>Debris excluder or other approved means in accordance with Section 1603.18-1603.17, and disinfection in accordance with Section 1603.16-1603.15.</td>
<td>N/A</td>
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<tr>
<td>Spray irrigation where the maximum storage volume is equal to or more than 360 gallons</td>
<td>Debris excluder or other approved means in accordance with Section 1603.18-1603.17, and 100 microns in accordance with Section 1603.19-1603.18.</td>
<td>N/A</td>
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<tr>
<td>Urinal and water closet flushing, clothes washing, and trap priming</td>
<td>Debris excluder or other approved means in accordance with Section 1603.18-1603.17, and 100 microns in accordance with Section 1603.19-1603.18.</td>
<td>Escherichia coli: &lt; 10 CFU/100 mL, and Turbidity: &lt; 10 NTU</td>
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<tr>
<td>Ornamental fountains and other water features</td>
<td>Debris excluder or other approved means in accordance with Section 1603.18-1603.17, and 100 microns in accordance with Section 1603.19-1603.18.</td>
<td>Escherichia coli: &lt; 10 CFU/100 mL, and Turbidity: &lt; 10 NTU</td>
</tr>
<tr>
<td>Cooling tower make-up water</td>
<td>Debris excluder or other approved means in accordance with Section 1603.18-1603.17, and 100 microns in accordance with Section 1603.19-1603.18.</td>
<td>Escherichia coli: &lt; 10 CFU/100 mL, and Turbidity: &lt; 10 NTU</td>
</tr>
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</table>

For SI units: 1 micron = 1 µm, 1 gallon = 3.785 L

### 1603.9 Drainage and Overflow

Rainwater storage tanks shall be provided with a means of draining and cleaning. The overflow drain shall not be equipped with a shutoff valve. The overflow outlet shall discharge in accordance with this code for storm drainage systems. Where discharging to the storm drainage system, the overflow drain shall be protected from backflow of the storm drainage system by a backwater valve or other approved method.

#### 1603.10 Overflow Outlet Size

The overflow outlet shall be sized to accommodate the flow of the rainwater entering the tank and not less than the aggregate cross-sectional area of inflow pipes.

#### 1603.11 Opening and Access Protection

Rainwater tank openings shall be protected to prevent the entrance of insects, birds, or rodents into the tank.

Rainwater tank access openings exceeding 12 inches (305 mm) in diameter shall be secured to prevent tampering and unintended entry by either a lockable device or other approved method.

#### 1603.12 Marking

Rainwater tanks shall be permanently marked with the capacity and the language: “NONPOTABLE RAINWATER.” Where openings are provided to allow a person to enter the tank, the opening shall be marked with the following language: “DANGER-CONFINED SPACE.”

#### 1603.13 Storage Tank Venting

Where venting using drainage or overflow piping is not provided or is considered insufficient, a vent shall be installed on each tank. The vent shall be directed downward and covered with a ¾ inch (2.4 mm) mesh screen to prevent the entry of vermin and insects.

#### 1603.14 Pumps

Pumps supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than 15 pounds-force per square inch (psi) (103 kPa) residual pressure at the highest and most remote outlet served. Where the water pressure in the rainwater supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve reducing the pressure to 80 psi (552 kPa) or less to water outlets in the building shall be installed in accordance with this code.

#### 1603.15 Roof Drains

Primary and secondary roof drains, conductors, leaders, and gutters shall be designed and installed in accordance with this code.

#### 1603.16 Water Quality Devices and Equipment

Devices and equipment used to treat rainwater to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) and approved for the intended application.

#### 1603.17 Freeze Protection

Tanks and piping installed in locations subject to freezing shall be provided with an approved means of freeze protection.
1603.18-1603.17 Debris Removal. The rainwater catchment conveyance system shall be equipped with a debris excluder or other approved means to prevent the accumulation of leaves, needles, other debris and sediment from entering the storage tank. Devices or methods used to remove debris or sediment shall be accessible and sized and installed in accordance with manufacturer’s installation instructions.

1603.19-1603.18 Required Filters. A filter permitting the passage of particulates not larger than 100 microns (100 µm) shall be provided for rainwater supplied to water closets, urinals, trap primers, and drip irrigation system.

1603.20-1603.19 Roof Gutters. Gutters shall maintain a minimum slope and be sized in accordance with Section 1103.3.

1503.2-4-1603.20 Rainwater Diversion Valves. Rainwater diversion valves ranging from 2 inches (50 mm) through 4 inches (100 mm) in diameter shall comply with IAPMO PS 59. Rainwater diversion valves ranging from 6 inches (150 mm) to 12 inches (300 mm) in diameter shall comply with IAPMO IGC 352. Valves shall be accessible and include a filter located upstream of the valve when required.

1604.0 Signs.

1604.1 General. Signs in buildings using rainwater shall be in accordance with Section 1604.2 and Section 1604.3.

1604.2 Commercial, Industrial, and Institutional Restroom Signs. A sign shall be installed in restrooms in commercial, industrial, and institutional occupancies using nonpotable rainwater for water closets, urinals, or both. Each sign shall contain ½ of an inch (12.7 mm) letters of a highly visible color on a contrasting background. The location of the sign(s) shall be such that the sign(s) shall be visible to users. The number and location of the signs shall be approved by the Authority Having Jurisdiction and shall contain the following text:

TO CONSERVE WATER, THIS BUILDING USES RAINWATER TO FLUSH TOILETS AND URINALS.

1604.3 Equipment Room Signs. Each equipment room containing nonpotable rainwater equipment shall have a sign posted with the following wording in 1 inch (25.4 mm) letters:

CAUTION NONPOTABLE RAINWATER, DO NOT DRINK. DO NOT CONNECT TO DRINKING WATER SYSTEM. NOTICE: CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM.

This sign shall be posted in a location that is visible to anyone working on or near rainwater equipment.

1605.0 Inspection and Testing.

1605.1 General. Rainwater catchment systems shall be inspected and tested in accordance with Section 1605.2 and Section 1605.3.

1605.2 Supply System Inspection and Test. Rainwater catchment systems shall be inspected and tested in accordance with the applicable provisions of this code for testing of potable water and storm drainage systems. Storage tanks shall be filled with water to the overflow opening for a period of 24 hours, and during the inspection, or by other means as approved by the Authority Having Jurisdiction. Seams and joints shall be exposed during the inspection and checked for watertightness.

1605.3 Annual Cross-Connection Inspection and Testing. An initial and subsequent annual inspection and test in accordance with Section 1602.5 shall be performed on both the potable and rainwater catchment water systems. The potable and rainwater catchment water systems shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection in accordance with Section 1605.3.1 through Section 1605.3.4.

1605.3.1 Visual System Inspection. Prior to commencing the cross-connection testing, a dual system inspection shall be conducted by the Authority Having Jurisdiction and other authorities having jurisdiction as follows:

1. Pumps, equipment, equipment room signs, and exposed piping in an equipment room shall be checked.

1605.3.2 Cross-Connection Test. The procedure for determining cross-connection shall be followed by the applicant in the presence of the Authority Having Jurisdiction and other authorities having jurisdiction to determine whether a cross-connection has occurred as follows:

1. The potable water system shall be activated and pressurized. The rainwater catchment water system shall be shut down and completely drained.

2. The potable water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the rainwater catchment water system is empty. The minimum period the rainwater catchment water system is to remain depressurized shall be determined on a case-by-case basis, taking into account the size and complexity of the potable and rainwater catchment water distribution systems, but in no case shall that period be less than 1 hour.

3. Fixtures, potable, and rainwater shall be tested and inspected for flow. Flow from a rainwater catchment water system outlet shall indicate a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the rainwater system.

4. The drain on the rainwater catchment water system shall be checked for flow during the test and at the end of the period.

5. The potable water system shall then be completely drained.

6. The rainwater catchment water system shall then be activated and pressurized.

7. The rainwater catchment water system shall remain pressurized for a minimum period of time specified by the Authority Having Jurisdiction while the
The potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than 1 hour.

(8) Fixtures, potable and rainwater catchment, shall be tested and inspected for flow. Flow from a potable water system outlet shall indicate a cross-connection. No flow from a rainwater catchment water outlet shall indicate that it is connected to the potable water system.

(9) The drain on the potable water system shall be checked for flow during the test and at the end of the period.

(10) Where there is no flow detected in the fixtures which would indicate a cross-connection, the potable water system shall be repressurized.

1605.3.3 Discovery of Cross-Connection. In the event that a cross-connection is discovered, the following procedure, in the presence of the Authority Having Jurisdiction, shall be activated immediately:

1. Rainwater catchment piping to the building shall be shutdown at the meter, and the rainwater riser shall be drained.

2. Potable water piping to the building shall be shutdown at the meter.

3. The cross-connection shall be uncovered and disconnected.

4. The building shall be retested following procedures listed in Section 1605.3.1 and Section 1605.3.2.

5. The potable water system shall be chlorinated with 50 ppm chlorine for 24 hours.

6. The potable water system shall be flushed after 24 hours, and a standard bacteriological test shall be performed. Where test results are acceptable, the potable water system shall be permitted to be recharged.

1605.3.4 Annual Inspection. An annual inspection of the rainwater catchment water system, following the procedures listed in Section 1605.3.1 shall be required. Annual cross-connection testing, following the procedures listed in Section 1605.3.2 shall be required by the Authority Having Jurisdiction, unless site conditions do not require it. In no event shall the test occur less than once in 4 years.

Alternate testing requirements shall be permitted by the Authority Having Jurisdiction.
CHAPTER 17
REFERENCED STANDARDS

1701.0 General.

1701.1 Standards. The standards listed in Table 1701.1 are referenced in various sections of this code and shall be considered part of the requirements of this document. The standards are listed herein by the standard number and effective date, the title, application and the section(s) of this code that references the standard. The application of the referenced standard(s) shall be as specified in Section 301.2.2. The promulgating agency acronyms referred to in Table 1701.1 are defined in a list found at the end of the tables.

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1701.2 Standards, Publications, Practices, and Guides. The standards, publications, practices, and guides listed in Table 1701.2 are not referenced in other sections of this code. The application of the referenced standards, publications, practices, and guides shall be as specified in Section 301.2.2. The promulgating agency acronyms are found at the end of the tables.

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CSA B55.2-2015 (R2019) | Drain Water Heat Recovery Units | Miscellaneous |
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<td>TCNA A118.10-2014</td>
<td>Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation</td>
<td>Miscellaneous</td>
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<tr>
<td><strong>UL</strong></td>
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<td>UL 70-2001</td>
<td>Septic Tanks, Bituminous-Coated Metal</td>
<td>DWV Components</td>
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<td>Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids (with revisions through January 16, 2014-April 26, 2019)</td>
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</tr>
<tr>
<td>UL 144-2012</td>
<td>LP-Gas Regulators (with revisions through November 5, 2011-December 10, 2019)</td>
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</tr>
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<td>UL 252-2017</td>
<td>Compressed Gas Regulators (with revisions through August 10, 2018)</td>
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<td>UL 296-2017</td>
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<td>Fuel Gas, Appliances</td>
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<tr>
<td>UL 404-2010</td>
<td>Gauges, Indicating Pressure, for Compressed Gas Service (with revisions through February 11, 2015)</td>
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<tr>
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<td>Electrically Operated Valves (with revisions through January 16, 2020)</td>
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<td>UL 536-2014</td>
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<td>UL 563-2009</td>
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<td>UL 726-1995</td>
<td>Oil-Fired Boiler Assemblies (with revisions through October 9, 2013)</td>
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<td>UL 1331-2005</td>
<td>Station Inlets and Outlets (with revisions through May 12, 2017, February 5, 2020)</td>
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<td>UL 1795-2016</td>
<td>Hydromassage Bathtubs (with revisions through December 8, 2017)</td>
<td>Fixtures</td>
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<td>UL 2157-2018</td>
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<td>WQA S-300-2000</td>
<td>Point-of-Use Low-Pressure Reverse Osmosis Drinking Water Systems</td>
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**ABBREVIATIONS IN TABLE 1701.1 AND TABLE 1701.2**

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<th>Abbreviation</th>
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<tr>
<td>ANSI</td>
<td>American National Standards Institute, Inc., 25 W. 43rd Street, 4th Floor, New York, NY 10036.</td>
</tr>
<tr>
<td>ARCSA</td>
<td>American Rainwater Catchment Systems Association, 6101 Long Prairie Road, Suite 744, PMB 251, Flower Mound, TX 75028.</td>
</tr>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400.</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc., 1791 Tullie Circle, NE, Atlanta, GA 30329-2305.</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineering, Two Park Avenue, New York, NY 10016-5990.</td>
</tr>
<tr>
<td>ASPE</td>
<td>American Society of Plumbing Engineers, 6400 Shafer Court, Suite 350, Rosemont, IL 60018.</td>
</tr>
<tr>
<td>ASSP</td>
<td>American Society of Safety Professionals, 520 N. Northwest Highway, Park Ridge, IL 60068.</td>
</tr>
<tr>
<td>ASTM</td>
<td>ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.</td>
</tr>
<tr>
<td>AWS</td>
<td>American Welding Society, 8669 NW 36 Street, #130 Miami, FL 33166-6672.</td>
</tr>
<tr>
<td>AWWA</td>
<td>American Water Works Association, 6666 W. Quincy Avenue, Denver, CO 80235.</td>
</tr>
<tr>
<td>CGA</td>
<td>Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151.</td>
</tr>
<tr>
<td>CISPI</td>
<td>Cast-Iron Soil Pipe Institute, 2401 Fielderest Drive, Mundelein, IL 60060.</td>
</tr>
<tr>
<td>CSA</td>
<td>Canadian Standards Association, 178 Rexdale Boulevard, Toronto, Ontario, Canada, M9W 1R3.</td>
</tr>
<tr>
<td>e1</td>
<td>An editorial change since the last revision or reapproval.</td>
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<tr>
<td>ENERGY STAR</td>
<td>1200 Pennsylvania Avenue, N.W., Washington, D.C. 20460.</td>
</tr>
<tr>
<td>EPA</td>
<td></td>
</tr>
<tr>
<td>WATERSENSE</td>
<td>U.S. Environmental Protection Agency, Office of Wastewater Management (4204M), 1200 Pennsylvania Avenue, N.W., Washington, D.C. 20460.</td>
</tr>
<tr>
<td>IAPMO</td>
<td>International Association of Plumbing and Mechanical Officials, 4755 E. Philadelphia Street, Ontario, CA 91761.</td>
</tr>
<tr>
<td>ICC</td>
<td>International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001.</td>
</tr>
<tr>
<td>ISEA</td>
<td>International Safety Equipment Association, 1901 N. Moore Street, Suite 808, Arlington, VA 22209-1762.</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization, 1 ch. de la Voie-Creuse, Casa Postale 56, CH-1211 Geneva 20, Switzerland.</td>
</tr>
<tr>
<td>MSS</td>
<td>Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, NE, Vienna, VA 22180.</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.</td>
</tr>
<tr>
<td>NSF</td>
<td>NSF International, 789 N. Dixboro Road, Ann Arbor, MI 48105.</td>
</tr>
<tr>
<td>PDI</td>
<td>Plumbing and Drainage Institute, 800 Turnpike Street, Suite 300, North Andover, MA 01845.</td>
</tr>
<tr>
<td>PSAI</td>
<td>Portable Sanitation Association International, 2626 E. 82nd Street, Suite 175, Bloomington, MN 55425.</td>
</tr>
<tr>
<td>SAE</td>
<td>Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062.</td>
</tr>
<tr>
<td>WQA</td>
<td>Water Quality Association, 4151 Naperville Road, Lisle, IL 60532-3696.</td>
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APPENDICES

The appendices are intended to supplement the provisions of the installation requirements of this code. The definitions in Chapter 2 are also applicable to the appendices.

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APPENDIX A
RECOMMENDED RULES FOR SIZING THE WATER SUPPLY SYSTEM

A 101.0 General.
A 101.1 Applicability. This appendix provides a general procedure for sizing a water supply system. Because of the variable conditions encountered, it is impractical to lay down definite detailed rules of procedure for determining the sizes of water supply pipes in an appendix, which shall necessarily be limited in length. For an adequate understanding of the problems involved, refer to Water-Distributing Systems for Buildings, Report BMS 79 of the National Bureau of Standards; and Plumbing Manual, Report BMS 66, also published by the National Bureau of Standards.

A 102.0 Preliminary Information.
A 102.1 Daily Service Pressure. Obtain the necessary information regarding the minimum daily service pressure in the area where the building is to be located.
A 102.2 Water Meter. Where the building supply is to be metered, obtain information regarding friction loss relative to the rate of flow of meters in the range of sizes likely to be used. Friction-loss data is capable of being obtained from most manufacturers of water meters. Friction losses for disk-type meters shall be permitted to be obtained from Chart A 102.2.
A 102.3 Local Information. Obtain available local information regarding the use of different kinds of pipe with respect both to durability and to decrease in capacity with the length of service in the particular water supply.

A 103.0 Demand Load.
A 103.1 Supply Demand. Estimate the supply demand for the building main, the principal branches and risers of the system by totaling the fixture units on each, Table A 103.1, and then by reading the corresponding ordinate from Chart A 103.1(1) or Chart A 103.1(2), whichever is applicable.
A 103.2 Continuous Supply Demand. Estimate continuous supply demands in gallons per minute (gpm) (L/s) for lawn sprinklers, air conditioners, etc., and add the sum to the total demand for fixtures. The result is the estimated supply demand of the building supply.

A 104.0 Permissible Friction Loss.
A 104.1 Residual Pressure. Decide what is the desirable minimum residual pressure that shall be maintained at the highest fixture in the supply system. Where the highest group of fixtures contains flushometer valves, the available residual pressure for the group shall be not less than 15 pounds-force per square inch (psi) (103 kPa). For flush tank supplies, the available residual pressure shall be not less than 8 psi (55 kPa).
A 104.2 Elevation. Determine the elevation of the highest fixture or group of fixtures above the water (street) main.

CHART A 102.2
FRICITION LOSSES FOR DISK-TYPE WATER METERS

For SI units: 1 inch = 25 mm, 1 pound-force per square inch = 6.8947 kPa, 1 gallon per minute = 0.06 L/s
Multiply this difference in elevation by 0.43. The result is the loss of static pressure in psi (kPa).

**A 104.3 Available Pressure.** Subtract the sum of loss in static pressure and the residual pressure to be maintained at the highest fixture from the average minimum daily service pressure. The result will be the pressure available for friction loss in the supply pipes, where no water meter is used. Where a meter is to be installed, the friction loss in the meter for the estimated maximum demand should also be subtracted from the service pressure to determine the pressure loss available for friction loss in the supply pipes.

**A 104.4 Developed Length.** Determine the developed length of pipe from the water (street) main to the highest fixture. Where close estimates are desired, compute with the aid of Table A 104.4(1), Table A 104.4(2), or Table A 104.4(3), whichever is applicable, the equivalent length of pipe for fittings in the line from the water (street) main to the highest fixture and add the sum to the developed length. The pressure available for friction loss in psi (kPa), divided by the developed lengths of pipe from the water (street) main to the highest fixture, times 100, will be the average permissible friction loss per 100 feet (30 480 mm) length of pipe.

**A 105.0 Size of Building Supply.**

**A 105.1 Diameter.** Knowing the permissible friction loss per 100 feet (30 480 mm) of pipe and the total demand, the diameter of the building supply pipe shall be permitted to be obtained from Chart A 105.1(1), Chart A 105.1(2), Chart A 105.1(3), Chart A 105.1(4), Chart A 105.1(5), Chart A 105.1(6), or Chart A 105.1(7), whichever is applicable. The diameter of pipe on or next above the coordinate point corresponding to the estimated total demand and the permissible friction loss will be the size needed up to the first branch from the building supply pipe.

**A 105.2 Copper and Copper Alloy Piping.** Where copper tubing or copper alloy pipe is to be used for the supply piping and where the character of the water is such that slight changes in the hydraulic characteristics are expected, Chart A 105.1(1) shall be permitted to be used.

**A 105.3 Hard Water.** Chart A 105.1(2) shall be used for ferrous pipe with the most favorable water supply in regards to corrosion and caking. Where the water is hard or corrosive, Chart A 105.1(3) or Chart A 105.1(4) will be applicable. For extremely hard water, it will be advisable to make additional allowances for the reduction of the capacity of hot-water lines in service.

**A 106.0 Size of Principal Branches and Risers.**

**A 106.1 Size.** The required size of branches and risers shall be permitted to be obtained in the same manner as the building supply, by obtaining the demand load on each branch or riser and using the permissible friction loss computed in Section A 104.0.

**A 106.2 Branches.** Where fixture branches to the building supply are sized for the same permissible friction loss per 100 feet (30 480 mm) of pipe as the branches and risers to the highest level in the building and lead to the inadequate water supply to the upper floor of a building, one of the following shall be provided:

1. Selecting the sizes of pipe for the different branches so that the total friction loss in each lower branch is approximately equal to the total loss in the riser, including both friction loss and loss in static pressure.
2. Throttling each such branch using a valve until the preceding balance is obtained.
3. Increasing the size of the building supply and risers above the minimum required to meet the maximum permissible friction loss.

**A 106.3 Water Closets.** The size of branches and mains serving flushometer tanks shall be consistent with sizing procedures for flush tank water closets.

**A 107.0 General.**

**A 107.1 Velocities.** Velocities shall not exceed 10 feet per second (ft/s) (3 m/s), except as otherwise approved by the Authority Having Jurisdiction.

**A 107.2 Pressure-Reducing Valves.** Where a pressure-reducing valve is used in the building supply, the developed length of supply piping and the permissible friction loss shall be computed from the building side of the valve.

**A 107.3 Fittings.** The allowances in Table A 104.4(1) for fittings are based on non-recessed threaded fittings. For recessed threaded fittings and streamlined soldered fittings, one-half of the allowances given in the table will be ample.
### TABLE A 103.1

WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES

<table>
<thead>
<tr>
<th>APPLIANCES, APPURTENANCES, OR FIXTURES</th>
<th>MINIMUM FIXTURE BRANCH PIPE SIZE&lt;sup&gt;1,4&lt;/sup&gt; (inches)</th>
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<th>PUBLIC</th>
<th>ASSEMBLY&lt;sup&gt;6&lt;/sup&gt;</th>
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<td>Bathtub or Combination Bath/Shower (fill)</td>
<td>½</td>
<td>4.0</td>
<td>4.0</td>
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<td>¼ inch Bathtub Fill Valve</td>
<td>¼</td>
<td>10.0</td>
<td>10.0</td>
<td>–</td>
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<tr>
<td>Bidet</td>
<td>½</td>
<td>1.0</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Clothes Washer</td>
<td>½</td>
<td>4.0</td>
<td>4.0</td>
<td>–</td>
</tr>
<tr>
<td>Dental Unit, cuspidor</td>
<td>½</td>
<td>–</td>
<td>1.0</td>
<td>–</td>
</tr>
<tr>
<td>Dishwasher, domestic</td>
<td>½</td>
<td>1.5</td>
<td>1.5</td>
<td>–</td>
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<tr>
<td>Drinking Fountain or Water Cooler</td>
<td>½</td>
<td>0.5</td>
<td>0.5</td>
<td>0.75</td>
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<tr>
<td>Hose Bibb</td>
<td>½</td>
<td>2.5</td>
<td>2.5</td>
<td>–</td>
</tr>
<tr>
<td>Hose Bibb, each additional&lt;sup&gt;7&lt;/sup&gt;</td>
<td>½</td>
<td>1.0</td>
<td>1.0</td>
<td>–</td>
</tr>
<tr>
<td>Lavatory</td>
<td>½</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Lawn Sprinkler, each head&lt;sup&gt;5&lt;/sup&gt;</td>
<td>–</td>
<td>1.0</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Mobile Home, each (minimum)</td>
<td>–</td>
<td>12.0</td>
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<td>–</td>
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<tr>
<td>Sinks</td>
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<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Bar</td>
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<td>Clinical Faucet</td>
<td>½</td>
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<td>Clinical Flushometer Valve with or without faucet</td>
<td>1</td>
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<tr>
<td>Kitchen, domestic &lt;sup&gt;with or without dishwasher&lt;/sup&gt;</td>
<td>½</td>
<td>1.5</td>
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<td>Laundry</td>
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<td>Service or Mop Basin</td>
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<td>1.5</td>
<td>3.0</td>
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<tr>
<td>Washup, each set of faucets</td>
<td>½</td>
<td>–</td>
<td>2.0</td>
<td>–</td>
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<tr>
<td>Shower per head</td>
<td>½</td>
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<td>Urinal, 1.0 GPF Flushometer Valve</td>
<td>½</td>
<td>3.0</td>
<td>4.0</td>
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<tr>
<td>Urinal, greater than 1.0 GPF Flushometer Valve</td>
<td>½</td>
<td>4.0</td>
<td>5.0</td>
<td>6.0</td>
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<tr>
<td>Urinal, flush tank</td>
<td>½</td>
<td>2.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Wash Fountain, circular spray</td>
<td>¾</td>
<td>–</td>
<td>4.0</td>
<td>–</td>
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<tr>
<td>Water Closet, 1.6 GPF Gravity Tank</td>
<td>½</td>
<td>2.5</td>
<td>2.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Water Closet, 1.6 GPF Flushometer Tank</td>
<td>½</td>
<td>2.5</td>
<td>2.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Water Closet, 1.6 GPF Flushometer Valve</td>
<td>1</td>
<td>5.0</td>
<td>5.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Water Closet, greater than 1.6 GPF Gravity Tank</td>
<td>½</td>
<td>3.0</td>
<td>5.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Water Closet, greater than 1.6 GPF Flushometer Valve</td>
<td>1</td>
<td>7.0</td>
<td>8.0</td>
<td>10.0</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm

**Notes:**

1. Size of the cold branch pipe, or both the hot and cold branch pipes.
2. Appliances, appurtenances, or fixtures not included in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.
3. The listed fixture unit values represent their total load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both cold and hot water connections shall be permitted to be three-quarters of the listed total value of the fixture.
4. The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.
5. For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s) and add it separately to the demand in gpm (L/s) for the distribution system or portions thereof.
6. Assembly [Public Use (see Table 422.1)].
7. Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized by 2.5 fixture units.
CHART A 103.1(1)
ESTIMATE CURVES FOR DEMAND LOAD

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

No. 1 for system predominantly for flushometer valves
No. 2 for system predominantly for flush tanks

CHART A 103.1(2)
ENLARGED SCALE DEMAND LOAD

For SI units: 1 gallon per minute = 0.06 L/s
### Table A 104.4(1)
ALLOWANCE IN EQUIVALENT LENGTH OF PIPE FOR FRICTION LOSS IN VALVES AND THREADED FITTINGS*

<table>
<thead>
<tr>
<th>DIAMETER OF FITTING (inches)</th>
<th>90° STANDARD ELBOW (feet)</th>
<th>45° STANDARD ELBOW (feet)</th>
<th>90° STANDARD TEE (feet)</th>
<th>COUPLING OR STRAIGHT RUN OF TEE (feet)</th>
<th>GATE VALVE (feet)</th>
<th>GLOBE VALVE (feet)</th>
<th>ANGLE VALVE (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>1.0</td>
<td>0.6</td>
<td>1.5</td>
<td>0.3</td>
<td>0.2</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>½</td>
<td>2.0</td>
<td>1.2</td>
<td>3.0</td>
<td>0.6</td>
<td>0.4</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>¾</td>
<td>2.5</td>
<td>1.5</td>
<td>4.0</td>
<td>0.8</td>
<td>0.5</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>1</td>
<td>3.0</td>
<td>1.8</td>
<td>5.0</td>
<td>0.9</td>
<td>0.6</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>1¼</td>
<td>4.0</td>
<td>2.4</td>
<td>6.0</td>
<td>1.2</td>
<td>0.8</td>
<td>35</td>
<td>18</td>
</tr>
<tr>
<td>1½</td>
<td>5.0</td>
<td>3.0</td>
<td>7.0</td>
<td>1.5</td>
<td>1.0</td>
<td>45</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>7.0</td>
<td>4.0</td>
<td>10.0</td>
<td>2.0</td>
<td>1.3</td>
<td>55</td>
<td>28</td>
</tr>
<tr>
<td>2¼</td>
<td>8.0</td>
<td>5.0</td>
<td>12.0</td>
<td>2.5</td>
<td>1.6</td>
<td>65</td>
<td>34</td>
</tr>
<tr>
<td>3</td>
<td>10.0</td>
<td>6.0</td>
<td>15.0</td>
<td>3.0</td>
<td>2.0</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>14.0</td>
<td>8.0</td>
<td>21.0</td>
<td>4.0</td>
<td>2.7</td>
<td>125</td>
<td>55</td>
</tr>
<tr>
<td>5</td>
<td>17.0</td>
<td>10.0</td>
<td>25.0</td>
<td>5.0</td>
<td>3.3</td>
<td>140</td>
<td>70</td>
</tr>
<tr>
<td>6</td>
<td>20.0</td>
<td>12.0</td>
<td>30.0</td>
<td>6.0</td>
<td>4.0</td>
<td>165</td>
<td>80</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 degree = 0.017 rad

* Allowances are based on nonrecessed threaded fittings. Use one-half the allowances for recessed threaded fittings or streamlined solder fittings.

### Table A 104.4(2)
EQUIVALENT LENGTH OF COPPER TUBE SIZE CPVC PIPE FOR VARIOUS FITTINGS

<table>
<thead>
<tr>
<th>DIAMETER OF FITTING (inches)</th>
<th>90° STANDARD ELBOW (feet)</th>
<th>45° STANDARD ELBOW (feet)</th>
<th>COUPLING OR STRAIGHT RUN OF TEE (feet)</th>
<th>90° DEGREE STANDARD TEE (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>1.6</td>
<td>0.8</td>
<td>1.0</td>
<td>3.1</td>
</tr>
<tr>
<td>½</td>
<td>2.1</td>
<td>1.1</td>
<td>1.4</td>
<td>4.1</td>
</tr>
<tr>
<td>1</td>
<td>2.6</td>
<td>1.4</td>
<td>1.7</td>
<td>5.3</td>
</tr>
<tr>
<td>1¼</td>
<td>3.5</td>
<td>1.8</td>
<td>2.3</td>
<td>6.9</td>
</tr>
<tr>
<td>1½</td>
<td>4.0</td>
<td>2.1</td>
<td>2.7</td>
<td>8.1</td>
</tr>
<tr>
<td>2</td>
<td>5.2</td>
<td>2.8</td>
<td>3.5</td>
<td>10.3</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

### Table A 104.4(3)
EQUIVALENT LENGTH OF SCHEDULE 40 AND 80 CPVC PIPE FOR VARIOUS FITTINGS

<table>
<thead>
<tr>
<th>DIAMETER OF FITTING (inches)</th>
<th>90° STANDARD ELBOW (feet)</th>
<th>45° STANDARD ELBOW (feet)</th>
<th>COUPLING OR STRAIGHT RUN OF TEE (feet)</th>
<th>90° DEGREE STANDARD TEE (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>1.5</td>
<td>0.8</td>
<td>1.0</td>
<td>4.0</td>
</tr>
<tr>
<td>½</td>
<td>2.0</td>
<td>1.1</td>
<td>1.4</td>
<td>5.0</td>
</tr>
<tr>
<td>1</td>
<td>2.5</td>
<td>1.4</td>
<td>1.7</td>
<td>6.0</td>
</tr>
<tr>
<td>1¼</td>
<td>3.8</td>
<td>1.8</td>
<td>2.3</td>
<td>7.0</td>
</tr>
<tr>
<td>1½</td>
<td>4.0</td>
<td>2.1</td>
<td>2.7</td>
<td>8.0</td>
</tr>
<tr>
<td>2</td>
<td>5.7</td>
<td>2.6</td>
<td>4.3</td>
<td>12.0</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm
For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 foot = 304.8 mm, 1 foot per second = 0.3048 m/s
For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 foot = 304.8 mm, 1 foot per second = 0.3048 m/s
CHART A 105.1(3)

Ferrous Pipe
Fairly Rough

FRICITION LOSS IN HEAD (pounds-force per square inch) PER 100-FOOT LENGTH

FLOW (gallons per minute)

For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 foot = 304.8 mm, 1 foot per second = 0.3048 m/s
CHART A 105.1(4)

Ferrous Pipe
Rough

For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 foot = 304.8 mm,
1 foot per second = 0.3048 m/s
APPENDIX A

CHART A 105.1(5)

For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 foot = 304.8 mm, 1 foot per second = 0.3048 m/s
### Chart A 105.1(6)

**Flow (gallons per minute)**

<table>
<thead>
<tr>
<th>Diameter (inches)</th>
<th>Friction Loss in Head (pounds-force per square inch) per 100-foot length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.3</td>
</tr>
<tr>
<td>1 1/4</td>
<td>12.3</td>
</tr>
<tr>
<td>1 3/4</td>
<td>14.3</td>
</tr>
<tr>
<td>1</td>
<td>16.3</td>
</tr>
<tr>
<td>1 1/2</td>
<td>18.3</td>
</tr>
<tr>
<td>2</td>
<td>20.3</td>
</tr>
</tbody>
</table>

**For SI units:**
- 1 inch = 25 mm
- 1 gallon per minute = 0.06 L/s
- 1 pound-force per square inch = 6.8947 kPa
- 1 foot = 304.8 mm
- 1 foot per second = 0.3048 m/s
For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 foot = 304.8 mm, 1 foot per second = 0.3048 m/s
**A 108.0 Sizing.**

**A 108.1 Example.** Assume an office building of four stories and basement; pressure on the building side of the pressure-reducing valve of 55 psi (379 kPa) (after an allowance for reduced pressure falloff at peak demand); an elevation of highest fixture above the pressure-reducing valve of 45 feet (13 716 mm); a developed length of pipe from the pressure-reducing valve to the most distant fixture of 200 feet (60 960 mm); and fixtures to be installed with flush valves for water closets and stall urinals as follows:

Where the pipe material and water supply are such that Chart A 105.1(2) applies, the required diameter of the building supply is 3½ inches (90 mm), and the required diameter of the branch to the hot-water heater is 1½ inches (40 mm).

The sizes of the various branches and risers shall be permitted to be determined in the same manner as the size of the building supply or the branch to the hot-water system, by estimating the demand for the riser or branch from Chart A 103.1(1) or Chart A 103.1(2) and applying the total demand estimate from the branch, riser, or section thereof to the appropriate flowchart.

### A 108.1 Example

<table>
<thead>
<tr>
<th>KIND OF FIXTURES</th>
<th>NUMBER OF FIXTURES</th>
<th>FIXTURE UNIT DEMAND</th>
<th>TOTAL UNITS</th>
<th>BUILDING SUPPLY DEMAND (gallons per minute)</th>
<th>NUMBER OF FIXTURES</th>
<th>FIXTURE UNIT DEMAND CALCULATION</th>
<th>DEMAND (gallons per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Closets</td>
<td>130</td>
<td>8.0</td>
<td>1040</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Urinals</td>
<td>30</td>
<td>4.0</td>
<td>120</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Showerheads</td>
<td>12</td>
<td>2.0</td>
<td>24</td>
<td>–</td>
<td>12</td>
<td>12 x 2 x (\frac{3}{4}) = 18</td>
<td>–</td>
</tr>
<tr>
<td>Lavatories</td>
<td>100</td>
<td>1.0</td>
<td>100</td>
<td>–</td>
<td>100</td>
<td>100 x 1 x (\frac{3}{4}) = 75</td>
<td>–</td>
</tr>
<tr>
<td>Service Sinks</td>
<td>27</td>
<td>3.0</td>
<td>81</td>
<td>–</td>
<td>27</td>
<td>27 x 3 x (\frac{3}{4}) = 61</td>
<td>–</td>
</tr>
<tr>
<td>Total</td>
<td>–</td>
<td>–</td>
<td>1365</td>
<td>252</td>
<td>–</td>
<td>154</td>
<td>55</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square foot = 6.8947 kPa

Allowing for 15 psi (103 kPa) at the highest fixture under the maximum demand of 252 gallons per minute (15.90 L/s), the pressure available for friction loss is found by the following:

\[
55 - [15 + (45 x 0.43)] = 20.65 \text{ psi (142.38 kPa)}
\]

The allowable friction loss per 100 feet (30 480 mm) of the pipe is, therefore:

\[
100 x 20.65 \div 200 = 10.32 \text{ psi (71.15 kPa)}
\]
APPENDIX B
EXPLANATORY NOTES ON COMBINATION WASTE AND VENT SYSTEMS
(See Section 910.0 for specific limitations)

B 101.0 General.
B 101.1 Applicability. This appendix provides general guidelines for the design and installation of a combination waste and vent system.

B 101.2 General Requirements. Combination waste and vent systems, (which at best are merely an expedient designed to be used in locations where it would be structurally impractical to provide continuous venting of fixtures) as outlined in Section 910.0 of this code, cover the horizontal wet venting of a series of traps using a common waste and vent pipe. Pipe sizes not less than two pipe sizes larger than those required for a conventional system are designed to maintain a wetted perimeter or flow line low enough in the waste pipe to allow adequate air movement in the upper portion, thus balancing the system. Sinks, lavatories, and other fixtures that rough in above the floor, shall not be permitted on a combination waste and vent system, which, at best, is merely an expedient designed to be used in locations where it would be structurally impractical to provide venting in a conventional manner.

Combination waste and vent systems are intended primarily for extensive floor or shower drain installations where separate venting is not practical, for floor sinks in markets, demonstration or work tables in school buildings, or for similar applications where the fixtures are not adjacent to walls or partitions. Due to its oversize characteristics, such a waste system is not self-scouring and, consequently, care shall be exercised as to the type of fixtures connected to it and the location of cleanouts. Given its grease-producing potential, restaurant kitchen equipment shall not be connected to a combination waste and vent system.

B 101.3 Caution. Caution shall be exercised to exclude appurtenances delivering large quantities or surges of water (such as pumps, sand interceptors, etc.) from combination waste and vent systems so that adequate venting will be maintained. Small fixtures with a waste-producing potential of less than 7½ gallons per minute (gpm) (0.47 L/s) shall be permitted to be safely assigned a loading value of one unit. Long runs shall be laid at the minimum permissible slope to keep tailpieces as short as possible. Tailpieces shall not exceed 2 feet (610 mm) in length, which shall necessitate slopes up to 45 degrees (0.79 rad) (see definition of horizontal pipe) on some branches.

B 101.4 Pneumatics. It is essential that the pneumatics of such a system be properly engineered, as the air pressure within the line shall at all times balance that of outside atmosphere to prevent either trap seal loss or air locking between traps. Long mains shall be provided with additional relief vents located at intervals not exceeding 100 feet (30 480 mm). Each such relief vent shall equal not less than one-half of the inside cross-sectional area of the drainpipe served.

B 101.5 Trap Sizes. Trap sizes are required to be equivalent to the branches they serve (two pipe sizes larger than normal), and tailpieces between fixtures or floor drains and such traps shall be reduced to normal size.

B 101.6 Layout Drawings. Duplicate layout drawings of each proposed piping system shall be presented to the Authority Having Jurisdiction and approval obtained before an installation is made. Complicated layouts shall be checked by qualified personnel.

B 101.6.1 Example of Sizing. A floor drain normally requires a 2 inch (50 mm) trap and waste. On a combination waste and vent system, both trap and waste shall be increased two pipe sizes (through 2½ inches and 3 inches) (65 mm and 80 mm), which would make the trap 3 inches (80 mm). Pipe sizes recognized for this purpose are 2 inches, 2½ inches, 3 inches, 3½ inches, 4 inches, 4½ inches, 5 inches, 6 inches, etc. (50 mm, 65 mm, 80 mm, 90 mm, 100 mm, 115 mm, 125 mm, 150 mm, etc.). The tailpiece between the floor drain and its trap shall be 2 inches (50 mm) (or normal size) to ensure that the amount of wastewater entering the trap partially fills the waste branch. A 3 inch (80 mm) floor drain would thus require a 4 inch (100 mm) trap, and a 4 inch (100 mm) floor drain would require a 5 inch (125 mm) trap for the reasons previously stated.

WHERE IN DOUBT, CHECK WITH YOUR LOCAL Authority Having Jurisdiction.
APPENDIX C
ALTERNATE PLUMBING SYSTEMS

C 101.0 General.
C 101.1 Applicability. The intent of this appendix is to provide clarification of procedures for the design and approval of engineered plumbing systems, alternate materials, and equipment not specifically covered in other parts of the code.
C 101.2 Provisions. The provisions of this appendix apply to the design, installation, and inspection of an engineered plumbing system, alternate material, and equipment.
C 101.3 Authority Having Jurisdiction. The Authority Having Jurisdiction has the right to require descriptive details of an engineered plumbing system, alternate material, or equipment including pertinent technical data to be filed.
C 101.4 Standards and Specifications. Components, materials, and equipment shall comply with standards and specifications listed in Chapter 17 of this code and other national consensus standards applicable to plumbing systems and materials.
C 101.5 Alternate Materials and Equipment. Where such standards and specifications are not available, alternate materials and equipment shall be approved in accordance with Section 301.3 of this code.

C 201.0 Definitions.
C 201.1 General. For the purposes of this code appendix, these following definitions shall apply to this appendix:
Branch Interval. A length of soil or waste stack corresponding in general to a story height, but in no case less than 8 feet (2438 mm), within which the horizontal branches from one floor or story of the building are connected to the stack.
Engineered Plumbing System. A system designed for a specific building project with drawings and specifications indicating plumbing materials to be installed, all as prepared by a registered design professional.

C 301.0 Engineered Plumbing Systems.
C 301.1 Inspection and Installation. In other than one- and two-family dwellings, the designer of the system is to provide periodic inspection of the installation on a schedule approved by the Authority Having Jurisdiction. Prior to the final approval, the designer shall verify to the Authority Having Jurisdiction that the installation is in accordance with the approved plans, specifications, and data and such amendments to it. The designer shall certify to the Authority Having Jurisdiction that the installation is in accordance with the applicable engineered design criteria.
C 301.2 Owner Information. The designer of the system shall provide the building owner with information concerning the system, considerations applicable for subsequent modifications to the system, and maintenance requirements as applicable.

C 302.0 Water Heat Exchangers.
C 302.1 Protection from Contamination. Heat exchangers used for heat transfer, heat recovery, or solar heating shall protect the potable water system from being contaminated by the heat-transfer medium.
C 302.2 Single-Wall Heat Exchangers. Single-wall heat exchangers shall comply with the following requirements:
1. The heat-transfer medium is either potable water or contains essentially nontoxic transfer fluids having a toxicity rating or class of 1 (see Section 207.0).
2. The pressure of the heat-transfer medium is maintained at less than the normal minimum operating pressure of the potable water system.
   Exception: Steam in accordance with Section C 302.2(1) above.
3. The equipment is permanently labeled to indicate that only additives recognized as safe by the FDA shall be used in the heat-transfer medium.
C 302.3 Alternate Designs. Other heat exchanger designs shall be permitted where approved by the Authority Having Jurisdiction.

C 303.0 Fixture Unit Values for Private or Private Use Bathroom Groups.
C 303.1 Fixtures. Table C 303.2 and Table C 303.3 reflect the fixture unit loads for the fixtures in bathrooms as groups, rather than as individual fixtures. Such fixtures include water closets, lavatories, and bathtubs or showers. The tables reflect diversity in the use of fixtures within a bathroom and between multiple bathrooms.
C 303.2 Water Supply Fixture Unit Values. The listed water supply fixture unit values in Table C 303.2 reflect the load of entire bathroom groups on the cold water building supply. Individual hot and cold water branch piping to the fixtures shall be permitted to be sized in accordance with Chapter 6 and Appendix A.
C 303.3 Drainage Fixture Unit Values. The listed drainage fixture unit values in Table C 303.3 reflect a load of entire bathroom groups on the sanitary drainage system. Where fixtures within bathrooms connect to different branches of the drainage system, the fixture unit values for the individual fixtures shall be used, as listed in Table 702.1 of this code.

C 304.0 Drainage System Sizing.
C 304.1 Drainage Fixture Units. Drainage fixture unit values shall be sized in accordance with Section 702.0 and Table 702.1.
C 304.2 Size of Building Drain and Building Sewer. The maximum number of drainage fixture units allowed on the building drain or building sewer of a given size shall be in accordance with Table C 304.2. The size of a building drain or building sewer serving a water closet shall be not less than 3 inches (80 mm).

C 304.3 Size of Horizontal Branch or Vertical Stack. The maximum number of drainage fixture units allowed on a horizontal branch or vertical soil or waste stack of a given size shall be in accordance with Table C 304.3. Stacks shall be sized based on the total accumulated connected load at each story or branch interval.

C 401.0 Vent System Sizing.

C 401.1 Size of Vents. The size of vent piping shall be determined from the developed length and the total number of drainage fixture units connected in accordance with Table C 401.1. Vents shall be not less than one-half the required size of the drainage pipe size served as determined by Table C 304.3 for horizontal fixture branches and stacks nor less than 11/4 inches (32 mm) in diameter. The drainage system shall be vented by not less than one vent pipe which shall be not less than one-half the size of the required building drain and which shall extend from the building drain or extension of building drain to the outdoors. Vents shall be installed in accordance with Chapter 9.

C 401.2 Vent Stack. A vent stack shall be required for a drainage stack that extends five or more branch intervals above the building drain or horizontal branch. The developed length of the vent stack shall be measured from the lowest connection of a branch vent to the termination outdoors. Vents shall be installed in accordance with Chapter 9.

C 401.3 Branch Vents. Where branch vents exceed 40 feet (12 192 mm) in developed length, such vent shall be increased by one pipe size for the entire developed length of the vent pipe.

C 401.4 Venting Horizontal Offsets. Drainage stacks with horizontal offsets shall be vented where five or more branch intervals below the top of the stack.

### TABLE C 303.2
WATER SUPPLY FIXTURE UNITS (WSFU) FOR BATHROOM GROUPS

<table>
<thead>
<tr>
<th>Private Use Bathroom Group</th>
<th>Serving 3 or More Private Use Bathroom Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLD</td>
<td>HOT</td>
</tr>
<tr>
<td>bathroom groups having up to 1.6 GPF gravity-tank water closets</td>
<td></td>
</tr>
<tr>
<td>half-bath or powder room</td>
<td>3.5</td>
</tr>
<tr>
<td>1 bathroom group</td>
<td>5.0</td>
</tr>
<tr>
<td>1 1/2 bathrooms</td>
<td>6.0</td>
</tr>
<tr>
<td>2 bathrooms</td>
<td>7.0</td>
</tr>
<tr>
<td>2 1/2 bathrooms</td>
<td>8.0</td>
</tr>
<tr>
<td>3 bathrooms</td>
<td>9.0</td>
</tr>
<tr>
<td>each additional 1/2 bath</td>
<td>0.5</td>
</tr>
<tr>
<td>each additional bathroom group</td>
<td>1.0</td>
</tr>
<tr>
<td>bathroom groups having up to 1.6 GPF pressure-tank water closets</td>
<td></td>
</tr>
<tr>
<td>half-bath or powder room</td>
<td>3.5</td>
</tr>
<tr>
<td>1 bathroom group</td>
<td>5.0</td>
</tr>
<tr>
<td>1 1/2 bathrooms</td>
<td>6.0</td>
</tr>
<tr>
<td>2 bathrooms</td>
<td>7.0</td>
</tr>
<tr>
<td>2 1/2 bathrooms</td>
<td>8.0</td>
</tr>
<tr>
<td>3 bathrooms</td>
<td>9.0</td>
</tr>
<tr>
<td>each additional 1/2 bath</td>
<td>0.5</td>
</tr>
<tr>
<td>each additional bathroom group</td>
<td>1.0</td>
</tr>
<tr>
<td>bathroom group (1.6 GPF flushometer value)</td>
<td>6.0</td>
</tr>
<tr>
<td>kitchen group (sink and dishwasher)</td>
<td>2.0</td>
</tr>
<tr>
<td>laundry group (sink and clothes washer)</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Notes:
1. A bathroom group, for this table, consists of one water closet, up to two lavatories, and either one bathtub or one shower.
2. A half-bath or powder room, for this table, consists of one water closet and one lavatory.
3. Multi-unit dwellings with individual water heaters use the same WSFU as for individual dwellings.
intervals are located above the offset. The upper and lower section of the horizontal offset shall be vented in accordance with Section C 401.4.1 and Section C 401.4.2.

C 401.4.1 Venting Upper Section. The vent for the upper section of the stack shall be vented as a separate stack with a vent stack connection installed at the base of the drainage stack. Such vent stack shall connect below the lowest horizontal branch or building drain. Where vent stack connects to the building drain, the connection shall be located downstream of the drainage stack and within a distance of 10 times the diameter of the drainage stack.

C 401.4.2 Venting Lower Section. The vent for the lower section of the stack shall be vented by a yoke vent connecting between the offset and the next lower horizontal branch using a wye-branch fitting. The size of the yoke vent and connection shall be not less in diameter than the required size for the vent serving the drainage stack. The yoke vent connection shall be permitted to be a vertical extension of the drainage stack.

C 501.0 Vacuum Drainage Systems.

C 501.1 General. This section regulates the design and installation provisions for vacuum waste drainage systems. Plans for vacuum waste drainage systems shall be submitted to the Authority Having Jurisdiction for approval and shall be considered an engineered designed system. Such plans shall be prepared by a registered design professional to perform plumbing design work. Details are necessary to ensure compliance with the requirements of this section, together with a full description of the complete installation including quality, grade of materials, equipment, construction, and methods of assembly and installation. Components, materials, and equipment shall comply with standards and specifications listed in Chapter 17 of this code or approved by the Authority Having Jurisdiction and other national consensus standards applicable to plumbing systems and materials. Where such standards and specifications are not available, alternate materials and equipment shall be approved in accordance with Section 301.3.
C 501.2 System Design. Vacuum waste drainage systems shall be designed and installed in accordance with the manufacturer’s installation instructions. A vacuum waste drainage system shall include a vacuum generating system, waste collection center, piping network, vacuum valve, and control components used to isolate the vacuum piping network from atmospheric pressure and to collect waste at its point of origin. Where a vacuum system provides the only means of sanitation, the duplicate vacuum generating equipment set to operate automatically shall be installed to allow the system to continue in operation during periods of maintenance.

C 501.2.1 Vacuum Generating System. The vacuum generating station shall include vacuum pumps to create a constant vacuum pressure within the piping network and storage tanks. The operation of pumps, collection tanks, and alarms shall be automated by controls. The vacuum pumps shall be activated on demand and accessible for repair or replacement. The vent from the vacuum pump shall be provided for vacuum pump air exhaust and shall be of a size capable of handling the total air volume of the vacuum pump.

C 501.2.2 Waste Collection Center or Storage Tanks. Vacuum collection center or storage tanks shall be of such capacity as to prevent fouling of the system. Such collection or storage tank shall be capable of withstanding 150 percent of the

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### Table C 304.2
**Building Drains and Building Sewers**

<table>
<thead>
<tr>
<th>DIAMETER OF PIPE (Inches)</th>
<th>MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS FOR SANITARY BUILDING DRAINS AND RUNOUTS FROM STACKS</th>
<th>SLOPE (Inches per foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>¼</td>
<td>½</td>
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<tr>
<td>2</td>
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</tr>
<tr>
<td>2½</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3</td>
<td>–</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>–</td>
<td>180</td>
</tr>
<tr>
<td>5</td>
<td>–</td>
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</tr>
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<td>3900</td>
<td>4600</td>
</tr>
<tr>
<td>15</td>
<td>7000</td>
<td>8300</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 inch per foot = 83.3 mm/m

Notes:
1. On-site sewers that serve more than one building shall be permitted to be sized according to the current standards and specifications of the administrative authority for public sewers.
2. A maximum of two water closets or two bathroom groups, except in single-family dwellings, where a maximum of three water closets or three bathroom groups shall be permitted to be installed.

### Table C 304.3
**Horizontal Fixture Branches and Stacks**

<table>
<thead>
<tr>
<th>DIAMETER OF PIPE (Inches)</th>
<th>MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS</th>
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<tr>
<td></td>
<td>HORIZONTAL FIXTURE BRANCH¹</td>
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<tr>
<td></td>
<td>TOTAL AT ONE BRANCH INTERVAL</td>
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<tr>
<td>1½</td>
<td>3</td>
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<td>2</td>
<td>6</td>
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<td>2½</td>
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<td>3</td>
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<tr>
<td>15</td>
<td>7000</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm

Notes:
1. Does not include branches of the building drain.
2. A maximum of two water closets or bathroom groups within each branch interval or more than six water closets or bathroom groups on the stack.
rated vacuum (negative pressure) created by the vacuum source without leakage or collapse. Waste collection center or storage tanks shall be accessible for adjustment, repair, or replacement.

C 501.2.3 Piping Network. The piping network shall be under a continuous vacuum and shall be designed to withstand 150 percent of the vacuum (negative pressure) created by the vacuum source within the system without leakage or collapse. Sizing the piping network shall be in accordance with the manufacturer’s instructions. The water closet outlet fitting shall connect with a piping network having not less than an 11⁄2 inch (40 mm) nominal inside diameter.

C 501.2.4 Vacuum Interface Valve. A closed vacuum interface valve shall be installed to separate the piping network vacuum from atmospheric pressure. A control device shall open the vacuum interface valve where a signal is generated to remove waste from the plumbing fixture.

C 501.2.5 Control Components. Where a pneumatic signal is generated at the controller, a vacuum from the system to open the extraction valve shall be designed to operate where vacuum pressure exists to remove the accumulated waste. Each tank shall incorporate a level indicator switch that automatically controls the discharge pump and warns of malfunction or blockage as follows:

1. Start discharge.
2. Stop discharge.
3. Activate an audible alarm where the level of effluent is usually high.
4. Warning of system shutdown where the tank is full.

C 501.3 Fixtures. Fixtures utilized in a vacuum waste drainage system shall be in accordance with referenced standards listed in Chapter 17. Components shall be of corrosion resistant materials. The water closet outlet shall be able to pass a 1 inch (25.4 mm) diameter ball and shall have a smooth, impervious surface. The waste outlet and passages shall be free of obstructions, recesses, or chambers that are capable of permitting fouling. The mechanical valve and its seat shall be of such materials and design to provide a leak-free connection where at atmospheric pressure or under vacuum. The flushing mechanism shall be so designed as to ensure proper cleansing of the interior surfaces during the flushing cycle at a minimum operating flow rate. Mechanical seal mechanisms shall withdraw completely from the path of the waste discharge during the flushing operation. Each mechanical seal vacuum water closet shall be equipped with a

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**APPENDIX C**

**TABLE C 401.1**

**SIZE AND LENGTH OF VENTS**

<table>
<thead>
<tr>
<th>SIZE OF SOIL OR WASTE STACK (inches)</th>
<th>FIXTURE UNITS CONNECTED</th>
<th>DIAMETER OF VENT REQUIRED (inches)</th>
<th>MAXIMUM LENGTH OF VENT (feet)</th>
</tr>
</thead>
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<tr>
<td>1½</td>
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<td>2, 3, 4, 5, 6, 8</td>
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<td>30, 75, 200</td>
<td>2</td>
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<td>20</td>
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<td>3</td>
<td>42</td>
<td>30, 100, 300</td>
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<td>10</td>
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<tr>
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<td>50, 80, 400</td>
<td>2</td>
</tr>
<tr>
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<td>100</td>
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<td>7½</td>
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<tr>
<td>12½</td>
<td>5600</td>
<td>30, 80, 350</td>
<td></td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm.
listed vacuum breaker. The vacuum breaker shall be mounted with the critical level or marking not less than 1 inch (25.4 mm) above the flood-level rim of the fixture. Vacuum breakers shall be installed on the discharge side of the last control valve in the potable water supply line and shall be located to be protected from physical damage and contamination.

C 501.4 Drainage Fixture Units. Drainage fixture units shall be determined by the manufacturer’s instructions. The pump discharge load from the collector tanks shall be in accordance with this appendix.

C 501.5 Water Supply Fixture Units. Water supply fixture units shall be determined by the manufacturer’s instructions.

C 501.6 Materials. Materials used for water distribution pipe and fittings shall be in accordance with Table 604.1. Materials used for aboveground drainage shall be in accordance with Table 701.2 and shall have a smooth bore, and be constructed of non- porous material.

C 501.7 Traps and Cleanouts. Traps and cleanouts shall be installed in accordance with Chapter 7 and Chapter 10.

C 501.8 Testing. The entire vacuum waste system shall be subjected to a vacuum test of 29 inches of mercury (98 kPa) or not less than the working pressure of the system for 30 minutes. The system shall be gastight and watertight at all points. Verification of test results shall be submitted to the Authority Having Jurisdiction.

C 501.9 Manufacturer’s Instructions. Manufacturer’s instructions shall be provided to provide information regarding safe and proper operating instructions whether or not as part of the condition of listing to determine compliance. Such instructions shall be submitted and approved by the Authority Having Jurisdiction.

C 601.0 Single-Stack Vent System.

C 601.1 Where Permitted. Single-stack venting shall be designed by a registered design professional as an engineered design. A drainage stack shall be permitted to serve as a single-stack vent system where sized and installed in accordance with Section C 601.2 through Section C 601.9. The drainage stack and branch piping in a single-stack vent system shall provide for the flow of liquids, solids, and air without the loss of fixture trap seals.

C 601.2 Stack Size. Drainage stacks shall be sized in accordance with Table C 601.2. Not more than two water closets shall be permitted to discharge to a 3 inch (80 mm) stack. Stacks shall be uniformly sized based on the total connected drainage fixture unit load, with no reductions in size.

C 601.2.1 Stack Vent. The drainage stack vent shall have a stack vent of the same size terminating to the outdoors.

C 601.3 Branch Size. Horizontal branches connecting to a single-stack vent system shall be sized in accordance with Table 703.2.

Exceptions:

(1) Not more than one water closet within 18 inches (457 mm) of the stack horizontally shall be permitted on a 3 inch (80 mm) horizontal branch.

(2) A water closet within 18 inches (457 mm) of a stack horizontally and one other fixture with up to 1½ inch (40 mm) fixture drain size shall be permitted on a 3 inch (80 mm) horizontal branch where connected to the stack through a sanitary tee.

C 601.4 Length of Horizontal Branches. Water closets shall be not more than 4 feet (1219 mm) horizontally from the stack.

Exception: Water closets shall be permitted to be up to 8 feet (2438 mm) horizontally from the stack where connected to the stack through a sanitary tee.

C 601.4.1 Other Fixtures. Fixtures other than water closets shall be not more than 12 feet (3658 mm) horizontally from the stack.

C 601.4.2 Length of Vertical Piping. The length of a vertical piping from a fixture trap to a horizontal branch shall not be considered in computing the fixture’s horizontal distance from the stack.

C 601.5 Maximum Vertical Drops from Fixtures. Vertical drops from fixture traps to horizontal branch piping shall be one size larger than the trap size, but not less than 2 inches (50 mm) in diameter. Vertical drops shall be 4 feet (1219 mm) maximum length. Fixture drains that are not increased in size, or have a vertical drop exceeding 4 feet (1219 mm) shall be individually vented.

C 601.6 Additional Venting Required. Additional venting shall be provided where more than one water closet is on a horizontal branch and where the distance from a fixture trap to the stack exceeds the limits in Section C 601.4. Where additional venting is required, the fixture(s) shall be vented by individual vents, common vents, wet vents, circuit vents, or a combination waste and vent pipe. The dry vent extensions for the additional venting shall connect to a branch vent, vent stack, stack vent, or be extended outdoors and terminate to the open air.

C 601.7 Stack Offsets. Where there are no fixture drain connections below a horizontal offset in a stack, the offset does not need to be vented. Where there are fixture drain connections below a horizontal offset in a stack, the offset shall be vented. There shall be no fixture connections to a stack within 2 feet (610 mm) above and below a horizontal offset.

C 601.8 Separate Stack Required. Where stacks are more than two stories high, a separate stack shall be provided for the fixtures on the lower two stories. The stack for the lower two stories shall be permitted to be connected to the branch of the building drain that serves the stack for the upper stories at a point that is not less than 10 pipe diameters downstream from the base of the upper stack.

C 601.9 Sizing Building Drains and Sewers. In a single-stack vent system, the building drain and branches thereof shall be sized in accordance with Table 703.2, and the building sewer shall be sized in accordance with Table 717.1.
### TABLE C 601.2
SINGLE STACK SIZE *

<table>
<thead>
<tr>
<th>STACK SIZE (inches)</th>
<th>STACKS LESS THAN 75 FEET IN HEIGHT</th>
<th>STACK 75 FEET TO LESS THAN 160 FEET IN HEIGHT</th>
<th>STACK 160 FEET OR GREATER IN HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>24</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>4</td>
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<tr>
<td>15</td>
<td>13 600</td>
<td>8100</td>
<td>4500</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm
* NP = Not permitted
APPENDIX D
SIZING STORM WATER DRAINAGE SYSTEMS

D 101.0 General.
D 101.1 Applicability. This appendix provides general guidelines for the sizing of storm water drainage systems based on maximum rates of rainfall for various cities. The rainfall rates in Table D 101.1 shall be permitted to be used for design unless higher values are established locally.

D 102.0 Sizing by Flow Rate.
D 102.1 General. Storm drainage systems shall be permitted to be sized by storm water flow rates, using the gallons per minute per square foot \( [(L/s)/m^2] \) of rainfall listed in Table D 101.1 for the local area. Multiplying the listed gallons per minute per square foot \( [(L/s)/m^2] \) by the roof area being drained (in square feet) \( (m^2) \) by each inlet produces the gallons per minute \( (gpm) \) \( (L/s) \) of required flow for sizing each drain inlet. The flow rates shall be permitted to be added to determine the flows in each of the drainage systems. Required pipe sizes for various flow rates are listed in Table 1103.1 and Table 1103.2.

D 103.0 Sizing by Roof Area.
D 103.1 General. Storm drainage systems shall be permitted to be sized using the roof area served by each of the drainage systems. Maximum allowable roof areas with various rainfall rates are listed in Table 1103.1 and Table 1103.2, along with the required pipe sizes. By using this method, it shall be permitted to interpolate between two listed rainfall rate columns (inches per hour) \( (mm/h) \). To determine the allowable roof area for a listed pipe size at a listed slope, divide the allowable square feet \( (m^2) \) of the roof for a 1 inch per hour \( (in/h) \) \( (25.4 \text{ mm/h}) \) rainfall rate by the listed rainfall rate for the local area. For example, the allowable roof area for a 6 inch \( (150 \text{ mm}) \) drain at \( \frac{1}{8} \) inch per foot \( (10.4 \text{ mm/m}) \) slope with a rainfall rate of 3.2 in/h \( (81 \text{ mm/h}) \) is 21400/3.2 = 6688 square feet \( (621.3 \text{ m}^2) \).

D 104.0 Capacity of Rectangular Scuppers.
D 104.1 General. Table D 104.1 lists the discharge capacity of rectangular roof scuppers of various widths with various heads of water. The maximum allowable level of water on the roof shall be obtained from the registered design professional, based on the design of the roof.

<table>
<thead>
<tr>
<th>TABLE D 101.1</th>
<th>MAXIMUM RATES OF RAINFALL FOR VARIOUS CITIES*</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATES AND CITIES</td>
<td>STORM DRAINAGE 60-MINUTE DURATION, 100-YEAR RETURN</td>
</tr>
<tr>
<td></td>
<td>inches per hour</td>
</tr>
<tr>
<td>ALABAMA</td>
<td></td>
</tr>
<tr>
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<td>Fairbanks</td>
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UNIFORM PLUMBING CODE - PREPRINT
### TABLE D 101.1
MAXIMUM RATES OF RAINFALL FOR VARIOUS CITIES* (continued)

<table>
<thead>
<tr>
<th>STATES AND CITIES</th>
<th>STORM DRAINAGE 60-MINUTE DURATION, 100-YEAR RETURN</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>inches per hour</td>
<td>gallons per minute per square foot</td>
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<td>Lake Tahoe</td>
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<td>0.014</td>
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<td>Los Angeles</td>
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<td>0.026</td>
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<td>Needles</td>
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### TABLE D 101.1
MAXIMUM RATES OF RAINFALL FOR VARIOUS CITIES* (continued)

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### TABLE D 101.1

**MAXIMUM RATES OF RAINFALL FOR VARIOUS CITIES*** (continued)

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For SI units: 1 inch per hour = 25.4 mm/h, 1 gallon per minute per square foot = 0.679 [(L/s)/m²]

* The rainfall rates in this table are based on U.S. Weather Bureau Technical Paper No. 40, Chart 14: 100-Year 60-Minute Rainfall (inches).
TABLE D 104.1
DISCHARGE FROM RECTANGULAR SCUPPERS (gallons per minute)\(^1,2,3,4\)

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</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 gallon per minute = 0.06 L/s

Notes:
1. Table D 104.1 is based on discharge over a rectangular weir with end contractions.
2. The head is the depth of water above the bottom of the scupper opening.
3. The height of the scupper opening shall be not less than two times the design head.
4. Coordinate the allowable head of water with the structural design of the roof.
APPENDIX E
MANUFACTURED/MOBILE HOME PARKS AND RECREATIONAL VEHICLE PARKS

E 101.0 Manufactured/Mobile Home Park.
E 101.1 Applicability. The manufactured home park plumbing and drainage systems shall be designed and installed in accordance with the requirements of this appendix and the requirements of this code.

E 101.2 Construction Documents. Before plumbing or sewage disposal facilities are installed or altered in a manufactured home park, duplicate construction documents shall be filed and proper permits obtained from the department or departments having jurisdiction. Plans shall show in detail:

1. Plot plan of the park drawn to scale, indicating elevations, property lines, driveways, existing or proposed buildings, and the sizes of manufactured home lots.
2. Complete specification and piping layout of proposed plumbing systems or alteration.
3. Complete specification and layout of proposed sewage disposal system or alteration.
4. The nature and extent of the work proposed, showing clearly that such work will conform to the provisions of this code.

E 201.0 Definitions.
E 201.1 General. For the purposes of this chapter appendix, the following definitions shall apply:

Manufactured/Mobile Home. A structure transportable in one or more sections, which in the traveling mode is 8 feet (2438 mm) or more in width and 40 feet (12 192 mm) or more in length or, where erected on-site, is 320 square feet (29.73 m²) or more, and which is built on a permanent chassis, and designed to be used as a dwelling with or without a permanent foundation where connected to the required utilities. It includes the plumbing, heating, air-conditioning, and electrical systems contained therein. For further clarification of definition, see Federal Regulation 24 CFR.

Manufactured/Mobile Home Accessory Building or Structure. A building or structure that is an addition to or supplements the facilities provided to a manufactured home. It is not a self-contained, separate, habitable building or structure. Examples are awnings, cabanas, ramadas, storage structures, carports, fences, windbreaks, or porches.

Manufactured/Mobile Home Lot. A portion of a manufactured home park designed for the accommodation of one manufactured home and its accessory buildings or structures for the exclusive use of the occupants.

Manufactured/Mobile Home Park. A parcel (or contiguous parcels) of land that has been so designated and improved that it contains two or more manufactured home lots available to the general public for the placement thereon of a manufactured home for occupancy.

Recreational Vehicle (RV). A vehicular-type unit primarily designed as temporary living quarters for recreational, camping, travel, or seasonal use that either has its own motive power or is mounted on or towed by another vehicle. The basic entities are camping trailer, fifth-wheel trailer, motor home, park trailer, travel trailer, and truck camper.

Recreational Vehicle Park. A plot of land upon which two or more recreational vehicle sites are located, established or maintained for occupancy by recreational vehicles of the general public as temporary living quarters for recreation or vacation purpose.

Recreational Vehicle Site. Within a recreational vehicle park, a plot of ground intended for the accommodation of a recreational vehicle, a tent, or another individual camping unit on a temporary basis.

E 301.0 Manufactured/Mobile Home Park Drainage System Construction.
E 301.1 General. A drainage system shall be provided in manufactured home parks for conveying and disposing of sewage. Where feasible, the connection shall be made to a public system. New improvements shall be designed, constructed, and maintained in accordance with applicable laws and regulations. Where the drainage lines of the manufactured home park are not connected to a public sewer, the Authority Having Jurisdiction shall approve sewage disposal facilities prior to construction.

E 301.2 Underground Drainage System Location, Size, and Slope. Drainage (sewage) collection lines shall be located in trenches at an approved depth to be free of breakage from traffic or other movements and shall be separated from the park water supply system as specified in this code. Drainage (sewage) lines shall have a minimum size and slope as specified in Table E 301.2(1) and Table E 301.2(2).

<table>
<thead>
<tr>
<th>SIZE OF DRAINAGE (inches)</th>
<th>MAXIMUM NUMBER OF FIXTURE UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2*</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>35</td>
</tr>
<tr>
<td>4</td>
<td>256</td>
</tr>
<tr>
<td>5</td>
<td>428</td>
</tr>
<tr>
<td>6</td>
<td>720</td>
</tr>
<tr>
<td>8</td>
<td>2640</td>
</tr>
<tr>
<td>10</td>
<td>4680</td>
</tr>
<tr>
<td>12</td>
<td>8200</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm
* Except for six unit fixtures
E 301.2.1 Inlet, System, and Lateral Sizing. Each manufactured home lot drainage inlet shall be assigned a waste loading value of 12 drainage fixture units, and each park drainage system shall be sized in accordance with Table E 301.2(1) or as provided herein. Drainage laterals shall be not less than 3 inches (80 mm) in diameter.

E 301.2.2 Engineered Design. A park drainage system that exceeds the fixture unit loading of Table E 301.2(1) or in which the grade and slope of drainage pipe do not meet the minimum specified in Table E 301.2(2) shall be designed by a registered design professional.

E 301.2.3 Materials. Pipe and fittings installed underground in manufactured home park drainage systems shall be of a material approved for the purpose. Manufactured home lot drainage inlets and extensions to grade shall be of a material approved for underground use within a building.

E 301.3 Lot Drainage Inlet. Provision shall be made for plugging or capping the sewage drain inlet where a manufactured home does not occupy the lot. Surface drainage shall be diverted away from the inlet. The rim of the inlet shall extend to a maximum of 4 inches (102 mm) aboveground elevation.

E 301.3.1 Location. Each lot drainage inlet shall be located in the third rear section and within 4 feet (1219 mm) of the proposed location of the manufactured home.

E 301.3.2 Materials. Materials used for drainage connections between a manufactured home, and the lot drainage inlet shall be semi-rigid, corrosion resistant, nonabsorbent, and durable. The inner surface shall be smooth.

E 301.4 Drain Connector. A manufactured home shall be connected to the lot drainage inlet using a drain connector consisting of approved pipe not less than Schedule 40, approved fittings and connectors, and not less in size than the manufactured home drainage outlet. An approved cleanout shall be provided between the manufactured home and the lot drainage inlet. The fitting connected to the lot drainage inlet shall be a directional fitting to discharge the flow into the drainage inlet.

E 301.4.1 Grade and Gastightness. A drain connector shall be installed or maintained with a grade not less than ¼ inch per foot (20.8 mm/m). A drain connector shall be gastight and no longer than necessary to make the connection between the manufactured home outlet and the drain inlet on the lot. A flexible connector shall be permitted to be used at the lot drainage inlet area. Each lot drainage inlet shall be capped gastight where not in use.

E 302.0 Manufactured-Mobile Home Park Water Supply.
E 302.1 Potable Water Supply. An accessible and approved supply of potable water shall be provided in each manufactured home park. Where a public supply of water of approved quantity, quality, and pressure is available at or within the boundary of the park site, the connection shall be made to it and its supply used exclusively. Where an approved public water supply is not available, a private water supply system shall be developed and used as approved by the Authority Having Jurisdiction.

E 302.2 Water Service Outlet. Each manufactured home lot shall be provided with a water service outlet delivering potable water. The water service outlet riser shall be not less than ¼ of an inch (20 mm) nominal pipe size and capable of delivering 12 water supply fixture units.

E 302.2.1 Connection. A manufactured home shall be connected to the park water service outlet by a flexible connector, such as copper or copper alloy or other approved material not less than ¼ of an inch nominal (20 mm) interior diameter.

E 302.2.2 Water Supply Fixture Units. Park water distribution systems shall be designed to deliver a minimum of 12 water supply fixture units to each lot and installed with materials in accordance with Chapter 6, Appendix A, or both of this code.

E 302.2.3 Pressure. Each manufactured home park water distribution system shall be so designed and maintained as to provide a pressure of not less than 20 pounds-force per square inch (psi) (138 kPa) at each manufactured home lot at maximum operating conditions.

E 302.2.4 Location. Each lot water service outlet shall be located in the third rear section and within 4 feet (1219 mm) of the proposed location of the manufactured home.

E 302.3 Shutoff Valve. A separate water shutoff valve shall be installed in each water service outlet at each manufactured home lot. Where a listed backflow protective device is installed, the service shutoff shall be located on the supply side of such device.

E 302.4 Backflow Preventer. Where a condition exists in the plumbing of a manufactured home that creates a cross-connection, a listed backflow preventer shall be installed in the water service line to the manufactured home at or near the water service outlet. Where a hose bibb or outlet is installed on the supply outlet riser in addition to the service connector, a listed backflow preventer shall be installed on each additional outlet.

E 302.5 Pressure-Relief Valve. Where it is required to install a backflow preventer at the manufactured home lot service outlet, a listed pressure-relief valve shall be installed in the water service line on the discharge side of the backflow preventer. Pressure-relief valves shall be set to release at

### TABLE E 301.2(2)
MINIMUM GRADE AND SLOPE OF DRAINAGE PIPE

<table>
<thead>
<tr>
<th>PIPE SIZE (inches)</th>
<th>SLOPE (per 100 feet)</th>
<th>PIPE SIZE (inches)</th>
<th>SLOPE (per 100 feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>25</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>10</td>
<td>3/2</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 inch per foot = 83.3 mm/m
a pressure at a maximum of 150 psi (1034 kPa). Pressure-relief valves shall discharge toward the ground. Backflow preventers and pressure-relief valves shall be not less than 12 inches (305 mm) above the ground.

E 302.6 Mechanical Protection. Park water service outlets, backflow preventers, and pressure-relief valves shall be protected from damage by vehicles or other causes. Such protection shall be permitted to consist of posts, fencing, or other permanent barriers.

E 302.7 Water-Conditioning Equipment. A permit shall be obtained from the Authority Having Jurisdiction before installing water-conditioning equipment on a manufactured home lot. Approval of the park operator is required on applications for a permit to install such equipment. Where the water-conditioning equipment is of the regenerating type, and the park drainage system discharges into a public sewer, approval of the sanitary district or agency having jurisdiction over the public sewer is required.

E 302.7.1 Approval. Regenerating water-conditioning equipment shall be listed and labeled by an approved listing agency.

E 302.7.2 Installation. Regenerating units shall discharge the effluent of regeneration into a trap not less than 1½ inches (40 mm) in diameter connected to the manufactured home park drainage system. An approved air gap shall be installed on the discharge line a minimum of 12 inches (305 mm) above the ground.

E 302.8 Testing. Installations shall be tested and inspected in accordance with Chapter 3 of this code.

E 401.0 Fuel Supply.

E 401.1 Fuel Gas Piping Systems. All fuel gas piping systems serving manufactured homes, accessory buildings, or structures and communities shall be designed and constructed in accordance with any applicable provisions of NFPA 54 and NFPA 58. NFPA 31 shall apply to oil fuel-burning systems and shall conform to the criteria of the Authority Having Jurisdiction. [NFPA 501A:4.1.1.1 – 4.1.1.2]

E 401.2 Gas Supply Connections. Gas supply connections at sites, where provided from an underground gas supply piping system, shall be located and arranged to permit attachment to a manufactured home occupying the site.

For the installation of liquefied petroleum gas (LP-Gas) storage systems, the provisions of NFPA 58 shall be followed. [NFPA 501A:4.1.2.1 – 4.1.2.2]

E 401.3 Location of Gas Supply Connection. The gas supply to the manufactured home shall be located within 4 feet (1219 mm) of the manufactured home stand.

Exception: The requirement of Section E 401.3 shall not apply to gas supply connections for manufactured homes located on all-weather wood, concrete, or concrete block foundation systems or on foundations constructed in accordance with the local building code or, in the absence of a local code, with a recognized model building code. [NFPA 501A:4.1.3]

E 401.4 Recreational Vehicle Park Fuel Gas Equipment and Installations. Fuel gas equipment and installations shall comply with this appendix, except as otherwise permitted or required by this code.

E 402.0 Single and Multiple Manufactured Home Site Fuel Supply Systems.

E 402.1 Underground Installations. Underground gas piping system installations shall comply with any applicable building code, Section E 402.2 and Section E 402.2.1. [NFPA 501A:4.2.1]

E 402.2 Open-Ended Gastight Conduit. Underground gas piping shall not be installed beneath that portion of a manufactured home site reserved for the location of a manufactured home or manufactured home accessory building or structure unless installed in the open-ended gastight conduit of Section E 402.2.1. [NFPA 501A:4.2.1.1]

E 402.2.1 Requirements. The open-ended gastight conduit shall conform to the requirements in the following:

1. The conduit shall be not less than Schedule 40 pipe that is approved for underground installation beneath buildings.
2. The interior diameter of the conduit shall be not less than ½ of an inch (15 mm) larger than the outside diameter of the gas piping.
3. The conduit shall extend to a point not less than 4 inches (102 mm) beyond the outside wall of the manufactured home or accessory building or structure, and the outer ends shall not be sealed.
4. Where the conduit terminates within a manufactured home or accessory building or structure, it shall be accessible, and the space between the conduit and the gas piping shall be sealed to prevent leakage of gas into the building. [NFPA 501A:4.2.1.2 – 4.2.1.2.4]

E 402.3 Shutoff Valve. Each manufactured home site shall have a listed gas shutoff valve installed upstream of the manufactured home site gas outlet. The gas shutoff valve shall be located on the outlet riser at a height of not less than 6 inches (152 mm) above grade. A gas shutoff valve shall not be located under any manufactured home. The outlet shall be equipped with a cap or plug to prevent discharge of gas whenever the manufactured home site outlet is not connected to a manufactured home. [NFPA 501A:4.2.2.1 – 4.2.2.4]

Exception: Gas shutoff valves shall conform to Section E 402.3, except for manufactured homes located on foundations constructed in accordance with the local building code or, in the absence of a local code, with a recognized model building code. [NFPA 501A:4.2.2]

E 402.4 Gas Meters. Where installed, gas meters shall be supported by a post or bracket placed on a firm footing or other means providing equivalent support and shall not depend on the gas outlet riser for support. [NFPA 501A:4.2.3.1]

E 402.4.1 Location of Meters. Each gas meter shall be installed in an accessible location and shall be provided with unions or other fittings so that the meter can
be removed easily and placed in an upright position. Meters shall not be installed in unventilated or inaccessible locations or closer than 3 feet (914 mm) to sources of ignition. [NFPA 501A:4.2.3.2 – 4.2.3.2.2]

**E 402.4.2 Meter Shutoff Valve or Cock.** All gas meter installations shall be provided with shutoff valves or cocks located adjacent to and on the inlet side of the meters. In the case of a single meter installation utilizing an LP-Gas container, the container service valve shall be permitted to be used in lieu of the shutoff valve or cock. All gas meter installations shall be provided with test tees located adjacent to and on the outlet side of the meters. [NFPA 501A:4.2.4.1 – 4.2.4.3]

**E 403.0 Multiple Manufactured Home Site Fuel Distribution and Supply Systems.**

**E 403.1 Manufactured Home Community LP-Gas Supply Systems.** Where 10 or more customers are served by one LP-Gas supply system, the installation of the gas supply system shall be in accordance with 49 CFR 192. Other types of liquefied petroleum gas supply systems and the storage and handling of LP-Gas shall be in accordance with NFPA 58 (See also Section E 403.10). [NFPA 501A:4.3.2.1 – 4.3.2.2]

**E 403.2 Required Gas Supply.** The minimum hourly volume of gas required at each manufactured home site outlet or any section of the manufactured home community gas piping system shall be calculated as shown in Table E 403.2.

In extreme climate areas, additional capacities other than those in Table E 403.2 shall be considered. [NFPA 501A:4.3.4.1 – 4.3.4.2]

**TABLE E 403.2**

DEMAND FACTORS FOR USE IN CALCULATING GAS PIPING SYSTEMS IN MANUFACTURED HOME COMMUNITIES [NFPA 501A: TABLE 4.3.4.1]

<table>
<thead>
<tr>
<th>NUMBER OF MANUFACTURED HOME SITES</th>
<th>BTU/H PER MANUFACTURED HOME SITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>125 000</td>
</tr>
<tr>
<td>2</td>
<td>117 000</td>
</tr>
<tr>
<td>3</td>
<td>104 000</td>
</tr>
<tr>
<td>4</td>
<td>96 000</td>
</tr>
<tr>
<td>5</td>
<td>92 000</td>
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<tr>
<td>6</td>
<td>87 000</td>
</tr>
<tr>
<td>7</td>
<td>83 000</td>
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<td>8</td>
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</tr>
<tr>
<td>9</td>
<td>79 000</td>
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<tr>
<td>10</td>
<td>77 000</td>
</tr>
<tr>
<td>11–20</td>
<td>66 000</td>
</tr>
<tr>
<td>21–30</td>
<td>62 000</td>
</tr>
<tr>
<td>31–40</td>
<td>58 000</td>
</tr>
<tr>
<td>41–60</td>
<td>55 000</td>
</tr>
<tr>
<td>Over 60</td>
<td>50 000</td>
</tr>
</tbody>
</table>

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

**E 403.3 Size.** The size of each section of a gas piping system shall be determined in accordance with NFPA 54 or by other standard engineering methods acceptable to the Authority Having Jurisdiction. [NFPA 501A:4.3.5.1]

**E 403.4 Pressure.** Where all connected appliances are operated at their rated capacity, the gas supply pressure shall be not less than 7 inches water column (1.7 kPa). The gas supply pressure shall not exceed 14 inches water column (3.5 kPa). [NFPA 501A:4.3.5.2]

**E 403.5 Metal Gas Piping.** Metal gas pipe shall be standard-weight wrought iron or steel (galvanized or black), yellow brass containing not more than 75 percent copper, or internally tinned or treated copper of iron pipe size. Galvanizing shall not be considered protection against corrosion.

Seamless copper or steel tubing shall be permitted to be used with gases not corrosive to such material. Steel tubing shall comply with ASTM A254. Copper tubing shall comply with ASTM B88 (Type K or Type L) or ASTM B280. Copper tubing (unless tin-lined) shall not be used if the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 standard cubic feet (scf) of gas (0.7 mg/100 L). [NFPA 501A:4.3.6.1.1 – 4.3.6.1.6]

**E 403.6 Protection Coatings for Metal Gas Piping.** All buried or submerged metallic gas piping shall be protected from corrosion by approved coatings or wrapping materials. All gas pipe protective coatings shall be approved types, shall be machine applied, and shall conform to recognized standards. Field wrapping shall provide equivalent protection and is restricted to those short sections and fittings that are necessarily stripped for threading or welding. Risers shall be coated or wrapped to a point at least 6 inches (152 mm) above ground. [NFPA 501A:4.3.6.2.1 – 4.3.6.2.4]

**E 403.7 Plastic Piping.** Plastic piping shall only be used underground and shall meet the requirements of ASTM D2513 or ASTM D2517, as well as the design pressure and design limitations of 49 CFR 192. [NFPA 501A:4.3.7.2.1, 4.3.7.2.2]

**E 403.8 Gas Piping Installation.** All piping installed below ground level shall have a minimum earth cover of 18 inches (457 mm) and shall be installed with at least 12 inches (305 mm) of clearance in any direction from any other underground utility system. [NFPA 501A:4.3.7.2.1]

**E 403.8.1 Metallic Gas Piping.** All metallic gas piping systems shall be installed in accordance with approved plans and specifications, including provisions for cathodic protection. Each cathodic protection system shall be designed and installed to conform to the provisions of 49 CFR 192. [NFPA 501A:4.3.7.2.1, 4.3.7.2.2]

**E 403.8.2 Cathodic Protection.** Where the cathodic protection system is designed to protect only the gas piping system, the gas piping system shall be electrically isolated from all other underground metallic systems or installations. Where only the gas piping system is cathodically protected against corrosion, a dielectric fitting shall be used in the manufactured home gas connection to
insulate the manufactured home from the underground gas piping system. [NFPA 501A:4.3.7.2.3, 4.3.7.2.4]

**E 403.8.3 Underground Metallic Systems.** Where a cathodic protection system is designed to provide all underground metallic systems and installations with protection against corrosion, all such systems and installations shall be electrically bonded together and protected as a whole. [NFPA 501A:4.3.7.2.5]

**E 403.8.4 Plastic Gas Piping.** Plastic gas piping shall be used only underground and shall be installed with an electrically conductive wire for locating the pipe. The wire used to locate the plastic pipe shall be copper, not smaller in size than 18 AWG, with insulation approved for direct burial. Every portion of a plastic gas piping system consisting of metallic pipe shall be cathodically protected against corrosion. [NFPA 501A:4.3.7.3.1 – 4.3.7.3.3]

**E 403.9 Gas Piping System Shutoff Valve.** An accessible and identifiable shutoff valve controlling the flow of gas to the entire manufactured home community gas piping system shall be installed in a location acceptable to the Authority Having Jurisdiction and near the point of connection to the service piping or to the supply connection of an LP-Gas container. [NFPA 501A:4.3.7.4]

**E 403.10 Liquefied Petroleum Gas Equipment.** LP-Gas equipment shall be installed in accordance with the applicable provisions of NFPA 58. [NFPA 501A:4.3.8]

**E 403.11 Oil Supply.** The following three methods of supplying oil to an individual manufactured home site shall be permitted:

1. Supply from an outside underground tank (see Section E 404.6).
2. Supply from a centralized oil distribution system designed and installed in accordance with accepted engineering practices and in compliance with NFPA 31.
3. Supply from an outside aboveground tank (see Section E 404.6). [NFPA 501A:4.3.9]

**E 403.12 Minimum Oil Supply Tank Size.** Oil supply tanks shall have a minimum capacity equal to 20 percent of the average annual oil consumption. [NFPA 501A:4.3.10]

**E 403.13 Oil Supply Connections.** Oil supply connections at manufactured home sites, where provided from a centralized oil distribution system, shall be located and arranged to permit attachment to a manufactured home utilizing the stand. [NFPA 501A:4.3.11.1] The installation of such facilities shall comply with the following requirements:

1. The main distribution pipeline shall be permitted to be connected to a tank or tanks having an aggregate capacity not exceeding 20,000 gallons (75,708 L) at a point below the liquid level.
2. Where this piping is so connected, a readily accessible internal or external shutoff valve shall be installed in the piping as close as practicable to the tank.
3. If external and aboveground, the shutoff valve and its tank connections shall be made of steel.
4. Connections between the tank(s) and the main pipeline shall be made with double swing joints or flexible connectors, or shall otherwise be arranged to permit the tank(s) to settle without damaging the system.
5. If located aboveground, the connections specified in Section E 403.13(4) shall be located within the diked area.
6. A readily accessible and identified manual shutoff valve shall be installed either inside or outside of the structure in each branch supply pipeline that enters a building, mobile home, travel trailer, or other structure. If outside, the valve shall be protected from weather and damage. If inside, the valve shall be located directly adjacent to the point at which the supply line enters the structure. If outside, the valve shall be protected from weather and damage.
7. A device shall be provided in the supply line at or ahead of the point where it enters the interior of the structure that will automatically shut off the oil supply, if the supply line between this device and the appliance is broken. This device shall be located on the appliance side of the manual shutoff valve required in Section E 403.13(6) and shall be solidly supported and protected from damage.
8. Means shall be provided to limit the oil pressure at the appliance inlet to a maximum gauge pressure of 3 pounds-force per square inch gauge (psig) (21 kPa). If a pressure-reducing valve is used, it shall be a type approved for the service.
9. A device shall be provided that will automatically shut off the oil supply to the appliance if the oil pressure at the appliance inlet exceeds a gauge pressure of 8 psig (55 kPa). This device shall not be required under either of the following conditions:
   a. Where the distribution system is supplied from a gravity tank and the maximum hydrostatic head of oil in the tank is such that the oil pressure at the appliance inlet will not exceed a gauge pressure of 8 psig (55 kPa).
   b. Where a means is provided to automatically shut off the oil supply if the pressure-regulating device provided in accordance with Section E 403.13(8) fails to regulate the pressure as required.
10. Only appliances equipped with primary safety controls specifically listed for the appliance shall be connected to a centralized oil distribution system. [NFPA 31:9.2.10 – 9.2.15]

**E 404.0 Fuel Supply Systems Installation.**

**E 404.1 Flexible Gas Connector.** Except for manufactured homes located on an all-weather wood, concrete, or concrete block foundation system or on a foundation constructed in accordance with the local building code or, in the absence of a local code, with a recognized model building code, each gas supply connector shall be listed for outside manufactured home use, shall be not more than 6 feet (1829 mm) in length, and shall have a capacity rating to supply the connected load. [NFPA 501A:4.4.1]
E 404.2 Use of Approved Pipe and Fittings of Extension. Where it is necessary to extend a manufactured home inlet to permit connection of the 6 foot (1829 mm) listed connector to the site gas outlet, the extension shall be of approved materials of the same size as the manufactured home inlet and shall be adequately supported at no more than 4 foot (1219 mm) intervals to the manufactured home. [NFPA 501A:4.4.2]

E 404.3 Mechanical Protection. All gas outlet risers, regulators, meters, valves, and other exposed equipment shall be protected against accidental damage. [NFPA 501A:4.4.3]

E 404.4 Special Rules on Atmospherically Controlled Regulators. Atmospherically controlled regulators shall be installed in such a manner that moisture cannot enter the regulator vent and accumulate above the diaphragm. Where the regulator vent is obstructed due to snow and icing conditions, shields, hoods, or other suitable devices shall be provided to guard against closing of the vent opening. [NFPA 501A:4.4.4.1 – 4.4.4.2]

E 404.5 Fuel Gas Piping Test. The manufactured home fuel gas piping system shall be tested only with air before it is connected to the gas supply. The manufactured home gas piping system shall be subjected to a pressure test with all appliance shutoff valves in their closed positions. [NFPA 501A:4.4.5]

E 404.5.1 Procedures. The fuel gas piping test shall consist of air pressure at not less than 10 inches water column or more than 14 inches water column (2.5 kPa to 3.5 kPa). The fuel gas piping system shall be isolated from the air pressure source and shall maintain this pressure for not less than 10 minutes without perceptible leakage. Upon satisfactory completion of the fuel gas piping test, the appliance valves shall be opened, and the gas appliance connectors shall be tested with soapy water or bubble solution while under the pressure remaining in the piping system. Solutions used for testing for leakage shall not contain corrosive chemicals. Pressure shall be measured with a manometer, slope gauge, or gauge that is calibrated in either water inch (mm) or psi (kPa) with increments of either 1⁄8 inch (2.5 mm) or 1⁄16 psi (0.7 kPa) gauge, as applicable. Upon satisfactory completion of the fuel gas piping test, the manufactured home gas supply connector shall be installed, and the connections shall be tested with soapy water or bubble solution. [NFPA 501A:4.4.5.1.1 – 4.4.5.1.6]

E 404.5.2 Warning. The following warning shall be supplied to the installer:

WARNING: Do not overpressurize the fuel gas piping system. Damage to valves, regulators, and appliances can occur due to pressurization beyond the maximums specified. [NFPA 501A:4.4.5.2]

E 404.5.3 Vents. Gas appliance vents shall be visually inspected to ensure that they have not been dislodged in transit and are connected securely to the appliance. [NFPA 501A:4.4.5.3]

E 404.6 Oil Tanks. Oil tank capacities shall comply with the following:

(1) No more than one 660 gallon (2498 L) tank or two tanks with an aggregate capacity of 660 gallons (2498 L) or less shall be connected to one oil-burning appliance.

(2) Two supply tanks, where used, shall be cross-connected and provided with a single fill and single vent, as described in NFPA 31 and shall be on a common slab and rigidly secured, one to the other.

(3) Tanks having a capacity of 660 gallons (2498 L) or less shall be securely supported by rigid, noncombustible supports to prevent settling, sliding, or lifting. [NFPA 501A:4.4.6]

E 404.6.1 Installation. Oil supply tanks shall be installed in accordance with the applicable provisions of NFPA 31. [NFPA 501A:4.4.6.1]

E 404.6.2 Capacity. A tank with a capacity no larger than 60 gallons (227 L) shall be permitted to be a DOT-5 shipping container (drum), and so marked, or a tank meeting the provisions of UL 80. Tanks other than DOT-5 shipping containers having a capacity of not more than 660 gallons (2498 L) shall meet the provisions of UL 80. Pressure tanks shall be built in accordance with Section VIII, Pressure Vessels of the ASME Boiler and Pressure Vessel Code. [NFPA 501A:4.4.6.2.1 – 4.4.6.2.2]

E 404.6.3 Location. Tanks, as described in Section E 404.6 and Section E 404.6.2, that are adjacent to buildings shall be located not less than 10 feet (3048 mm) from a property line that is permitted to be built upon. [NFPA 501A:4.4.6.3]

E 404.6.4 Vent. Tanks with a capacity no larger than 660 gallons (2498 L) shall be equipped with an open vent not smaller than 1⁄2 inch (40 mm) pipe size; tanks with a capacity no larger than 660 gallons (2498 L) shall be equipped with a vent of 1⁄2 inch (32 mm) pipe size. [NFPA 501A:4.4.6.4]

E 404.6.5 Liquid Level. Tanks shall be provided with a means of determining the liquid level. [NFPA 501A:4.4.6.5]

E 404.6.6 Fill Opening. The fill opening shall be a size and in a location that permits filling without spillage. [NFPA 501A:4.4.6.6]

E 405.0 Manufactured Home Accessory Building Fuel Supply Systems.

E 405.1 General. Fuel gas supply systems installed in a manufactured home accessory building or structure shall comply with the applicable provisions of NFPA 54 and NFPA 58. Fuel oil supply systems shall comply with the applicable provisions of NFPA 31. [NFPA 501A:4.5.1 – 4.5.2]

E 406.0 Community Building Fuel Supply Systems in Manufactured Home Communities.

E 406.1 Fuel Gas Piping and Equipment Installations. Fuel gas piping and equipment installed within a permanent building in a manufactured home community shall comply with nationally recognized appliance and fuel gas piping codes and standards adopted by the Authority Having Jurisdiction. Where the state or other political subdivision does not assume jurisdiction, such fuel gas piping and equipment installations shall be designed and installed in accordance with the applicable provisions of NFPA 54 or NFPA 58. [NFPA 501A:4.6.1.1 – 4.6.1.2]
E 406.2 Oil Supply Systems. Oil burning equipment and installation within a manufactured home community shall be designed and constructed in accordance with the applicable codes and standards adopted by the Authority Having Jurisdiction. Where the state or other political subdivision does not assume jurisdiction, such installations shall be designed and constructed in accordance with the applicable provisions of NFPA 31. [NFPA 501A:4.6.2.1 – 4.6.2.2]

E 406.3 Oil-Burning Equipment and Installation. Oil burning equipment and installation within a building constructed in a manufactured home community in accordance with the local building code or a nationally recognized building code shall comply with nationally recognized codes and standards adopted by the Authority Having Jurisdiction. Where the state or other political subdivision does not assume jurisdiction, such oil-burning equipment and installations shall be designed and installed in accordance with the applicable provisions of NFPA 31. [NFPA 501A:4.6.3.1 – 4.6.3.2]

E 406.4 Inspections and Tests. Inspections and tests for fuel gas piping shall be made in accordance with Chapter 1 and Chapter 12 of this code.

E 501.0 Recreational Vehicle Parks.

E 501.1 Plumbing Systems. Plumbing systems shall be installed in accordance with the plumbing codes of the Authority Having Jurisdiction and with this appendix.

E 501.2 Toilet Facilities. Water closets and urinals shall be provided at one or more locations in a recreational vehicle park. They shall be of convenient access and shall be located within a 500 foot (152 m) radius from a recreational vehicle site not provided with an individual sewer connection.

E 501.2.1 Signage. Facilities for males and females shall be appropriately marked.

E 501.2.2 Interior Finish. The interior finish of walls shall be moisture resistant to a height of not less than 4 feet (1219 mm) to facilitate washing and cleaning.

E 501.2.3 Receptacle. Each toilet room for women shall be provided with a receptacle for sanitary napkins. The receptacle shall be of durable, impervious, readily cleanable material, and shall be provided with a lid.

E 501.2.4 Ceiling Height and Doors. A toilet facility shall have a ceiling height of not less than 7 feet (2134 mm) and, unless the artificial light is provided, a window or skylight area equal to not less than 10 percent of the floor area shall be provided.

Doors to the exterior shall open outward, be self-closing, and shall be visually screened using a vestibule or wall to prevent a direct view of the interior where the exterior doors are open. Such screening shall not be required on single toilet units.

E 501.2.5 Ventilation. A toilet facility shall have permanent, non-closable, screened opening(s), having a total area not less than 5 percent of the floor area and opening directly to the exterior to provide proper ventilation. A listed exhaust fan(s), vented to the exterior, the rating of which in cubic feet per minute (L/s) is not less than 25 percent of the total volume of the room(s) served, shall be considered as meeting the requirements of this section. Openable windows and vents to the outside shall be provided with fly-proof screens of not less than number 16 mesh.

E 501.3 Water Closets. Not less than one water closet shall be provided for each sex up to the first 25 sites. For each additional 25 sites not provided with sewer connections, an additional water closet shall be provided.

E 501.3.1 Application. Water closets shall be of an approved, elongated bowl type and shall be provided with seats with open fronts.

E 501.3.2 Compartment. Each water closet shall be in a separate compartment and shall be provided with a latched door for privacy. A holder or dispenser for toilet paper shall be provided. Dividing walls or partitions shall be not less than 5 feet (1524 mm) high and shall be separated from the floor by a space not exceeding 12 inches (305 mm).

E 501.3.3 Size. Water closet compartments shall be not less than 30 inches (762 mm) in width [no water closet shall be set closer than 15 inches (381 mm) from its center to a side wall] and shall be not less than 30 inches (762 mm) of clear space in front of each water closet.

E 501.4 Lavatories. Where water-supplied water closets are provided, an equal number of lavatories shall be provided for up to six water closets. One additional lavatory shall be provided for each two water closets where more than six water closets are required. Each lavatory basin shall have a piped supply of potable water and shall drain into the drainage system.

E 501.5 Urinals. Where separate facilities are provided for men and women, urinals shall be acceptable for not more than one-third of the water closets required in the men’s facilities, except that one urinal shall be permitted to be used to replace a water closet in a minimum park. Individual stall or wall-hung types of urinals shall be installed. Floor-type trough units shall be prohibited.

E 501.6 Floors and Drains. The floors shall be constructed of material impervious to water and shall be easily cleanable. A building having water-supplied water closets shall be provided with a floor drain in the toilet room. This drain shall be provided with means to protect the trap seal in accordance with this code.

E 501.7 Shower Size. Each shower, where provided, shall have a floor area of 36 inches by 36 inches (914 mm by 914 mm), shall be capable of encompassing a 30 inch (762 mm) diameter circle and shall be of the individual type. The shower area shall be visually screened from view with a minimum floor area of 36 by 36 inches (914 mm by 914 mm) per shower. Each shall be provided with individual dressing areas screened from view and shall contain a minimum of one clothing hook and stool (or bench area).

E 501.7.1 Drainage Connection. Each shower area shall be designed to minimize the flow of water into the dressing area and shall be connected to the drainage system using a properly trapped and vented inlet. Each such area shall have an impervious, skid-resistant surface; wooden racks (duck boards) over shower floors shall be prohibited.
E 501.8 Drinking Fountains. Where provided, drinking fountains shall be in accordance with the requirements of this code.

E 502.0 Recreational Vehicle Park Potable Water Supply and Distribution.

E 502.1 Quality. The supply or supplies of water shall comply with the potable water standards of the state, local health authority or, in the absence thereof, with the Drinking Water Standard of the Federal Environmental Protection Agency.

E 502.2 Sources. Water approved by a regulating agency shall be acceptable. Where an approved public water supply system is available, it shall be used. Where the park has its own water supply system, the components of the system shall be approved. A water supply system that is used on a seasonal basis shall be provided with means for draining.

E 502.3 Prohibited Connections. The potable water supply shall not be connected to a nonpotable or unapproved water supply, nor be subjected to backflow or backsiphonage.

E 502.4 Supply. The water supply system shall be designed and constructed in accordance with the following:

1. A minimum of 25 gallons (95 L) per day per site for sites without individual water connections.
2. A minimum of 50 gallons (189 L) per day per site for sites with individual water connections.
3. A minimum of 50 gallons (189 L) per day per site where water-supplied water closets are provided in restrooms.

E 502.5 Pressure and Volume. Where water is distributed under pressure to an individual site, the water supply system shall be designed to provide a minimum flow pressure of not less than 20 psi (138 kPa) with a minimum flow of 2 gallons per minute (gpm) (0.1 L/s) at an outlet. The pressure shall not exceed 80 psi (552 kPa).

E 502.6 Outlets. Water outlets shall be convenient to access and, where not piped to individual recreational vehicle sites, shall not exceed 300 feet (91 m) from a site. Provisions shall be made to prevent accumulation of standing water or the creation of muddy conditions at each water outlet.

E 502.7 Storage Tanks. Water storage tanks shall be constructed of impervious materials, protected against contamination, and provided with locked, watertight covers. Overflow or ventilation openings shall be down-facing and provided with a corrosion-resistant screening of not less than number 24 mesh to prevent the entrance of insects and vermin. Water storage tanks shall not have direct connections to sewers.

E 503.0 Recreational Vehicle Park Water Connections for Individual Recreational Vehicles.

E 503.1 Location. Where provided, the water connections for potable water to individual recreational vehicle sites shall be located on the left rear half of the site (left side of recreational vehicle) within 4 feet (1219 mm) of the stand.

E 503.2 Water Riser Pipe. Each potable water connection shall consist of a water riser pipe that is equipped with a threaded male spigot located not less than 12 inches (305 mm) but not more than 24 inches (610 mm) above grade level for the attachment of a standard water hose. The water riser pipe shall be protected from physical damage in accordance with this code. This connection shall be equipped with a listed anti-siphon backflow prevention device.

E 504.0 Recreational Vehicle Park Drainage System.

E 504.1 Where Required. An approved drainage system shall be provided in recreational vehicle parks for conveying and disposing of sewage. Where available, parks shall be connected to a public sewer system.

E 504.2 Location. Sewer lines shall be located to prevent damage from vehicular traffic.

E 504.3 Materials. Pipe and fittings installed in the drainage system shall be of material listed, approved, and installed in accordance with this code.

E 504.4 Pipe Sizes. The minimum diameters of drainage laterals, branches, and mains serving recreational vehicle sites shall be in accordance with Table E 504.4.

<table>
<thead>
<tr>
<th>MAXIMUM NUMBER OF RECREATIONAL VEHICLE STANDS SERVED</th>
<th>MINIMUM PIPE SIZES (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>36</td>
<td>4</td>
</tr>
<tr>
<td>71</td>
<td>5</td>
</tr>
<tr>
<td>120</td>
<td>6</td>
</tr>
<tr>
<td>440</td>
<td>8</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm

E 504.5 Cleanouts. Cleanouts shall be provided in accordance with Chapter 7 of this code.

E 504.6 Drainage Inlet. Where provided, the site drainage system inlet connections for individual recreational vehicles shall be located to prevent damage by the parking of recreational vehicles or automobiles and shall consist of a sewer riser extending vertically to grade. The minimum diameter of the sewer riser pipe shall be not less than 3 inches (80 mm) in diameter, and shall be provided with a 4 inch (100 mm) inlet or not less than a 3 inch (80 mm) female fitting.

E 504.6.1 Location. Where provided, the sewer inlet to individual recreational vehicle sites shall be located on the left rear half of the site (left side of the recreational vehicle) within 4 feet (1219 mm) of the stand.

E 504.6.2 Protection. The sewer riser pipe shall be firmly imbedded in the ground and protected against damage from movement. It shall be provided with a tight-fitting plug or cap, which shall be secured by a durable chain (or equivalent) to prevent loss.

E 505.0 Recreational Vehicle Park Sanitary Disposal Stations.

E 505.1 Where Required. One recreational vehicle sanitary disposal station shall be provided for each 100 recreational vehicle sites, or part thereof, which are not equipped with individual drainage system connections.
**E 505.2 Access.** Each station shall be level and convenient of access from the service road and shall provide easy ingress and egress for recreational vehicles.

**E 505.3 Construction.** Unless other approved means are used, each station shall have a concrete slab with the drainage system inlet located to be on the road (left) side of the recreational vehicle. The slab shall be not less than 3 feet by 3 feet (914 mm by 914 mm), not less than 3½ inches (89 mm) thick and properly reinforced. The slab surface is to be troweled to a smooth finish and sloped from each side inward to a drainage system inlet.

The drainage system inlet shall consist of a 4 inch (102 mm), self-closing, foot-operated hatch of approved material with the cover milled to fit tight. The hatch body shall be set in the concrete of the slab with the lip of the opening flush with its surface to facilitate the cleansing of the slab with water. The hatch shall be properly connected to a drainage system inlet, which shall discharge to an approved sanitary sewage disposal facility.

**E 505.4 Flushing Device.** Where the recreational vehicle park is provided with a piped water supply system, means for flushing the recreational vehicle holding tank and the sanitary disposal station slab shall be provided that consists of a piped supply of water under pressure, terminating in an outlet located and installed to prevent damage by automobiles or recreational vehicles. The flushing device shall consist of a properly supported riser terminating not less than 2 feet (610 mm) above the ground surface, with a ¾ of an inch (20 mm) valved outlet adaptable for a flexible hose.

The water supply to the flushing device shall be protected from backflow using a listed vacuum breaker or backflow prevention device located downstream from the last shutoff valve.

Adjacent to the flushing arrangement shall be posted a sign of durable material not less than 2 feet by 2 feet (610 mm by 610 mm) in size. Inscribed thereon in clearly legible letters shall be the following:

“DANGER – NOT TO BE USED FOR DRINKING OR DOMESTIC PURPOSES.”

**E 506.0 Recreational Vehicle Park Water Supply Stations.**

**E 506.1 Potable Watering Stations.** A potable watering station, where provided for filling recreational vehicle potable water tanks, shall be located not less than 50 feet (15 240 mm) from a sanitary disposal station. Where such is provided, adjacent to the potable water outlet there shall be a posted sign of durable material not less than 2 feet by 2 feet (610 mm by 610 mm) in size. Inscribed thereon in clear, legible letters on a contrasting background shall be:

“POTABLE WATER. NOT TO BE USED FOR FLUSHING WASTE TANKS.”

The potable water shall be protected from backflow using a listed vacuum breaker located downstream from the last shutoff valve.
APPENDIX F
FIREFIGHTER BREATHING AIR REPLENISHMENT SYSTEMS

F 101.0 General.
F 101.1 Applicability. This chapter covers minimum requirements for the installation of firefighter breathing air replenishment systems.

F 201.0 Definitions.
F 201.1 General. For the purposes of this chapter appendix, the following definitions shall apply:

High-Rise Building. A building where the floor of an occupiable story is greater than 75 feet (22 860 mm) above the lowest level of fire department vehicle access. [NFPA 5000:3.3.68.10]

Interior Cylinder Fill Panels. Lockable interior panels that provide firefighters the ability to regulate breathing air pressure and refill self-contained breathing apparatus (SCBA) cylinders.

Interior Cylinder Fill Stations and Enclosures. Freestanding fill containment stations that provide firefighters the ability to regulate breathing air pressure and refill SCBA cylinders.

Open-Circuit Self-Contained Breathing Apparatus. An SCBA in which exhalation is vented to the atmosphere and not rebreathed. [NFPA 1981:3.3.34]

Self-Contained Breathing Apparatus (SCBA). An atmosphere-supplying respirator that supplies a respirable air atmosphere to the user from a breathing air source that is independent of the ambient environment and designed to be carried by the user. [NFPA 1981:3.3.46]

For this appendix, where this term is used without a qualifier, it indicates an open-circuit self-contained breathing apparatus or combination SCBA/SARs. For this appendix, combination SCBA/SARs are encompassed by the terms self-contained breathing apparatus or SCBA.

Welding Procedure Specification (WPS). A written qualified welding procedure prepared to provide direction for making production welds to code requirements. [ASME B31.1:100.2]

F 301.0 System Components.
F 301.1 General. Firefighter breathing air replenishment systems shall contain, as a minimum, the following components:

(1) Exterior fire department connection panel
(2) Interior fire department air fill panel or station
(3) Interconnected piping distribution system
(4) Pressure monitoring switch

F 401.0 Required Installations.
F 401.1 General. A firefighter air system shall be installed in the following buildings:

(1) High-rise buildings.
(2) Underground structures that are three or more floors below grade with an area greater than 20 000 square feet (1858 m²).
(3) Large area structures with an area greater than 200 000 square feet (18 580 m²) and where the travel distance from the building centerline to the closest exit is greater than 500 feet (152 m), such as warehouses, manufacturing complexes, malls, or convention centers.
(4) Underground transportation or pedestrian tunnels exceeding 500 feet (152 m) in length.
F 501.8 Pressure-Relief Valve. Pressure-relief valves shall be installed downstream of the pressure regulator inlet. The relief valve shall meet the requirements of CGA S-1.3 and shall not be field adjustable. The relief valve shall have a set-to-open pressure not exceeding 1.1 times the design pressure of the system. Pressure-relief valve discharge shall terminate so that the exhaust air stream cannot impinge upon personnel in the area. Valves, plugs, or caps shall not be installed in the discharge of a pressure-relief valve. Where discharge piping is used, the end shall not be threaded.

F 501.9 Security. The fire department connection panel enclosure shall be locked by an approved means.

F 601.0 Interior Cylinder Fill Panels.

F 601.1 Cabinet Requirements. Each cylinder fill panel shall be installed in a metal cabinet constructed of not less than 18-gauge carbon steel or equivalent. The depth of the cabinet shall not create an exit obstruction where installed in building stairwells. Except for the shutoff valve, pressure gauges, fill hoses and ancillary components; no system components shall be visible and shall be contained behind a not less than an 18-gauge interior panel.

F 601.2 Clearance and Access. The panel shall be located not less than 36 inches (914 mm) but not more than 60 inches (1524 mm) above the finished floor or a stairway landing. Clear, unobstructed access shall be provided to each panel.

F 601.3 Door. The door shall be arranged such that where the door is open, it does not reduce the required exit width or create an obstruction in the path of egress.

F 601.4 Cabinet Marking. The front of each cylinder fill panel shall be marked, “FIREFIGHTER AIR SYSTEM.” The lettering shall be in a color that contrasts with the cabinet front and in letters that are not less than 2 inches (51 mm) high with a 3⁄8 of an inch (9.5 mm) brush stroke.

F 601.5 Cabinet Components. The cabinet shall be of a size to allow for the installation of the components in Section F 601.5.1.

F 601.5.1 Cylinder Fill Panel. The cylinder fill panel shall contain the gauges, isolation valves, pressure-regulating valves, check valves, tubing, fittings, supports, connectors, hoses, adapters, and other components to refill SCBA cylinders.

F 601.6 Cylinder Filling Hose. The design of the cabinet shall provide a means for storing the hose to prevent kinking. Where the hose is coiled, the brackets shall be installed so that the hose bend radius is maintained at 4 inches (102 mm) or greater. Fill hose connectors for connection to SCBA cylinders shall comply with the requirements of CGA V-1, number 346 or 347. No other SCBA cylinder fill connections shall be permitted.

F 601.7 Security. Each panel cover shall be maintained and locked by an approved means.

F 701.0 Interior Cylinder Fill Stations and Enclosures.

F 701.1 Location. The location of the closet or room for each air fill station shall be approved by the Authority Having Jurisdiction. Where approved by the Authority Having Jurisdiction, space shall be permitted to be utilized for other firefighting purposes. The door to each room enclosing the air filling station enclosure shall be readily accessible at all times. Not less than a 6 foot (1829 mm) radius and 180-degree (3.14 rad) clear, unobstructed access to the front of the air filling station shall be provided. The enclosure shall have emergency lighting installed in accordance with NFPA 70.

F 701.2 Security. Each air fill station shall be installed within a lockable enclosure, closet, or room by an approved means. Access to fill equipment and controls shall be restricted to authorized personnel by key or other means.

F 701.3 Components. The air fill station shall contain the gauges, isolation valves, pressure-relief valves, pressure-regulating valves, check valves, tubing, fittings, supports, connectors, hoses, adapters, and other components to refill SCBA cylinders.

F 701.4 Cylinder Filling Hose. Where hoses are used, the design of the cabinet shall provide a means for storing the hose to prevent kinking. Where the hose is coiled, the brackets shall be installed so that the hose bend radius is maintained at 4 inches (102 mm) or greater. Fill hose connectors for connection to SCBA cylinders shall comply with the requirements of CGA V-1, number 346 or 347. For high-pressure SCBA cylinders of 4500 pounds-force per square inch (psi) (31 026 kPa), no. 347 connectors shall be used. For low-pressure SCBA cylinders of 3000 psi (20 684 kPa) and 2200 psi (15 168 kPa), no. 346 connectors shall be used. No other SCBA cylinder fill connections shall be permitted.

F 701.5 Enclosure and Air Filling Station Marking. Each enclosure, closet, or room shall be marked, “FIREFIGHTERS AIR SYSTEM.” The lettering shall be in a color that contrasts with the cabinet front and in letters that are not less than 2 inches (51 mm) high with a 3⁄8 of an inch (9.5 mm) brush stroke.

F 801.0 Materials.

F 801.1 General. Pressurized components shall be compatible for use with high-pressure breathing air equipment and self-contained breathing air apparatus. Pressurized breathing air components shall be rated for not less than a working pressure of 5000 psi (34 474 kPa).

F 801.2 Tubing. Tubing shall be stainless steel in accordance with ASTM A269, or other approved materials that are compatible with breathing air at the system pressure. Routing of tubing and bends shall be such as to protect the tubing from mechanical damage.

F 801.3 Fittings. Fittings shall be constructed of stainless steel in accordance with ASTM A479, or other approved materials that are compatible with breathing air at the system pressure.

F 801.4 Prohibited Materials. The use of nonmetallic materials, carbon steel, iron pipe, malleable iron, high-strength gray iron, or alloy steel shall be prohibited for breathing air pipe and tubing materials.

F 801.5 Pressure Monitoring Switch. An electric low-pressure monitoring switch shall be installed in the piping
system to monitor the air pressure. The pressure switch shall transmit a supervisory signal to the central alarm monitoring station where the pressure of the breathing air system is less than 80 percent of the system operating pressure. Activation of the pressure switch shall also activate an audible alarm and visual strobe located at the building annunciator panel. A weather-resistant sign shall be provided in conjunction with the audible alarm stating, “FIREFIGHTER AIR SYSTEM – LOW AIR PRESSURE ALARM.” Where not part of a building annunciator panel, the lettering shall be in a contrasting color, and the letters shall be not less than 2 inches (51 mm) high with a ¼ of an inch (9.5 mm) brush stroke.

**F 801.6 Isolation Valve.** A system isolation valve shall be installed downstream of each air fill station and shall be located in the panel or within 3 feet (914 mm) of the station. The isolation valve shall be marked with its function in letters that are not less than ⅛ of an inch (4.8 mm) high with a ⅛ of an inch (1.6 mm) brush stroke.

**F 901.0 System Requirements.**

**F 901.1 Protection.** Components of the firefighter breathing air replenishment system installed in a building or structure shall be protected by not less than a 2-hour fire-resistive construction. Components shall be protected from physical damage.

**F 901.2 Markings.** Components shall be clearly identified using stainless steel or plastic labels or tags indicating their function. This shall include not less than all fire department connection panels, air fill stations, air storage system, gauges, valves, air connections, air outlets, enclosures, and doors.

**F 901.3 Tubing Markings.** Tubing shall be clearly marked, “FIREFIGHTERS AIR SYSTEM” and “HIGH PRESSURE BREATHING AIR” using signs or self-adhesive labels. Signs shall be 1 inch (25.4 mm) high and shall be secured to the tubing. Signs shall be made of copper alloy, stainless steel, or plastic and engraved with ⅛ of an inch (9.5 mm) letters with a ⅛ of an inch (1.6 mm) stroke lettering. Signs or labels shall be placed at not less than 20 foot (6096 mm) intervals and at each fitting, whether the tubing is concealed or in plain view. Tubing shall have a sign or label at an accessible point.

**F 901.4 Support.** Pipe and tubing shall be supported at intervals not less than that shown in Table 313.3 of this code. Pipe and tubing shall be supported in accordance with Section 313.0 of this code.

**F 1001.0 Design Criteria.**

**F 1001.1 Fill Time.** The system shall be designed to fill, at the most remote fill station or panel, not less than two 66 cubic foot (ft³) (1.87 m³) compressed breathing air cylinders to a pressure not to exceed 4500 psi (31 026 kPa) simultaneously in 3 minutes or less. Where greater capacity is required, the Authority Having Jurisdiction shall specify the required system capacity.

**F 1001.2 Fill Panels or Stations Location.** Cylinder fill panels or stations shall be installed in the interior of buildings in accordance with Section F 1001.2.1 through Section F 1001.2.3.

**F 1001.2.1 High-Rise Buildings.** An interior cylinder fill panel or station shall be installed commencing on the third floor and every third floor thereafter above grade. For underground floors in buildings with more than five underground floors, an interior cylinder fill panel or station shall be installed commencing on the third floor below grade and every three floors below grade thereafter, except for the bottom-most floor.

**F 1001.2.2 Underground Structures.** For underground floors in buildings with more than five underground floors, an interior cylinder fill panel or station shall be installed commencing on the third floor below grade and every three floors below grade thereafter, except for the bottom-most floor.

**F 1001.2.3 Installation Locations.** The specific location or locations on each floor shall be approved by the Authority Having Jurisdiction.

**F 1001.3 Prevention of Contamination.**

**F 1001.3.1 Isolation of Contaminated Air.** Where air is to be used that is not 100% pure breathing air, the air shall be isolated prior to its use. This shall include the isolation of impurities that may be present such as oxygen-depleted air or air that contains oil, dust, or other contamination.

**F 1001.3.2 Protection of Contaminated Air.** Air containing contaminants shall be isolated from uncontaminated air by means of flow control devices, tight-fitting valves, or other appropriate means.

**F 1101.0 System Assembly Requirements.**

**F 1101.1 General.** The system shall be an all-welded system except where the tubing joints are readily accessible and at the individual air fill panels or stations. Where mechanical high-pressure tube fittings are used, they shall be approved for the type of materials to be joined and rated for the maximum pressure of the system.

**F 1101.2 Welding Requirements.** Prior to and during the welding of sections of tubing, a continuous, regulated dry nitrogen or argon purge at 3 psi (21 kPa) shall be maintained to eliminate contamination with products of the oxidation or welding flux. The purge shall commence not less than 2 minutes prior to welding operations and continue until the welded joint is at ambient temperature. Welding procedures shall comply with the following requirements:

1. Qualification of the WPS to be used, and of the performance of welders and operators, is required.
2. No welding shall be done if there is impingement of rain, snow, sleet, or high wind on the weld area.
3. Tack welds permitted to remain in the finished weld shall be made by a qualified welder. Tack welds made by an unqualified welder shall be removed. Tack welds that remain shall be made with an electrode and WPS, which is the same as or equivalent to the electrode and WPS to be used for the first pass. The stopping and starting ends shall be prepared by grinding or other means so that they are capable of being satisfactorily incorporated into the final weld. Tack welds that have cracked shall be removed.
4. **CAUTION.** Arc strikes outside the area of the intended weld shall be avoided on a base metal. Arc strikes made outside of the weld joint area shall be removed and the surface visually examined. The surface shall also be examined by the liquid penetrant or magnetic particle method when the material is P-No. 4, P-No. 5A, P-No. 5B, or P-No. 15E. [ASME B31.1:127.4.1]

**F 1101.3 Prevention of Contamination.** The system components shall not be exposed to contaminants, including
but not limited to, oils, solvents, dirt, and construction materials. Where contamination of system components has occurred, the affected component shall not be installed in the system.

**F 1201.0 System Acceptance and Certification.**

**F 1201.1 Static Pressure Testing.** Following fabrication, assembly, and installation of the piping distribution system, exterior connection panel, and interior cylinder fill panels, the Authority Having Jurisdiction shall witness the pneumatic testing of the complete system at a test pressure of not less than 7500 psi (51 711 kPa) using oil-free dry air, nitrogen, or argon. A pneumatic test of not less than 24 hours shall be performed. During this test, all fittings, joints, and system components shall be inspected for leaks. A solution compatible with the system component materials shall be used on each joint and fitting. Defects in the system or leaks detected shall be documented on an inspection report, repaired or replaced. As an alternate, a pressure-decay test in accordance with ASME B31.3 shall be permitted.

**F 1201.2 Low-Pressure Switch Test.** Upon successful completion of the 24 hour static pressure test, the system’s low-pressure monitoring switch shall be calibrated to not less than 3000 psi (20 684 kPa) descending, and tested to verify that the signal is annunciated at the building’s main fire alarm panel and by means of an audible alarm and visual strobe located in a visible location.

**F 1201.3 Compatibility Check.** Each air fill panel and station, and each exterior fire department connection panel shall be tested for compatibility with the fire department’s SCBA fill fittings.

**F 1201.4 Material Certifications.** The pipe or tubing material certifications shall be provided to the Authority Having Jurisdiction.

**F 1201.5 Air Sampling.** Before the system is placed into service, a minimum of two samples shall be taken from separate air fill panels and submitted to an independent certified gas analysis laboratory to verify the system’s cleanliness and that the air is in accordance with the following requirements for breathing air:

1. Breathing air shall have oxygen content not less than 19.5 percent and not greater than 23.5 percent by volume.
2. Breathing air shall not have a concentration of carbon monoxide exceeding 5.0 parts per million (ppm) by volume.
3. Breathing air shall not have a concentration of carbon dioxide exceeding 1000 ppm by volume.
4. Breathing air shall not have a concentration of condensed oil and particulate exceeding 7.2 E-11 pounds per cubic inch (lb/in³) (2.0 mg/m³) at 72°F (22°C) and 30 in Hg (102 kPa).
5. Where breathing air supply for respirators is stored at pressures exceeding 15 bars (1500 kPa), the breathing air shall not have a concentration of water exceeding 24 ppm by volume.
6. Breathing air shall not have a nonmethane volatile organic compound (VOC) content exceeding 25 ppm as methane equivalents.
7. Breathing air shall not have a pronounced or unusual odor.
8. Breathing air shall have a concentration of nitrogen not less than 75 percent and not more than 81 percent. [NFPA 1989:5.6]

The written report of the analysis shall be submitted to the Authority Having Jurisdiction, documenting that the breathing air is in accordance with this section.

**F 1201.5.1 Air Quality Analysis.** During the period of air quality analysis, the air fill panel inlet shall be secured so that no air is capable of being introduced into the system and each air fill panel shall be provided with a sign stating, “AIR QUALITY ANALYSIS IN PROGRESS, DO NOT FILL OR USE ANY AIR FROM THIS SYSTEM.” This sign shall be not less than 8½ inches (216 mm) by 11 inches (279 mm) with not less than 1 inch (25.4 mm) lettering.

**F 1201.6 Annual Air Sampling.** The breathing air within the system shall be sampled and certified annually and inspected in accordance with the procedure in Section F 1201.5.

**F 1201.7 Final Proof Test.** The Authority Having Jurisdiction shall witness the filling of two empty 66 cubic foot (ft³) (1.87 m³) capacity SCBA cylinders in 3 minutes or less, using compressed air supplied by fire department equipment connected to the exterior fire department connection panel. The SCBA cylinders shall be filled at the air fill panel or station farthest from the exterior fire department connection panel. Following this, not less than two air samples shall then be taken from separate air filling stations and submitted to an independent certified gas analyst laboratory to verify the system’s cleanliness and that the air is in accordance with the requirements of NFPA 1989. The written report shall be provided to the Authority Having Jurisdiction certifying that the air analysis is in accordance with the above requirements.
**APPENDIX G**

**SIZING OF VENTING SYSTEMS**

(The content of this Appendix is based on Annex F of NFPA 54)

**G 101.0 General.**

**G 101.1 Applicability.** This appendix provides general guidelines for sizing venting systems serving appliances equipped with draft hoods, Category I appliances, and appliances listed for use with Type B vents.

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**Table 510.1.2(1)** is used when sizing a Type B double-wall gas vent connected directly to the appliance.

**Note:** The appliance can be either Category I draft-hood-equipped or fan-assisted type.

**FIGURE G 101.2(1)**

**TYPE B DOUBLE-WALL VENT SYSTEM SERVING A SINGLE APPLIANCE WITH A TYPE B DOUBLE-WALL VENT**

*([NFPA 54: FIGURE F.1(a)])*

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**Table 510.1.2(2)** is used when sizing a single-wall metal vent connector attached to a Type B double-wall gas vent.

**Note:** The appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(2)**

**TYPE B DOUBLE-WALL VENT SYSTEM SERVING A SINGLE APPLIANCE WITH A SINGLE-WALL METAL VENT CONNECTOR**

*([NFPA 54: FIGURE F.1(b)])*

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**Table 510.1.2(3)** is used when sizing a Type B double-wall gas vent connector attached to a tile-lined masonry chimney.

**Notes:**
1. $A$ is the equivalent cross-sectional area of the tile liner.
2. The appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(3)**

**VENT SYSTEM SERVING A SINGLE APPLIANCE WITH A MASONRY CHIMNEY AND A TYPE B DOUBLE-WALL VENT CONNECTOR**

*([NFPA 54: FIGURE F.1(c)])*

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**Table 510.1.2(4)** is used when sizing a single-wall vent connector attached to a tile-lined masonry chimney.

**Notes:**
1. $A$ is the equivalent cross-sectional area of the tile liner.
2. The appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(4)**

**VENT SYSTEM SERVING A SINGLE APPLIANCE USING A MASONRY CHIMNEY AND A SINGLE-WALL METAL VENT CONNECTOR**

*([NFPA 54: FIGURE F.1(d)])*
Asbestos cement Type B or single-wall metal vent serving a single draft hood-equipped appliance. [See Table 510.1.2(5)]

**FIGURE G 101.2(5)**
ASBESTOS CEMENT TYPE B OR SINGLE-WALL METAL VENT SYSTEM SERVING A SINGLE DRAFT HOOD-EQUIPPED APPLIANCE
[NFPA 54: FIGURE F.1(e)]

Table 510.2(1) is used when sizing Type B double-wall gas vent connectors attached to a Type B double-wall common vent.

**Note:** Each appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(6)**
VENT SYSTEM SERVING TWO OR MORE APPLIANCES WITH TYPE B DOUBLE-WALL VENT CONNECTORS AND TYPE B DOUBLE-WALL VENT CONNECTORS
[NFPA 54: FIGURE F.1(d)]

Table 510.2(2) is used when sizing single-wall vent connectors attached to a Type B double-wall common vent.

**Note:** Each appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(7)**
VENT SYSTEM SERVING TWO OR MORE APPLIANCES WITH TYPE B DOUBLE-WALL VENT AND SINGLE-WALL METAL VENT CONNECTORS
[NFPA 54: FIGURE F.1(g)]

Table 510.2(3) is used when sizing Type B double-wall vent connectors attached to a tile-lined masonry chimney.

**Notes:**
1. \(A\) is the equivalent cross-sectional area of the tile liner.
2. Each appliance can be either Category I draft hood-equipped or fan-assisted type.

**FIGURE G 101.2(8)**
MASONRY CHIMNEY SERVING TWO OR MORE APPLIANCES WITH TYPE B DOUBLE-WALL VENT CONNECTORS
[NFPA 54: FIGURE F.1(h)]
Table 510.2(4) is used when sizing single-wall metal vent connectors attached to a tile-lined masonry chimney.

Notes:
1. $A$ is the equivalent cross-sectional area of the tile liner.
2. Each appliance can be either Category I draft hood-equipped or fan-assisted type.

Example: Manifolded common vent connector $LM$ can be no greater than 18 times the common vent connector manifold inside diameter; that is, a 4 inch (102 mm) inside diameter common vent connector manifold should not exceed 72 inches (1829 mm) in length. [See Section 510.2.3]

Note: This is an illustration of a typical manifolded vent connector. Different appliance, vent connector, or common vent types are possible. [See Section 510.2]

Asbestos cement Type B or single-wall metal pipe vent serving two or more draft hood-equipped appliances. [See Table 510.2(5)]

Example: Offset common vent

Note: This is an illustration of a typical offset vent. Different appliance, vent connector, or vent types are possible. [See Section 510.1 and Section 510.2]
G 101.3 Example 1: Single Draft Hood-Equipped Appliance. An installer has a 120 000 British thermal units per hour (Btu/h) (35 kW) input appliance with a 5 inch (127 mm) diameter draft hood outlet that needs to be vented into a 10 foot (3048 mm) high Type B vent system. What size vent shall be used assuming: (1) a 5 foot (1524 mm) lateral single-wall metal vent connector is used with two 90 degree (1.57 rad) elbows or (2) a 5 foot (1524 mm) lateral single-wall metal vent connector is used with three 90 degree (1.57 rad) elbows in the vent system? (See Figure G 101.3)

Solution:
Table 510.1.2(2) should be used to solve this problem because single-wall metal vent connectors are being used with a Type B vent, as follows:

1. Read down the first column in Table 510.1.2(2) until the row associated with a 10 foot (3048 mm) height and 5 foot (1524 mm) lateral is found. Read across this row until a vent capacity greater than 120 000 Btu/h (35 kW) is located in the shaded columns labeled NAT Max for draft hood-equipped appliances. In this case, a 5 inch (127 mm) diameter vent has a capacity of 122 000 Btu/h (35.7 kW) and can be used for this application.

2. If three 90 degree (1.57 rad) elbows are used in the vent system, the maximum vent capacity listed in the tables must be reduced by 10 percent. This implies that the 5 inch (127 mm) diameter vent has an adjusted capacity of only 110 000 Btu/h (32 kW). In this case, the vent system must be increased to 6 inches (152 mm) in diameter. See the following calculations:

\[
122 000 \text{ Btu/h (35.7 kW)} \times 0.90 = 110 000 \text{ Btu/h (32 kW)}
\]

From Table 510.1.2(2), select 6 inch (152 mm) vent. 186 000 Btu/h (54.5 kW) \times 0.90 = 167 000 Btu/h (49 kW)

This figure is greater than the required 120 000 Btu/h (35 kW). Therefore, use a 6 inch (152 mm) vent and connector where three elbows are used. [NFPA 54:F.1.1]
**G 101.4 Example 2: Single Fan-Assisted Appliance.**

An installer has an 80 000 Btu/h (23.4 kW) input fan-assisted appliance that must be installed using 10 feet (3048 mm) of lateral connector attached to a 30 foot high (9144 mm) Type B vent. Two 90-degree (1.57 rad) elbows are needed for the installation. Can a single-wall metal vent connector be used for this application? (See Figure G 101.4)

**Solution:**

Table 510.1.2(2) refers to the use of single-wall metal vent connectors with Type B vent. In the first column find the row associated with a 30 foot (9144 mm) height and a 10 foot (3048 mm) lateral. Read across this row, looking at the FAN Min and FAN Max columns, to find that a 3 inch (76 mm) diameter single-wall metal vent connector is not recommended. Moving to the next larger size single-wall connector [4 inch (102 mm)] we find that a 4 inch (102 mm) diameter single-wall metal connector has a recommended minimum vent capacity of 91 000 Btu/h (26.7 kW) and a recommended maximum vent capacity of 144 000 Btu/h (42.2 kW). The 80 000 Btu/h (23.4 kW) fan-assisted appliance is outside this range, so the conclusion is that a single-wall metal vent connector cannot be used to vent this appliance using 10 feet (3048 mm) of lateral for the connector.

However, if the 80 000 Btu/h (23.4 kW) input appliance could be moved to within 5 feet (1524 mm) of the vertical vent, a 4 inch (102 mm) single-wall metal connector could be used to vent the appliance. Table 510.1.2(2) shows the acceptable range of vent capacities for a 4 inch (102 mm) vent with 5 feet (1524 mm) of lateral to be between 72 000 Btu/h (21.1 kW) and 157 000 Btu/h (46 kW).

If the appliance cannot be moved closer to the vertical vent, a Type B vent could be used as the connector material. In this case, Table 510.1.2(2) shows that, for a 30 foot (9144 mm) high vent with 10 feet (3048 mm) of lateral, the acceptable range of vent capacities for a 4 inch (102 mm) diameter vent attached to a fan-assisted appliance is between 37 000 Btu/h (10.8 kW) and 150 000 Btu/h (44 kW).  

**G 101.5 Example 3: Interpolating Between Table Values.**

An installer has an 80 000 Btu/h (23.4 kW) input appliance with a 4 inch (102 mm) diameter draft hood outlet that needs to be vented into a 12 foot (3658 mm) high Type B vent. The vent connector has a 5 foot (1524 mm) lateral length and is also Type B. Can this appliance be vented using a 4 inch (102 mm) diameter vent?

**Solution:**

Table 510.1.2(1) is used in the case of an all Type B Vent system. However, Table 510.1.2(1) does not have an entry for a height of 12 feet (3658 mm), and interpolation must be used. Read down the 4 inch (102 mm) diameter NAT Max column to the row associated with 10 foot (3048 mm) height and 5 foot (1524 mm) lateral to find the capacity value of 77 000 Btu/h (22.6 kW). Read further down to the 15 foot (4572 mm) height, 5 foot (1524 mm) lateral row to find the capacity value of 87 000 Btu/h (25.5 kW). The difference between the 15 foot (4572 mm) height capacity value and the 10 foot (3048 mm) height capacity value is 10 000 Btu/h (3 kW). The capacity for a vent system with a 12 foot (3658 mm) height is equal to the capacity for a 10 foot (3048 mm) height plus two-fifths of the difference between the 10 foot (3048 mm) and 15 foot (4572 mm) height values, or 77 000 Btu/h (22.6 kW) + 2/5 x 10 000 Btu/h (3 kW) = 81 000 Btu/h (23.7 kW). Therefore, a 4 inch (102 mm) diameter vent can be used in the installation.

**G 101.6 Example 4: Common Venting Two Draft Hood-Equipped Appliances.**

A 35 000 Btu/h (10.3 kW) water heater is to be common vented with a 150 000 Btu/h (44 kW) furnace, using a common vent with a total height of 30 feet (9144 mm). The connector rise is 2 feet (610 mm) for the water heater with a horizontal length of 4 feet (1219 mm). The connector rise for the furnace is 3 feet (914 mm) with a
horizontal length of 8 feet (2438 mm). Assume single-wall metal connectors will be used with Type B vent. What size connectors and combined vent should be used in this installation? (See Figure G 101.6)

Solution:
Table 510.2(2) should be used to size single-wall metal vent connectors attached to Type B vertical vents. In the vent connector capacity portion of Table 510.2(2), find the row associated with a 30 foot (9144 mm) vent height. For a 2 foot (610 mm) rise on the vent connector for the water heater, read the shaded columns for draft hood-equipped appliances to find that a 3 inch (76 mm) diameter vent connector has a capacity of 37 000 Btu/h (10.8 kW). Therefore, a 3 inch (76 mm) single-wall metal vent connector can be used with the water heater. For a draft hood-equipped furnace with a 3 foot (914 mm) rise, read across the appropriate row to find that a 5 inch (127 mm) diameter vent connector has a maximum capacity of 120 000 Btu/h (35 kW) (which is too small for the furnace) and a 6 inch (152 mm) diameter vent connector has a maximum vent capacity of 172 000 Btu/h (50 kW). Therefore, a 6 inch (152 mm) diameter vent connector should be used with the 150 000 Btu/h (44 kW) furnace. Because both vent connector, horizontal lengths are less than the maximum lengths listed in Section 510.2.1, the table values can be used without adjustments.

In the common vent capacity portion of Table 510.2(2), find the row associated with a 30 foot (9144 mm) vent height and read over to the NAT + NAT portion of the 6 inch (152 mm) diameter column to find a maximum combined capacity of 257 000 Btu/h (75 kW). Since the two appliances total only 185 000 Btu/h (54 kW), a 6 inch (152 mm) common vent can be used. [NFPA 54:E.2.1]

G 101.7 Example 5(a): Common Venting a Draft Hood-Equipped Water Heater with a Fan-Assisted Furnace into a Type B Vent. In this case, a 35 000 Btu/h (10.3 kW) input draft hood-equipped water heater with a 4 inch (102 mm) diameter draft hood outlet, 2 feet (610 mm) of connector rise, and 4 feet (1219 mm) of horizontal length is to be common vented with a 100 000 Btu/h (29 kW) fan-assisted furnace with a 4 inch (102 mm) diameter flue collar, 3 feet (914 mm) of connector rise, and 6 feet (1829 mm) of horizontal length. The common vent consists of a 30 foot (9144 mm) height of Type B vent. What are the recommended vent diameters for each connector and the common vent? The installer would like to use a single-wall metal vent connector. (See Figure G 101.7)

Solution:
Water Heater Vent Connector Diameter. Since the water heater vent connector, horizontal length of 4 feet (1219 mm) is less than the maximum value listed in Table 510.2(2), the venting table values can be used without adjustments. Using the Vent Connector Capacity portion of Table 510.2(2), read down the Total Vent Height (H) column to 30 feet (9144 mm) and read across the 2 feet (610 mm) Connector Rise (R) row to the first Btu/h rating in the NAT Max column that is equal to or greater than the water heater input rating. The table shows that a 3 inch (76 mm) vent connector has a maximum input rating of 37 000 Btu/h (10.8 kW). Although this rating is greater than the water heater input rating, a 3 inch (76 mm) vent connector is prohibited by Section 510.2.18. A 4 inch (102 mm) vent connector has a maximum input rating of 67 000 Btu/h (19.6 kW) and is equal to the draft hood outlet diameter. A 4 inch (102 mm) vent connector is selected. Since the water heater is equipped with a draft hood, there are no minimum input rating restrictions.
Furnace Vent Connector Diameter. Using the Vent Connector Capacity portion of Table 510.2(2), read down the Total Vent Height (H) column to 30 feet (9144 mm) and across the 3 feet (914 mm) Connector Rise (R) row. Because the furnace has a fan-assisted combustion system, find the first FAN Max column with a Btu/h rating greater than the furnace input rating. The 4 inch (102 mm) vent connector has a maximum input rating of 119 000 Btu/h (34.9 kW) and a minimum input rating of 85 000 Btu/h (24.9 kW).

The 100 000 Btu/h (29 kW) furnace in this example falls within this range, so a 4 inch (102 mm) connector is adequate. Because the furnace vent connector horizontal length of 6 feet (1829 mm) is less than the maximum value listed in Section 510.2.1, the venting table values can be used without adjustment. If the furnace had an input rating of 80 000 Btu/h (23.4 kW), a Type B vent connector would be needed in order to meet the minimum capacity limit.

Common Vent Diameter. The total input to the common vent is 135 000 Btu/h (40 kW). Using the Common Vent Capacity portion of Table 510.2(2), read down the Total Vent Height (H) column to 30 feet (9144 mm) and across this row to find the smallest vent diameter in the FAN + NAT column that has a Btu/h rating equal to or greater than 135 000 Btu/h (40 kW). The 4 inch (102 mm) common vent has a capacity of 132 000 Btu/h (39 kW) and the 5 inch (127 mm) common vent has a capacity of 202 000 Btu/h (59 kW). Therefore, the 5 inch (127 mm) common vent should be used in this example.

Summary: In this example, the installer can use a 4 inch (102 mm) connector for the water heater and a 4 inch (102 mm) diameter, single-wall metal vent connector for the water heater input rating. The table shows that a 3 inch (76 mm) vent connector has a maximum input of only 31 000 Btu/h (9 kW), while a 4 inch (102 mm) vent connector has a maximum input of 57 000 Btu/h (16.7 kW). A 4 inch (102 mm) vent connector must therefore be used.

Furnace Vent Connector Diameter. Using the Vent Connector Capacity portion of Table 510.2(4), read down the Total Vent Height (H) column to 30 feet (9144 mm) and across the 3 feet (914 mm) Connector Rise (R) row. Because the furnace has a fan-assisted combustion system, find the first FAN Max column with a Btu/h rating greater than the furnace input rating. The 4 inch (102 mm) vent connector has a maximum input rating of 127 000 Btu/h (37 kW) and a minimum input rating of 95 000 Btu/h (27.8 kW). The 100 000 Btu/h (29 kW) furnace in this example falls within this range, so a 4 inch (102 mm) connector is adequate.

Subsection 510.2.17 requires the common vent area to be no greater than seven times the smallest listed appliance categorized vent area, flue collar area, or draft hood outlet area. Both appliances in this installation have 4 inch (102 mm) diameter outlets. From Table G 101.8, the equivalent area for a nominal liner size of 8 inches (203 mm) by 12 inches (305 mm) is 63.6 square inches (0.041 m²). Seven times 12.2 equals 85.4, which is greater than 63.6, so this configuration is acceptable.

Solution: Table 510.2(4) is used to size common venting installations involving single-wall connectors into masonry chimneys.

Water Heater Vent Connector Diameter. Using Table 510.2(4), Vent Connector Capacity, read down the Total Vent Height (H) column to 30 feet (9144 mm), and read across the 2 feet (610 mm) Connector Rise (R) row to the first Btu/h rating in the NAT Max column that is equal to or greater than the water heater input rating. The table shows that a 3 inch (76 mm) vent connector has a maximum input of only 31 000 Btu/h (9 kW), while a 4 inch (102 mm) vent connector has a maximum input of 57 000 Btu/h (16.7 kW). A 4 inch (102 mm) vent connector must therefore be used.

Masonry Chimney. From Table G 101.8, the equivalent area for a nominal liner size of 8 inches (203 mm) by 12 inches (305 mm) is 63.6 square inches (0.041 m²). Using Table 510.2(4), Common Vent Capacity, read down the FAN + NAT column under the Minimum Internal Area of Chimney section 510.2.20, Type B vent connectors are required to be used with exterior masonry chimneys. Use Table 510.2(8) and Table 510.2(9) to size FAN+NAT common venting installations involving Type B double-wall connectors into exterior masonry chimneys.

The local 99 percent winter design temperature needed to use Table 510.2(8) and Table 510.2(9) can be found in ASHRAE Handbook – Fundamentals. For Charlotte, North Carolina, this design temperature is 19°F (-7.2°C).
Chimney Liner Requirement. As in Example 5(b), use the 63 square inches (0.04 m²) Internal Area columns for this size clay tile liner. Read down the 63 square inches (0.04 m²) column of Table 510.2(8) to the 30 foot (9144 mm) height row to find that the combined appliance maximum input is 747 000 Btu/h (218.9 kW). The combined input rating of the appliances in this installation, 135 000 Btu/h (40 kW), is less than the maximum value, so this criterion is satisfied. Table 510.2(9), at a 19°F (-7.2°C) design temperature, and at the same vent height and internal area used earlier, shows that the minimum allowable input rating of a space-heating appliance is 470 000 Btu/h (137.7 kW). The furnace input rating of 100 000 Btu/h (29 kW) is less than this minimum value. So this criterion is not satisfied, and an alternative venting design needs to be used, such as a Type B vent shown in Example 5(a) or a listed chimney liner system shown in the remainder of the example.

According to Section 510.2.19, Table 510.2(1) or Table 510.2(2) is used for sizing corrugated metallic liners in masonry chimneys, with the maximum common vent capacities reduced by 20 percent. This example will be continued assuming Type B vent connectors.

Water Heater Vent Connector Diameter. Using Table 510.2(1) Vent Connector Capacity, read down the total Vent Height (H) column to 30 feet (9144 mm), and read across the 2 feet (610 mm) Connector Rise (R) row to the first Btu/hour rating in the NAT Max column that is equal to or greater than the water heater input rating. The table shows that a 3 inch (76 mm) vent connector has a maximum capacity of 39 000 Btu/h (11.4 kW). Although this rating is greater than the water heater input rating, a 3 inch (76 mm) vent connector is prohibited by Section 510.2.20. A 4 inch (102 mm) vent connector has a maximum input rating of 70 000 Btu/h (20.5 kW) and is equal to the draft hood outlet diameter. A 4 inch (102 mm) vent connector is selected.

Furnace Vent Connector Diameter. Using Table 510.2(1), Vent Connector Capacity, read down the total Vent Height (H) column to 30 feet (9144 mm), and read across the 3 feet (914 mm) Connector Rise (R) row to the first Btu/h rating in the FAN MAX column that is equal to or greater than the furnace input rating. The 100 000 Btu/h (29 kW) furnace in this example falls within this range, so a 4 inch (102 mm) connector is adequate.

Table 510.2(1) Vent Connector Capacity, read down the total Vent Height (H) column to 30 feet (9144 mm), and read across the 3 feet (914 mm) Connector Rise (R) row to the first Btu/h rating in the FAN MAX column that is equal to or greater than the furnace input rating. The 100 000 Btu/h (29 kW) furnace in this example falls within this range, so a 4 inch (102 mm) connector is adequate.

**Table G 101.8**

<table>
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<th>NOMINAL LINER SIZE (inches)</th>
<th>INSIDE DIMENSIONS OF LINER (inches)</th>
<th>INSIDE DIAMETER OR EQUIVALENT DIAMETER (inches)</th>
<th>EQUIVALENT AREA (square inches)</th>
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For SI units: 1 inch = 25.4 mm. 1 square inch = 0.000645 m²

* When liner sizes differ dimensionally from those shown in this table, equivalent diameters can be determined from published tables for square and rectangular ducts of equivalent carrying capacity or by other engineering methods.
510.2(1) is 210,000 Btu/h (62 kW), and after reducing by 20 percent is 168,000 Btu/h (49.2 kW). Therefore, a 5 inch (127 mm) corrugated metal liner should be used in this example.

Single Wall Connectors. Once it has been established that relining the chimney is necessary, Type B double-wall vent connectors are not specifically required. This example could be redone using Table 510.2(2) for single-wall vent connectors. For this case, the vent connector and liner diameters would be the same as found for Type B double-wall connectors. [NFPA 54:F.2.4]
APPENDIX H
PRIVATE SEWAGE DISPOSAL SYSTEMS

H 101.0 General.

H 101.1 Applicability. This appendix provides general guidelines for the materials, design, and installation of private sewage disposal systems.

H 101.2 General Requirements. Where permitted by Section 713.0, the building sewer shall be permitted to be connected to a private sewage disposal system in accordance with the provisions of this appendix. The type of system shall be determined on the basis of location, soil porosity, and groundwater level, and shall be designed to receive all sewage from the property. The system, except as otherwise approved, shall consist of a septic tank with effluent discharging into a subsurface disposal field, into one or more seepage pits, or into a combination of subsurface disposal field and seepage pits. The Authority Having Jurisdiction shall be permitted to grant exceptions to the provisions of this appendix for permitted structures that have been destroyed due to fire or natural disaster, and that cannot be reconstructed in compliance with these provisions provided that such exceptions are the minimum necessary.

H 101.3 Quantity and Quality. Where the quantity or quality of the sewage is such that the above system cannot be expected to function satisfactorily for commercial, agricultural, and industrial plumbing systems; for installations where appreciable amounts of industrial or indigestible wastes are produced; for occupancies producing abnormal quantities of sewage or liquid waste; or where grease interceptors are required by other parts of this code, the method of sewage treatment and disposal shall be first approved by the Authority Having Jurisdiction. Special sewage disposal systems for minor, limited, or temporary uses shall be first approved by the Authority Having Jurisdiction.

H 101.4 Septic Tank and Disposal Field Systems. Disposal systems shall be designed to utilize the most porous or absorptive portions of the soil formation. Where the groundwater level extends within 12 feet (3658 mm) or less of the ground surface or where the upper soil is porous, and the underlying stratum is rock or impervious soil, a septic tank and disposal field system shall be installed.

H 101.5 Flood Hazard Areas. Disposal systems shall be located outside of flood hazard areas.

Exception: Where suitable sites outside of flood hazard areas are not available, disposal systems shall be permitted to be located in flood hazard areas on sites where the effects of inundation under conditions of the design flood are minimized.

H 101.6 Design. Private sewage disposal systems shall be so designed that additional seepage pits or subsurface drain fields, equivalent to not less than 100 percent of the required original system, shall be permitted to be installed where the original system cannot absorb all the sewage. No division of the lot or erection of structures on the lot shall be made where such division or structure impairs the usefulness of the 100 percent expansion area.

H 101.7 Capacity. No property shall be improved more than its capacity to absorb sewage effluent properly by the means provided in this code.

Exception: The Authority Having Jurisdiction shall be permitted to, at its discretion, approve an alternate system.

H 101.8 Location. No private sewage disposal system, or part thereof, shall be located in any lot other than the lot that is the site of the building or structure served by such private sewage disposal system, nor shall any private sewage disposal system or part thereof be located at any point having less than the minimum distances indicated in Table H 101.8.

Nothing contained in this code shall be construed to prohibit the use of all or part of an abutting lot to provide additional space for a private sewage disposal system or part thereof where proper cause, transfer of ownership, or change of boundary not in violation of other requirements has been first established to the satisfaction of the Authority Having Jurisdiction. The instrument recording such action shall constitute an agreement with the Authority Having Jurisdiction, which shall clearly state and show that the areas so joined or used shall be maintained as a unit during the time they are so used. Such agreement shall be recorded in the office of the County Recorder as part of the conditions of ownership of said properties and shall be binding on heirs, successors, and assigns to such properties. A copy of the instrument recording such proceedings shall be filed with the Authority Having Jurisdiction.

H 101.9 Building Permit. Where there is insufficient lot area or improper soil conditions for sewage disposal for the building or land use proposed, and the Authority Having Jurisdiction so finds, no building permit shall be issued, and no private sewage disposal shall be permitted. Where space or soil conditions are critical, no building permit shall be issued until engineering data, and test reports satisfactory to the Authority Having Jurisdiction have been submitted and approved.

H 101.10 Additional Requirements. Nothing contained in this appendix shall be construed to prevent the Authority Having Jurisdiction from requiring compliance with additional requirements than those contained herein, where such additional requirements are essential to maintaining a safe and sanitary condition.

H 101.11 Alternate Systems. Alternate systems shall be permitted to be used by special permission of the Authority Having Jurisdiction after being satisfied with their adequacy. This authorization is based on extensive field and test data from conditions similar to those at the proposed site or requires such additional data as necessary to assure that the
TABLE H 101.8
LOCATION OF SEWAGE DISPOSAL SYSTEM

<table>
<thead>
<tr>
<th>MINIMUM HORIZONTAL DISTANCE</th>
<th>BUILDING SEWER</th>
<th>SEPTIC TANK</th>
<th>DISPOSAL FIELD</th>
<th>SEEPAGE PIT OR CESSPOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building or structures¹</td>
<td>2 feet</td>
<td>5 feet</td>
<td>8 feet</td>
<td>8 feet</td>
</tr>
<tr>
<td>Property line adjoining pri-</td>
<td>Clear²</td>
<td>5 feet</td>
<td>5 feet</td>
<td>8 feet</td>
</tr>
<tr>
<td>vate property</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water supply wells</td>
<td>50 feet³</td>
<td>50 feet</td>
<td>100 feet</td>
<td>150 feet</td>
</tr>
<tr>
<td>Streams and other bodies of</td>
<td>50 feet</td>
<td>50 feet</td>
<td>100 feet</td>
<td>150 feet</td>
</tr>
<tr>
<td>water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trees</td>
<td>–</td>
<td>10 feet</td>
<td>–</td>
<td>10 feet</td>
</tr>
<tr>
<td>Seepage pits or cesspools³</td>
<td>–</td>
<td>5 feet</td>
<td>5 feet</td>
<td>12 feet</td>
</tr>
<tr>
<td>Disposal field²</td>
<td>–</td>
<td>5 feet</td>
<td>4 feet⁴</td>
<td>5 feet</td>
</tr>
<tr>
<td>On-site domestic water</td>
<td>1 foot⁵</td>
<td>5 feet</td>
<td>5 feet</td>
<td>5 feet</td>
</tr>
<tr>
<td>service line</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distribution box</td>
<td>–</td>
<td>–</td>
<td>5 feet</td>
<td>5 feet</td>
</tr>
<tr>
<td>Pressure public water</td>
<td>10 feet⁶</td>
<td>10 feet</td>
<td>10 feet</td>
<td>10 feet</td>
</tr>
</tbody>
</table>

For SI units: 1 foot = 304.8 mm

Notes:
1 Including porches and steps, whether covered or uncovered, breezeways, roofed porte cocheres, roofed patios, carports, covered walks, covered driveways, and similar structures or appurtenances.
2 See Section 312.3.
3 Drainage piping shall clear domestic water supply wells by not less than 50 feet (15 240 mm). This distance shall be permitted to be reduced to not less than 25 feet (7620 mm) where the drainage piping is constructed of materials approved for use within a building.
4 Plus 2 feet (610 mm) for each additional 1 foot (305 mm) of depth more than 1 foot (305 mm) below the bottom of the drain line. (See Section H 601.0)
5 See Section 720.0.
6 For parallel construction – For crossings, approval by the Health Department shall be required.
7 These minimum clear horizontal distances shall also apply to disposal fields, seepage pits, and the mean high-tide line.
8 Where disposal fields, seepage pits, or both are installed in sloping ground, the minimum horizontal distance between any part of the leaching system and ground surface shall be 15 feet (4572 mm).

H 201.0 Capacity of Septic Tanks.

H 201.1 General. The liquid capacity of septic tanks shall comply with Table H 201.1(1) and Table H 201.1(4) as determined by the number of bedrooms or apartment units in dwelling occupancies and the estimated waste/sewage design flow rate or the number of plumbing fixture units as determined from Table 702.1 of this code, whichever is greater in other building occupancies. The capacity of any one septic tank and its drainage system shall be limited to the soil structure classification in Table H 201.1(2), and as specified in Table H 201.1(3).

<table>
<thead>
<tr>
<th>TABLE H 201.1(1)</th>
<th>CAPACITY OF SEPTIC TANKS¹, ², ³, ⁴</th>
<th>SINGULAR FAMILY DWELLINGS - NUMBER OF BEDROOMS</th>
<th>MULTIPLE DWELLING UNITS OR APARTMENTS - ONE BEDROOM EACH</th>
<th>OTHER USES: MAXIMUM FIXTURE UNITS SERVED PER TABLE 702.1</th>
<th>MINIMUM SEPTIC TANK CAPACITY (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or 2</td>
<td>–</td>
<td>15</td>
<td>750</td>
<td>1500</td>
<td>750</td>
</tr>
<tr>
<td>3</td>
<td>–</td>
<td>20</td>
<td>1000</td>
<td>1200</td>
<td>1000</td>
</tr>
<tr>
<td>4</td>
<td>2 units</td>
<td>25</td>
<td>1500</td>
<td>2000</td>
<td>1500</td>
</tr>
<tr>
<td>5 or 6</td>
<td>3</td>
<td>33</td>
<td>1500</td>
<td>2250</td>
<td>1500</td>
</tr>
<tr>
<td>–</td>
<td>4</td>
<td>45</td>
<td>2000</td>
<td>2250</td>
<td>2000</td>
</tr>
<tr>
<td>–</td>
<td>5</td>
<td>55</td>
<td>2250</td>
<td>2750</td>
<td>2500</td>
</tr>
<tr>
<td>–</td>
<td>6</td>
<td>60</td>
<td>2500</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>–</td>
<td>7</td>
<td>70</td>
<td>2750</td>
<td>3250</td>
<td>3250</td>
</tr>
<tr>
<td>–</td>
<td>8</td>
<td>80</td>
<td>3000</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>–</td>
<td>9</td>
<td>90</td>
<td>3250</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>–</td>
<td>10</td>
<td>100</td>
<td>3500</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon = 3.785 L

Notes:
¹ Extra bedroom, 150 gallons (568 L) each.
² Extra dwelling units over 10: 250 gallons (946 L) each.
³ Extra fixture units over 100: 25 gallons (94.6 L) per fixture unit.
⁴ Septic tank sizes in this table include sludge storage capacity and the connection of domestic food waste disposers without further volume increase.

TABLE H 201.1(2)
DESIGN CRITERIA OF FIVE TYPICAL SOILS

<table>
<thead>
<tr>
<th>TYPE OF SOIL</th>
<th>REQUIRED SQUARE FEET OF LEACHING AREA PER 100 GALLONS</th>
<th>MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FEET OF LEACHING AREA FOR A 24 HOUR PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse sand or gravel</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Fine sand</td>
<td>25</td>
<td>4.0</td>
</tr>
<tr>
<td>Sandy loam or sandy clay</td>
<td>40</td>
<td>2.5</td>
</tr>
<tr>
<td>Clay with considerable sand or gravel</td>
<td>90</td>
<td>1.1</td>
</tr>
<tr>
<td>Clay with small amount of sand or gravel</td>
<td>120</td>
<td>0.8</td>
</tr>
</tbody>
</table>

For SI units: 1 square foot = 0.0929 m², 1 gallon = 3.785 L, 1 gallon per square foot = 40.7 L/m²
### TABLE H 201.1(3)
**LEACHING AREA SIZE BASED ON SEPTIC TANK CAPACITY**

<table>
<thead>
<tr>
<th>REQUIRED SQUARE FEET OF LEACHING AREA</th>
<th>MAXIMUM SEPTIC TANK SIZE ALLOWABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PER 100 GALLONS SEPTIC TANK CAPACITY</td>
<td>(gallons)</td>
</tr>
<tr>
<td>(square feet per 100 gallons)</td>
<td></td>
</tr>
<tr>
<td>20–25</td>
<td>7500</td>
</tr>
<tr>
<td>40</td>
<td>5000</td>
</tr>
<tr>
<td>90</td>
<td>3500</td>
</tr>
<tr>
<td>120</td>
<td>3000</td>
</tr>
</tbody>
</table>

For SI units: 1 square foot per 100 gallons = 0.000245 m²/L, 1 gallon = 3.785 L.

### TABLE H 201.1(4)
**ESTIMATED WASTE/SEWAGE FLOW RATES**

<table>
<thead>
<tr>
<th>TYPE OF OCCUPANCY</th>
<th>GALLONS PER DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airports (per employee)</td>
<td>15</td>
</tr>
<tr>
<td>Airports (per passenger)</td>
<td>5</td>
</tr>
<tr>
<td>Auto washers – check with equipment manufacturer</td>
<td>–</td>
</tr>
<tr>
<td>Bowling alleys – with snack bar only (per lane)</td>
<td>75</td>
</tr>
<tr>
<td>Campground – with central comfort station (per person)</td>
<td>35</td>
</tr>
<tr>
<td>Campground – with flush toilets - no showers (per person)</td>
<td>25</td>
</tr>
<tr>
<td>Camps (day) – no meals served (per person)</td>
<td>15</td>
</tr>
<tr>
<td>Camps (summer and seasonal camps) – (per person)</td>
<td>50</td>
</tr>
<tr>
<td>Churches – sanctuary (per seat)</td>
<td>5</td>
</tr>
<tr>
<td>Churches – with kitchen waste (per seat)</td>
<td>7</td>
</tr>
<tr>
<td>Dance halls – (per person)</td>
<td>5</td>
</tr>
<tr>
<td>Factories – no showers (per employee)</td>
<td>25</td>
</tr>
<tr>
<td>Factories – with showers (per employee)</td>
<td>35</td>
</tr>
<tr>
<td>Factories – with cafeteria (per employee)</td>
<td>5</td>
</tr>
<tr>
<td>Hospitals – (per bed)</td>
<td>250</td>
</tr>
<tr>
<td>Hospitals – kitchen waste only (per bed)</td>
<td>25</td>
</tr>
<tr>
<td>Hospitals – laundry waste only (per bed)</td>
<td>40</td>
</tr>
<tr>
<td>Hotels – no kitchen waste (per bed)</td>
<td>60</td>
</tr>
<tr>
<td>Institutions – resident (per person)</td>
<td>75</td>
</tr>
<tr>
<td>Nursing home – (per person)</td>
<td>125</td>
</tr>
<tr>
<td>Rest home – (per person)</td>
<td>125</td>
</tr>
<tr>
<td>Laundries – self-service with minimum 10 hours per day (per wash cycle)</td>
<td>50</td>
</tr>
<tr>
<td>Laundries – commercial check with manufacturer’s specification</td>
<td>–</td>
</tr>
<tr>
<td>Motel (per bed space)</td>
<td>50</td>
</tr>
<tr>
<td>Motel – with kitchen (per bed space)</td>
<td>60</td>
</tr>
<tr>
<td>Offices – (per employee)</td>
<td>20</td>
</tr>
<tr>
<td>Parks – mobile homes (per space)</td>
<td>250</td>
</tr>
<tr>
<td>Parks (picnic) – with toilets only (per parking space)</td>
<td>20</td>
</tr>
<tr>
<td>Parks (recreational vehicles) – without water hook-up (per space)</td>
<td>75</td>
</tr>
<tr>
<td>Parks (recreational vehicles) – with water and sewer hook-up (per space)</td>
<td>100</td>
</tr>
<tr>
<td>Restaurants – cafeteria (per employee)</td>
<td>20</td>
</tr>
<tr>
<td>Restaurants – with toilet waste (per customer)</td>
<td>7</td>
</tr>
<tr>
<td>Restaurants – with kitchen waste (per meal)</td>
<td>6</td>
</tr>
<tr>
<td>Restaurants – with kitchen waste disposable service (per meal)</td>
<td>2</td>
</tr>
<tr>
<td>Restaurants – with garbage disposal (per meal)</td>
<td>1</td>
</tr>
<tr>
<td>Restaurants – with cocktail lounge (per customer)</td>
<td>2</td>
</tr>
<tr>
<td>Schools staff and office (per person)</td>
<td>20</td>
</tr>
<tr>
<td>Schools – elementary (per student)</td>
<td>15</td>
</tr>
<tr>
<td>Schools – intermediate and high (per student)</td>
<td>20</td>
</tr>
<tr>
<td>Schools – with gym and showers (per student)</td>
<td>5</td>
</tr>
</tbody>
</table>
APPENDIX H

TABLE H 201.1(4) (continued)

<table>
<thead>
<tr>
<th>TYPE OF OCCUPANCY</th>
<th>GALLONS PER DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools – with cafeteria (per student)</td>
<td>3</td>
</tr>
<tr>
<td>Schools (boarding) – total waste (per person)</td>
<td>100</td>
</tr>
<tr>
<td>Service station – with toilets for 1st bay</td>
<td>1000</td>
</tr>
<tr>
<td>Service station – with toilets for each additional bay</td>
<td>500</td>
</tr>
<tr>
<td>Stores – (per employee)</td>
<td>20</td>
</tr>
<tr>
<td>Stores – with public restrooms (per 10 square feet of floor space)</td>
<td>1</td>
</tr>
<tr>
<td>Swimming pools – public (per person)</td>
<td>10</td>
</tr>
<tr>
<td>Theaters – auditoriums (per seat)</td>
<td>5</td>
</tr>
<tr>
<td>Theaters – with drive-in (per space)</td>
<td>10</td>
</tr>
</tbody>
</table>

Notes:
1 Sewage disposal systems sized using the estimated waste/sewage flow rates shall be calculated as follows:
   (a) Waste/sewage flow, up to 1500 gallons per day (5678 L/day)
       Flow x 1.5 = septic tank size
   (b) Waste/sewage flow, over 1500 gallons per day (5678 L/day)
       Flow x 0.75 + 1125 = septic tank size
   (c) Secondary system shall be sized for total flow per 24 hours.
2 See Section H 201.1.
3 Because of the many variables encountered, it is not possible to set absolute values for waste/sewage flow rates for all situations. The designer should evaluate each situation and, where figures in this table need modification; they should be made with the concurrence of the Authority Having Jurisdiction.

H 301.0 Area of Disposal Fields and Seepage Pits.

H 301.1 General. The minimum effective absorption area in disposal fields in square feet (m²), and in seepage pits in square feet (m²) of sidewall, shall be predicated on the required septic tank capacity of gallons (liters), estimated waste/sewage flow rate, or whichever is greater, and shall be in accordance with Table H 201.1(2) as determined by the type of soil found in the excavation, and shall be as follows:

(1) Where disposal fields are installed, not less than 150 square feet (13.9 m²) of trench bottom shall be provided for each system exclusive of any hard pan, rock, clay, or other impervious formations. Sidewall area more than the required 12 inches (305 mm) and not exceeding 36 inches (914 mm) below the leach line shall be permitted to be added to the trench bottom area where computing absorption areas.

(2) Where leaching beds are permitted instead of trenches, the area of each such bed shall be not less than 50 percent greater than the tabular requirements for trenches. Perimeter sidewall area more than the required 12 inches (305 mm) and not exceeding 36 inches (914 mm) below the leach line shall be permitted to be added to the trench bottom area where computing absorption areas.

(3) No excavation for a leach line or leach bed shall be located within 5 feet (1524 mm) of the water table nor to a depth where sewage is capable of contaminating the underground water stratum that is usable for domestic purposes.

Exception: In areas where the records or data indicate that the groundwaters are grossly degraded, the 10 foot (3048 mm) separation requirement shall be permitted to be reduced by the Authority Having Jurisdiction. The applicant shall supply evidence of groundwater depth to the satisfaction of the Authority Having Jurisdiction.

(4) The minimum effective absorption area in any seepage pit shall be calculated as the excavated sidewall area below the inlet exclusive of any hardpan, rock, clay, or other impervious formations. The minimum required area of porous formation shall be provided in one or more seepage pits. No excavation shall extend within 10 feet (3048 mm) of the water table nor to a depth where sewage is capable of contaminating underground water stratum that is usable for domestic purposes.

Exception: In areas where the records or data indicate that the groundwaters are grossly degraded, the 10 foot (3048 mm) separation requirement shall be permitted to be reduced by the Authority Having Jurisdiction.

The applicant shall supply evidence of groundwater depth to the satisfaction of the Authority Having Jurisdiction.

(5) Leaching chambers that comply with IAPMO PS 63 and bundled expanded polystyrene synthetic aggregate units that comply with IAPMO IGC 276 shall be sized using a 0.70 multiplier applied to the required area calculated using Table H 201.1(2) with a 0.70 multiplier.

H 401.0 Percolation Test.

H 401.1 Pit Sizes. Where practicable, disposal field and seepage pit sizes shall be computed from Table H 201.1(2). Seepage pit sizes shall be computed by percolation tests unless use of Table H 201.1(2) is approved by the Authority Having Jurisdiction.

H 401.2 Absorption Qualities. The absorption qualities of seepage pits and questionable soils other than those listed in Table H 201.1(2), the proposed site, shall be subjected to percolation tests acceptable to the Authority Having Jurisdiction.
H 401.3 Absorption Rates. Where a percolation test is required, no private disposal system shall be permitted to serve a building where that test shows the absorption capacity of the soil is less than 0.83 gallons per square foot (gal/ft²) (33.8 L/m²) or more than 5.12 gal/ft² (208.6 L/m²) of leaching area per 24 hours. Where the percolation test shows an absorption rate greater than 5.12 gal/ft² (208.6 L/m²) per 24 hours, a private disposal system shall be permitted where the site does not overlie groundwaters protected for drinking water supplies, a minimum thickness of 2 feet (610 mm) of the native soil below the entire proposed system is replaced by loamy sand, and the system design is based on percolation tests made in the loamy sand.

H 501.0 Septic Tank Construction.
H 501.1 Plans. Plans for septic tanks shall be submitted to the Authority Having Jurisdiction for approval. Such plans shall show dimensions, reinforcing, structural calculations, and such other pertinent data as required.
H 501.2 Design. Septic tank design shall be such as to produce a clarified effluent consistent with accepted standards and shall provide adequate space for sludge and scum accumulations.
H 501.3 Construction. Septic tanks shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight.
H 501.4 Compartments. Septic tanks shall have not less than two compartments unless otherwise approved by the Authority Having Jurisdiction. The inlet compartment of any septic tank shall be not less than two-thirds of the total capacity of the tank, nor less than 500 gallons (1892 L) liquid capacity, and shall be not less than 3 feet (914 mm) in width and 5 feet (1524 mm) in length. Liquid depth shall be not less than 2½ feet (762 mm) nor more than 6 feet (1829 mm). The secondary compartment of a septic tank shall have a capacity of not less than 250 gallons (946 L) and a capacity not exceeding one-third of the total capacity of such tank. In septic tanks having a 1500 gallon (5678 L) capacity, the secondary compartment shall be not less than 5 feet (1524 mm) in length.
H 501.5 Access. Access to each septic tank shall be provided by not less than two manholes 20 inches (508 mm) in minimum dimension or by an equivalent removable cover slab. One access manhole shall be located over the inlet, and one access manhole shall be located over the outlet. Where a first compartment exceeds 12 feet (3658 mm) in length, an additional manhole shall be provided over the baffle wall.
H 501.6 Pipe Opening Sizes. The inlet and outlet pipe openings shall not be larger in size than the connecting sewer pipe. The vertical leg of round inlet and outlet fittings shall not be less in size than the connecting sewer pipe nor less than 4 inches (100 mm) in diameter. A baffle-type fitting shall have the equivalent cross-sectional area of the connecting sewer pipe and not less than a 4 inch (102 mm) horizontal dimension where measured at the inlet and outlet pipe inverts.

H 501.7 Pipe Extension. The inlet and outlet pipe or baffle shall extend 4 inches (102 mm) above and not less than 12 inches (305 mm) below the water surface. The invert of the inlet pipe shall be at a level not less than 2 inches (51 mm) above the invert of the outlet pipe.
H 501.8 Free Vent Area. Inlet and outlet pipe fittings or baffles and compartment partitions shall have a free vent area equal to the required cross-sectional area of the house sewer or private sewer discharging therein to provide free ventilation above the water surface from the disposal field or seepage pit through the septic tank, house sewer, and stack to the outer air.
H 501.9 Sidewalls. The sidewalls shall extend not less than 9 inches (229 mm) above the liquid depth. The cover of the septic tank shall be not less than 2 inches (51 mm) above the back vent openings.
H 501.10 Partitions and Baffles. Partitions or baffles between compartments shall be of solid, durable material and shall extend not less than 4 inches (102 mm) above the liquid level. The transfer port between compartments shall be a minimum size equivalent to the tank inlet, but in no case less than 4 inches (102 mm) in size, shall be installed in the inlet compartment side of the baffle so that the entry into the port is placed 65 percent to 75 percent in the depth of the liquid. Wooden baffles are prohibited.
H 501.11 Structural Design. The structural design of septic tanks shall comply with the following requirements:
(1) Each such tank shall be structurally designed to withstand all anticipated earth or other loads. Septic tank covers shall be capable of supporting an earth load of not less than 500 pounds per square foot (lb/ft²) (2441 kg/m²) where the maximum coverage does not exceed 3 feet (914 mm).
(2) In flood hazard areas, tanks shall be anchored to counter buoyant forces during conditions of the design flood. The vent termination and service manhole of the tank shall be not less than 2 feet (610 mm) above the design flood elevation or fitted with covers designed to prevent the inflow of floodwater or the outflow of the contents of the tanks during conditions of the design flood.
H 501.12 Manholes. Septic tanks installed under concrete or blacktop paving shall have the required manholes accessible by extending the manhole openings to grade in a manner acceptable to the Authority Having Jurisdiction.
H 501.13 Materials. The materials used for constructing a septic tank shall be in accordance with the following:
(1) Materials used in constructing a concrete septic tank shall be in accordance with applicable standards in Chapter 17.
(2) The minimum wall thickness of a steel septic tank shall be number 12 U.S. gauge (0.109 of an inch) (2.77 mm), and each such tank shall be protected from corrosion both externally and internally by an approved bituminous coating or by other acceptable means.
(3) Septic tanks constructed of alternate materials shall be permitted to be approved by the Authority Having Jurisdiction where in accordance with approved applicable standards. Wooden septic tanks shall be prohibited.
H 501.14 Prefabricated Septic Tanks. Prefabricated septic tanks shall comply with the following requirements:

1) Manufactured or prefabricated septic tanks shall comply with 'IAPMO ANSI Z1000 or CSA B66' and be approved by the Authority Having Jurisdiction. Prefabricated bituminous coated septic tanks shall comply with UL 70.

2) Independent laboratory tests and engineering calculations certifying the tank capacity and structural stability shall be provided as required by the Authority Having Jurisdiction.

H 601.0 Disposal Fields.
H 601.1 Distribution Lines. Distribution lines shall be constructed of clay tile laid with open joints, perforated clay pipe, perforated bituminous fiber pipe, perforated high-density polyethylene pipe, perforated ABS pipe, perforated PVC pipe, or other approved materials, provided that approved openings are available for distribution of the effluent into the trench area.

H 601.1.1 Bundled Expanded Polystyrene Synthetic Aggregate Units. Bundled expanded polystyrene synthetic aggregate units with an integrated distribution line consisting of perforated, corrugated high-density polyethylene pipe that complies with IAPMO IGC 276 shall be permitted.

H 601.2 Filter Material. Before placing filter material or drain lines in a prepared excavation, smeared or compacted surfaces shall be removed from trenches by raking to a depth of 1 inch (25.4 mm) and the loose material removed. Clean stone, gravel, slag, or similar filter material acceptable to the Authority Having Jurisdiction, varying in size from 3/8 of an inch to 2 1/2 inches (19.1 mm to 64 mm), shall be placed in the trench to the depth and grade required by this section. Drain pipe shall be placed on filter material in an approved manner. The drain lines shall then be covered with filter material to the minimum depth required by this section, and this material covered with untreated building paper, straw, or similar porous material to prevent the closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspection and acceptance.

Exception: Listed or approved plastic leaching chambers and bundled expanded polystyrene synthetic aggregate units shall be permitted to be used in lieu of pipe and filter material. Chamber and bundled expanded polystyrene synthetic aggregate unit installations shall follow the rules for disposal fields, where applicable, and shall be in accordance with the manufacturer’s instructions.

H 601.3 Grade Board. A grade board staked in the trench to the depth of filter material shall be utilized where the distribution line is constructed with drain tile or a flexible pipe material that will not maintain alignment without continuous support.

H 601.4 Seepage Pits. Where seepage pits are used in combination with disposal fields, the filter material in the trenches shall terminate not less than 5 feet (1524 mm) from the pit excavation, and the line extending from such points to the seepage pit shall be approved pipe with watertight joints.

H 601.5 Distribution Boxes. Where two or more drain lines are installed, an approved distribution box of sufficient size to receive lateral lines shall be installed at the head of each disposal field. The invert of outlets shall be level, and the invert of the inlet shall be not less than 1 inch (25.4 mm) above the outlets. Distribution boxes shall be designed to ensure equal flow and shall be installed on a level concrete slab in natural or compacted soil.

H 601.6 Laterals. Laterals from a distribution box to the disposal field shall be approved pipe with watertight joints. Multiple disposal field laterals, where practicable, shall be of uniform length.

H 601.7 Connections. Connections between a septic tank and a distribution box shall be laid with approved pipe with watertight joints on natural ground or compacted fill.

H 601.8 Dosing Tanks. Where the quantity of sewage exceeds the amount that is permitted to be disposed of in 500 lineal feet (152.4 m) of leach line, a dosing tank shall be used. Dosing tanks shall be equipped with an automatic siphon or pump that discharges the tank once every 3 or 4 hours. The tank shall have a capacity equal to 60 to 75 percent of the interior capacity of the pipe to be dosed at one time. Where the total length of pipe exceeds 1000 lineal feet (305 m), the dosing tank shall be provided with two siphons or pumps dosing alternately and each serving one-half of the leach field.

H 601.9 Construction. Disposal fields shall be constructed in accordance with Table H 601.9.

Minimum spacing between trenches or leaching beds shall be not less than 4 feet (1219 mm) plus 2 feet (610 mm) for each additional foot (305 mm) of depth more than 1 foot (305 mm) below the bottom of the drain line. Distribution drain lines in leaching beds shall be not more than 6 feet (1829 mm) apart on centers, and no part of the perimeter of the leaching bed shall exceed 3 feet (914 mm) from a distribution drain line. Disposal fields, trenches, and leaching beds shall not be paved over or covered by concrete or a material that is capable of reducing or inhibiting a possible evaporation of sewer effluent.

### Table H 601.9
GENERAL DISPOSAL FIELD REQUIREMENTS

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of drain lines per field</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Length of each line</td>
<td>-</td>
<td>100 feet</td>
</tr>
<tr>
<td>Bottom width of trench</td>
<td>18 inches</td>
<td>36 inches</td>
</tr>
<tr>
<td>Spacing of lines, center-to-center</td>
<td>6 feet</td>
<td>-</td>
</tr>
<tr>
<td>Depth of earth cover of lines (preferred 18 inches)</td>
<td>12 inches</td>
<td>-</td>
</tr>
<tr>
<td>Grade of lines</td>
<td>level</td>
<td>3 inches per 100 feet</td>
</tr>
<tr>
<td>Filter material under drain lines</td>
<td>12 inches</td>
<td>-</td>
</tr>
<tr>
<td>Filter material over drain lines</td>
<td>2 inches</td>
<td>-</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m
H 601.10 Joints. Where necessary on sloping ground to prevent excessive line slope, leach lines or leach beds shall be stepped. The lines between each horizontal section shall be made with watertight joints and shall be designed, so each horizontal leaching trench or bed shall be utilized to the maximum capacity before the effluent shall pass to the next lower leach line or bed. The lines between each horizontal leaching section shall be made with approved watertight joints and installed on the natural or unfilled ground.

H 701.0 Seepage Pits.
H 701.1 Capacity. The capacity of seepage pits shall be based on the quantity of liquid waste discharging thereinto and on the character and porosity of the surrounding soil, and shall be in accordance with Section H 301.0 of this appendix.

H 701.2 Multiple Installations. Multiple seepage pit installations shall be served through an approved distribution box or be connected in series using a watertight connection laid on undistributed or compacted soil. The outlet from the pit shall have an approved vented leg fitting extending not less than 12 inches (305 mm) below the inlet fitting.

H 701.3 Construction. A seepage pit shall be circular in shape and shall have an excavated diameter of not less than 4 feet (1219 mm). Each such pit shall be lined with approved-type whole new hard-burned clay brick, concrete brick, concrete circular-type cesspool blocks, or other approved materials. Approval shall be obtained before construction for any pit having an excavated diameter greater than 6 feet (1829 mm).

H 701.4 Lining. The lining in a seepage pit shall be laid on a firm foundation. Lining materials shall be placed tight together and laid with joints staggered. Except in the case of approved-type precast concrete circular sections, no brick or block shall be greater in height than its width and shall be laid flat to form not less than a 4 inch (102 mm) wall. Brick or block greater than 12 inches (305 mm) in length shall have chamfered matching ends and be scored to provide for seepage. Excavation voids behind the brick, block, or concrete liner shall have not less than 6 inches (152 mm) of clean ¾ of an inch (19.1 mm) gravel or rock.

H 701.5 Brick and Block. Brick or block used in seepage pit construction shall have a compressive strength of not less than 2500 pounds per square inch (lb/in²) (1 757 674 kg/m²).

H 701.6 Sidewall. A seepage pit shall have a minimum sidewall (not including the arch) of 10 feet (3048 mm) below the inlet.

H 701.7 Arch and Dome. The arch or dome of a seepage pit shall be permitted to be constructed in one of three ways:

1. Approved-type hard-burned clay brick or solid concrete brick or block laid in cement mortar.

2. Approved brick or block laid dry. In both of the above methods, an approved cement mortar covering of not less than 2 inches (51 mm) in thickness shall be applied, said covering to extend not less than 6 inches (152 mm) beyond the sidewalls of the pit.

3. Approved-type one or two-piece reinforced concrete slabs of not less than 2500 lb/in² (1 757 674 kg/m²) minimum compressive strength, not less than 5 inches (127 mm) thick, and designed to support an earth load of not less than 400 pounds per square foot (lb/ft²) (1953 kg/m²). Each such cover shall be provided with a 9 inch (229 mm) minimum inspection hole with plug or cover and shall be coated on the underside with an approved bituminous or other nonpermeable protective compound.

H 701.8 Location. The top of the arch or cover shall be not less than 18 inches (457 mm) but not exceed 4 feet (1219 mm) below the surface of the ground.

H 701.9 Inlet Fitting. An approved vented inlet fitting shall be provided in the seepage pit so arranged as to prevent the inflow from damaging the sidewall.

Exception: Where using a one- or two-piece concrete slab cover inlet, fitting shall be permitted to be a one-fourth bend fitting discharging through an opening in the top of the slab cover. On multiple seepage pit installations, the outlet fittings shall comply with Section H 701.2 of this appendix.

H 801.0 Cesspools.
H 801.1 Limitations. A cesspool shall be considered as a temporary expedient pending the construction of a public sewer; as an overflow facility where installed in conjunction with an existing cesspool; or as a means of sewage disposal for limited, minor, or temporary uses, where first approved by the Authority Having Jurisdiction.

H 801.2 Septic Tanks. Where it is established that a public sewer system will be available in less than 2 years, and soil and groundwater conditions are favorable to cesspool disposal, cesspools without septic tanks shall be permitted to be installed for single-family dwellings or for other limited uses where first approved by the Authority Having Jurisdiction.

H 801.3 Construction. Each cesspool, where permitted, shall be in accordance with the construction requirements set forth in Section H 701.0 of this appendix for seepage pits and shall have a sidewall (not including arch) of not less than 20 feet (6096 mm) below the inlet, provided, however, that where a strata of gravel or equally pervious material of 4 feet (1219 mm) in thickness is found, the depth of such sidewall shall not exceed 10 feet (3048 mm) below the inlet.

H 801.4 Existing Installations. Where overflow cesspools or seepage pits are added to existing installations, the effluent shall leave the existing pit through an approved vented leg extending not less than 12 inches (305 mm) downward into such existing pit and having its outlet flow line not less than 6 inches (152 mm) below the inlet. The pipe between pits shall be laid with approved watertight joints.

H 901.0 Commercial or Industrial Special Liquid-Waste Disposal.
H 901.1 Interceptor. Where liquid wastes contain excessive amounts of grease, garbage, flammable wastes, sand, or other ingredients that affect the operation of a private sewage disposal system, an interceptor for such wastes shall be installed.
H 901.2 Installation. Installation of such interceptors shall comply with Section 1009.0 of this code, and their location shall comply with Table H 101.8 of this appendix.

H 901.3 Sampling Box. A sampling box shall be installed where required by the Authority Having Jurisdiction.

H 901.4 Design and Structural Requirement. Interceptors shall be of approved design and be not less than two compartments. Structural requirements shall comply with Section H 501.0 of this appendix.

H 901.5 Location. Interceptors shall be located as close to the source as possible and be accessible for servicing. Necessary manholes for servicing shall be at grade level and be gastight.

H 901.6 Waste Discharge. Waste discharge from interceptors shall be permitted to be connected to a septic tank or other primary system or be disposed into a separate disposal system.

H 901.7 Design Criteria. A formula shall be permitted to be adapted to other types of occupancies with similar wastes. (See Chart H 901.7)

H 1001.0 Inspection and Testing.

H 1001.1 Inspection. Inspection requirements shall comply with the following:

1. Applicable provisions of Section 105.0 of this code and this appendix shall be required. Plans shall be required in accordance with Section 103.3 of this code.
2. System components shall be properly identified as to manufacturer. Septic tanks or other primary systems shall have the rated capacity permanently marked on the unit.

H 1001.2 Testing. Testing requirements shall comply with the following:

1. Septic tanks or other primary components shall be filled with water to flow line before requesting an inspection. Seams or joints shall be left exposed (except the bottom), and the tank shall remain watertight.
2. A flow test shall be performed through the system to the point of effluent disposal. All lines and components shall be watertight. Capacities required air space, and fittings shall comply with the provisions outlined in this appendix.

H 1101.0 Abandoned Sewers and Sewage Disposal Facilities.

H 1101.1 Plugged and Capped. An abandoned building (house) sewer, or part thereof, shall be plugged or capped in an approved manner within 5 feet (1524 mm) of the property line.

H 1101.2 Fill Material. A cesspool, a septic tank, or a seepage pit that has been abandoned or has been discontinued otherwise from further use, or to which no waste or soil pipe from a plumbing fixture is connected, shall have the sewage removed therefrom and be completely filled with the earth, sand, gravel, concrete, or other approved material.

### Chart H 901.7

**Recommended Design Criteria**

<table>
<thead>
<tr>
<th>Grease and Garbage, Commercial Kitchens</th>
<th>Sand-Silt Oil, Auto Washers</th>
<th>Silt-Lint Grease, Laundries, Laundromats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of meals per peak hour x Waste flow rate¹ x Retention time² x Storage factor³ = Interceptor size (liquid capacity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of vehicles per hour x Waste flow rate¹ x Retention time² x Storage factor³ = Interceptor size (liquid capacity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of machines x 2 cycles per hour x Waste flow rate¹ x Retention time² = Storage factor³ = Interceptor size (liquid capacity)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

¹ For waste flow rate see Table H 201.1(4).
² Retention Times:
   (a) Kitchen (commercial) – with dishwasher, garbage disposal, or both = 2.5 hours
   (b) Kitchen (single service) – with garbage disposal = 1.5 hours
   (c) Auto Washers (sand-silt oil) = 2.0 hours
   (d) Laundries/Laundromats = 2.0 hours
³ Storage Factors:
   (a) Kitchen (commercial) – with 8 hours operation = 1
   (b) Kitchen (commercial) – with 16 hours operation = 2
   (c) Kitchen (commercial) – with 24 hours operation = 3
   (d) Kitchen (single service) = 1.5
   (e) Auto Washers (sand-silt oil) – with self service = 1.5
   (f) Auto Washers (sand-silt oil) – with employee operated = 2
   (g) Laundries/Laundromats – with rock filter = 1.5 hours
**APPENDIX H**

**H 1101.3 Filling Requirements.** The top cover or arch over the cesspool, septic tank, or seepage pit shall be removed before filling, and the filling shall not extend above the top of the vertical portions of the sidewalls or above the level of any outlet pipe until inspection has been called and the cesspool, septic tank, or seepage pit has been inspected. After such inspection, the cesspool, septic tank, or seepage pit shall be filled to the level of the top of the ground.

**H 1101.4 Owner.** No person owning or controlling a cesspool, septic tank, or seepage pit on the premises of such person or in that portion of any public street, alley, or other public property abutting such premises shall fail, refuse, or neglect to be in accordance with the provisions of this section or upon receipt of notice so to be in accordance with the Authority Having Jurisdiction.

**H 1101.5 Permittee.** Where disposal facilities are abandoned consequent to connecting any premises with the public sewer, the permittee making the connection shall fill all abandoned facilities in accordance with the Authority Having Jurisdiction within 30 days from the time of connecting to the public sewer.

**H 1201.0 Drawings and Specifications.**

**H 1201.1 General.** The Authority Having Jurisdiction, Health Officer, or other department having jurisdiction shall be permitted to require the following information before a permit is issued for a private sewage disposal system or at a time during the construction thereof:

1. Plot plan drawn to scale, completely dimensioned, showing direction and approximate slope of surface, location of present or proposed retaining walls, drainage channels, water supply lines or wells, paved areas and structures on the plot, number of bedrooms or plumbing fixtures in each structure, and location of the private sewage disposal system with relation to lot lines and structures.

2. Details of construction necessary to ensure compliance with the requirements of this appendix together with a full description of the complete installation including quality, kind, and grade of materials, equipment, construction, workmanship, and methods of assembly and installation.

3. A log of soil formations and groundwater levels as determined by test holes dug in close proximity to a proposed seepage pit or disposal field, together with a statement of water absorption characteristics of the soil at the proposed site, as determined by approved percolation tests.
# APPENDIX I

## INSTALLATION STANDARDS

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The information contained in this appendix is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI’s requirements for an ANS. As such, this appendix may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard.

The following IAPMO Installation Standard is included here for the convenience of the users of the Uniform Plumbing Code. It is not considered as a part of the Uniform Plumbing Code unless formally adopted as such. This Installation Standard is an independent, stand-alone document published by the International Association of Plumbing and Mechanical Officials and is printed herein by the expressed written permission of IAPMO.

TRENCHLESS INSERTION OF POLYETHYLENE (PE) PIPE FOR SEWER LATERALS

IAPMO IS 26-2019e2

ASTM International
ASTM D3261

ASTM F714
Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter

ASTM F894
Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

ASTM F1055
Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing

ASTM F2620
Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

3 Abbreviations
The following abbreviations apply in this Standard:
PE — Polyethylene
HDPE — High Density Polyethylene

4 General
4.1 Product Requirements
Polyethylene (PE) sewer pipe or tubing and fitting joining methods shall be installed in accordance...
with the manufacturer’s installation instructions and comply with ASTM F714, ASTM F894 the applicable nationally recognized standard.

4.2 HDPE Materials
HDPE Extra High Molecular Weight 3408 SDR 17 Pipe Socket-Type PE Fittings for Outside Diameter Controlled.

Note: The HDPE 3408 SDR 17 pipe used in this process was selected because of its ability to retain its circular shape even when bent on a 1.2 m (4 ft) radius during and after installation.

4.3 Protection of Pipe
Pipe shall be stored in a way to protect it from mechanical damage (slitting, puncturing, etc.). It shall be stored under cover to keep it clean and avoid long term exposure to sunlight. Exposure to sunlight during normal construction periods is acceptable.

4.4 Joining Methods
PE joints shall be made in accordance with the manufacturer’s installation instructions. PE pipe shall be joined to other pipe materials by an approved listed adapter or transition fittings listed for the specific transition intended.

4.4.1 Butt-Fusion Joints [2021 UPC 705.5.1.1]
Butt-fusion joints for PE pipe shall be installed in accordance with ASTM F2620 and shall be made by heating the prepared ends of two pipes, pipe and fitting, or two fittings by holding ends against a heated element. The heated element shall be removed when the required melt or times are obtained, and heated ends shall be placed together with applied force. Do not disturb the joint until cooled to ambient temperature.

4.4.2 Electro-Fusion Joints [2021 UPC 705.5.1.2]
Electro-fusion joints shall be heated internally by a conductor at the interface of the joint. Fittings shall comply with ASTM F1055 for the performance requirements of polyethylene electro-fusion fittings. The specified electro-fusion cycle used to form the joint requires consideration of the properties of the materials being joined, the design of the fitting being used, and the environmental conditions. Align and restrain fitting to pipe to prevent movement and apply electric current to the fitting. Turn off the current when the required time has elapsed to heat the joint. Do not disturb the joint until cooled to ambient temperature.

4.4.3 Socket-Fusion Joints [2021 UPC 705.5.1.3]
Socket fusion joints shall be installed in accordance with ASTM F2620 and shall be made by simultaneously heating the outside surface of a pipe end and the inside of a fitting socket. Where the required melt is obtained, the pipe and fitting shall be joined by inserting one into the other with applied force. Do not disturb the joint until cooled to ambient temperature.

4.5 Trenchless Installation of Sewers
The trenchless installation of sewers will be as follows:

(a) Preliminary Steps
(i) Inspect the inside of the sewer line using a camera and recording device to ascertain the line condition.
(ii) Mark the details revealed by the video inspection including:
   1. The ground surface to show the location of the lateral tie of the city wye.
   2. The line location with an arrow in the street pointing back at the lateral.
   3. The property denoting the lateral location.
   4. The locations of the proposed excavations.
(iii) Obtain utility line identification service contact information and all applicable permits.

(b) Excavation
In addition to the above markings, the local utility companies will mark utilities. Considerations are soil density; clearance from obstacles, utilities, and structures; location of bends, and water service locations. Excavations and shoring shall be in accordance with jurisdictional safety requirements.

(c) Set Up
Fuse the proper length of polyethylene pipe in accordance with ASTM F2620, or ASTM D3261 and fuse the end to a small length that is attached to the pulling head. A rod pusher cable is pushed through the damaged host pipe and attached to the pulling cable, which is then drawn through the pipe. The clevis end of the cable is attached to the pulling head. The pulling equipment is then set up according to the manufacturer’s instructions.

(d) Pulling
Pull the pulling head through. Once the pull is done, complete the connection to the existing piping.

4.6 Cleanouts

4.6.1 Plug
Each cleanout fitting for cast-iron pipe shall consist of a cast-iron or brass body and an approved plug. Each cleanout for galvanized wrought-iron, galvanized steel, copper, or brass pipe shall consist of a brass plug as specified in Table 1, or a standard weight brass cap, or an approved ABS or PVC plastic plug, or an approved stainless-steel cleanout or plug. Plugs shall have raised square heads or approved countersunk rectangular slots.

4.6.2 Approved
Each cleanout fitting and each cleanout plug, or cap shall be of an approved type.
4.6.3 Watertight and Gastight
Cleanouts shall be designed to be watertight and gastight.

5 Testing and Inspection Requirements
5.1 Media
The piping of the building sewer shall be tested with water. The Authority Having Jurisdiction shall be permitted to require the removal of cleanouts, etc., to ascertain whether the pressure has reached all parts of the system.

5.2 Water Test
The system shall be tested by plugging the end of the building sewer at its points of connection to the public sewer or private sewage disposal system and completely filling the building sewer with water from the lowest to the highest point thereof.

5.3 Inspections
The completed piping shall be internally inspected by camera unless waived by the Administrative Authority.

### TABLE 1
**CLEANOUTS**
(See Section 4.6.1)

<table>
<thead>
<tr>
<th>NPS</th>
<th>SIZE OF CLEANOUT (inches)</th>
<th>THREADS PER INCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>1.5</td>
<td>11.5</td>
</tr>
<tr>
<td>2</td>
<td>1.5</td>
<td>11.5</td>
</tr>
<tr>
<td>2.5</td>
<td>2.5</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>2.5</td>
<td>8</td>
</tr>
<tr>
<td>4 &amp; larger</td>
<td>3.5</td>
<td>8</td>
</tr>
</tbody>
</table>

**Note:** For SI units: 1 inch = 25 mm

The following standards from Tables 1701.1 and 1701.2 of the 2021 Uniform Plumbing Code apply.

#### Table 1701.1 Standards
- ASTM D2239 Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
- ASTM D2683 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- ASTM D3261 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- ASTM F714 Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
- ASTM F894 Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
- ASTM F1055 Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
- ASTM F2620 Heat Fusion Joining of Polyethylene Pipe and Fittings

#### Table 1701.2 Standards
- ASTM D2657 Heat Fusion Joining of Polyolefin Pipe and Fittings
- IAPMO PS 25 Metallic Fittings for Joining Polyethylene Pipe for Water Service and Yard Piping

Uniform Plumbing Code References

The following sections of the 2021 Uniform Plumbing Code apply:

- 105.2 Required Inspections
- 105.2.2 Other Inspections
- 105.3 Testing of Systems
- 301.2 Minimum Standards
- 309.0 Workmanship
- 312.0 Protection of Piping, Materials, and Structures
- 314.0 Trenching, Excavation, and Backfill
- 701.3 Drainage Fittings
- 705.5.1.1 Butt Fusion Joints
- 705.5.1.2 Electro-Fusion Joints
- 705.5.1.3 Socket-Fusion Joints
- 723.0 Building Sewer Test
1.0 Scope.

1.1 General.

1.1.1 This Standard specifies requirements for the installation of SDR 9 CTS crosslinked polyethylene (PEX) tubing and fittings, including cold-expansion, crimp, press, and mechanical compression fittings, intended for hot- and cold-water distribution systems within buildings.

1.1.2 This Standard applies to:
(a) SDR 9 CTS PEX tubing complying with ASTM F876 and pressure-rated in accordance with PPI TR-3; and
(b) PEX fitting systems complying with:
   (i) ASTM F877, for mechanical compression fittings and metal or plastic insert fittings with stainless steel press sleeves;
   (ii) ASTM F1807 or ASTM F2159, for metal or plastic insert fittings with copper crimp rings;
   (iii) ASTM F1960, for cold expansion fittings with PEX reinforced rings; or
   (iv) ASTM F2080, for cold expansion fittings with metal compression sleeves.

1.2 Terminology.

In this Standard,
(a) “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy to comply with the Standard;
(b) “should” is used to express a recommendation, but not a requirement;
(c) “may” is used to express an option or something permissible within the scope of the Standard; and
(d) “can” is used to express a possibility or a capability.

Notes accompanying sections of the Standard do not specify requirements or alternative requirements; their purpose is to separate explanatory or informative material from the text. Notes to tables and figures are considered part of the table or figure and can be written as requirements.

1.3 Amendments.

Proposals for amendments to this Standard will be processed in accordance with the standards-writing procedures of IAPMO.

2.0 Reference Publications.

This Standard refers to the following publications, and where such reference is made, it shall be to the current edition of those publications, including all amendments published thereto.

ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing


ASTM F1807 Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Crosslinked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing


ASTM F2080 Standard Specification for Cold-Expansion Fittings With Metal Compression-Sleeves for Cross-Linked Polyethylene (PEX) Pipe
4.2 Fittings.

4.2.1 Cold-Expansion Fittings.
Cold-expansion fittings typically
(a) are made of brass, stainless steel, or sulfone;
(b) consist of an insert and a PEX reinforcing ring;
and
(c) are available in NTS-⅛ to NTS-3.

4.2.2 Crimp or Press Insert Fittings.
Crimp or press insert fittings typically
(a) are made of brass, stainless steel, or sulfone;
(b) consist of an insert and a copper crimp ring or a stainless steel press ring
(c) are available in NTS-⅛ to NTS-2.

4.2.3 Compression Fittings.
Compression (i.e., transition) fittings typically
(a) are made of brass; and
(b) consist of
(i) a nut, a compression ring, and an insert; or
(ii) an O-ring brass insert with a compression sleeve
(c) are available in NTS-⅛ to NTS-3.

4.3 Installation.
Only fittings systems marked on the tubing shall be used for installation with that particular tubing.

4.4 Tools.
Tools and tool accessories (e.g., tool heads) used for the installation of PEX tubing systems shall be in accordance with the manufacturer’s specifications and written instructions.

4.5 Tubing Protection.

4.5.1 Abrasion.
PEX tubing passing through drilled or notched metal studs or metal joists, or hollow-shell masonry walls shall be protected from abrasion by elastomeric or plastic sleeves or grommets.

4.5.2 Puncture.
Steel-plate protection shall be installed in accordance with the local plumbing code.

5.0 Handling.

5.1 Receiving.
When receiving PEX tubing shipments, the receiver shall inspect and inventory each shipment, ensuring that there has been no loss or damage. In addition:
(a) At the time of unloading, the markings of all tubing, fittings, and accessories shall be verified to ensure that all items have been manufactured in accordance with the applicable product Standard and appropriately certified.
(b) An overall examination of the shipment shall be made. If the shipment is intact, ordinary inspection while unloading shall be sufficient to ensure that the items have arrived in good condition.

(c) If the load has shifted, has broken packaging, or shows evidence of rough treatment, each item shall be carefully inspected for damage.

(d) The total quantities of each shipment (e.g., tubing, gaskets, fittings, and accessories) shall be checked against shipping records.

(e) Any damaged or missing items shall be noted on the delivery slip. The carrier shall be notified immediately and a claim made in accordance with its instructions.

(f) No damaged material shall be disposed of. The carrier shall recommend the procedure to follow.

(g) Shortages and damaged materials are normally not reshipped without request. If replacement material is needed, it shall be reordered from the manufacturer, the distributor, or a manufacturer’s representative.

§ 5.2 Storage and UV Exposure.

5.2.1 PEX tubing and fittings shall be stored indoors and in its original packaging until the time of installation. Appropriate precautions to protect the tubing from damage, impact, and punctures shall be taken.

5.2.2 Accumulative exposure time to UV radiation during storage and installation shall not exceed the UV exposure limits recommended by the manufacturer or specified in ASTM F876.

Note: ASTM F876 has four categories for UV-resistance, ranging from untested to 6 months of continuous exposure, as listed in the material designation code.

5.3 Exposure to Heat.

5.3.1 PEX tubing and fittings shall not be exposed to open flames.

5.3.2 PEX tubing shall not be exposed to temperatures exceeding 93°C (200°F).

5.4 Exposure to Chemicals.

5.4.1 Chemical compatibility (e.g., with common construction materials) shall be verified with the manufacturer prior to direct contact.

5.4.2 In general, petroleum- or solvent-based chemicals (e.g., paints, greases, pesticides, or sealants) shall not be allowed to come in direct contact with PEX tubing or fittings.

6.0 Thermal Expansion and Contraction.

6.1 Horizontal Tubing Runs.

Thermal expansion and contraction forces on suspended horizontal runs of PEX tubing that can experience a 22°C (40°F) or greater change in temperature (operating temperature compared to ambient temperature) shall be controlled by a means of mitigating temperature-induced stresses to other parts of the water distribution system. Means for controlling thermal expansion and contraction include

(a) loops;

(b) offsets;

(c) arms with rigid anchor points; and

(d) supporting the tubing with continuous runs of CTS support channels with

(i) rigid anchor points installed every 20 m (65 ft); and

(ii) proper strapping (e.g., 27 kg (60 lb) straps or equivalent) spaced 1 m (3 ft) and rated for the maximum temperature and UV exposure of the PEX tubing application.

6.2 Vertical Tubing Runs.

Thermal expansion and contraction forces on vertical runs of PEX tubing that pass through more than one floor and can experience a 22°C (40°F) or greater change in temperature (operating temperature compared to ambient temperature) shall be controlled by installing

(a) a riser clamp at the top of every other floor; and

(b) mid-story guides to maintain the alignment of the vertical tubing.

Note: Installing riser clamps isolates expansion and contraction to two-floor intervals allowing the PEX tubing to naturally compensate for the expansion and contraction.

6.3 Clearance.

Adequate clearance shall be provided between PEX tubing and the building structure (e.g., using bored holes and sleeves) to allow for free longitudinal movement of the tubing.

6.4 Expansion Arms and Expansion Loops.

6.4.1 Expansion Arms (See Figure 1).

6.4.1.1 Expansion arms shall be installed as illustrated in Figure 1.

6.4.1.2 The minimum length of expansion arms shall be calculated using the following equation:

\[ LB = C \times \sqrt{(D \times \Delta L)} \]

where

\[ LB = \text{length of flexible arm} \]

\[ C = \text{material constant (12 for PEX)} \]

\[ D = \text{nominal outside diameter of tubing} \]

\[ \Delta L = \text{thermal expansion length} \]

6.4.2 Expansion Loops (See Figure 2).

6.4.2.1 Expansion loops shall be installed at the mid-point between anchors, as illustrated in Figure 2.
6.4.2.2 The minimum length of expansion loops shall be calculated using the equation in Section 6.4.1.2; however, the distance \( LB \) shall be divided into three sections, as illustrated in Figure 2, where
\[
L1 = \frac{LB}{5}; \text{ and} \\
L2 = L1 \times 2
\]

7.0 Hangers and Supports.
7.1 Vertical Tubing.
Vertical PEX tubing shall
(a) be supported at each floor or as specified by the water-distribution system designer to allow for expansion and contraction; and
(b) have mid-story guides.
7.2 Horizontal Tubing.
Unless otherwise authorized by the authority having jurisdiction, suspended horizontal runs of PEX tubing
(a) NTS-1 and smaller shall be supported every 0.8 m (32 in), unless continuously supported by metallic CTS or V channels that
(i) are supported at intervals not exceeding 1.8 m (6 ft);
(ii) have a maximum cantilever, measured from the support to the end of the CTS support channel, of 0.5 m (1.5 ft); and
(b) NTS-1\( \frac{1}{8} \) and larger shall be supported every 1.2 m (4 ft), unless continuously supported by metallic CTS or V channels that
(i) are supported at intervals not exceeding 2.4 m (8 ft); and
(ii) have a maximum cantilever, measured from the support to the end of the CTS support channel, of 0.5 m (1.5 ft).

7.3 Anchors.
Anchors shall be
(a) used to restrict PEX tubing movement;
(b) made of materials that provide rigidity to the support system and utilize pipe clamps designed for plastic tubing capable of restraining the tubing; and
(c) installed in accordance with Figures 1 or 2, as applicable (i.e., anchor distances and size of arms and offsets).

Note: Anchors are typically installed every 20 m (65 ft). See Section 6.

8.0 Joints and Connections.
8.1 Assembly Procedure.
The procedure for making joints shall be as specified by the manufacturer.

8.2 Concealed Joints.
PEX tubing systems manufactured in accordance with the applicable standards referenced in Section 2 are deemed manufactured joints and may be installed in concealed spaces without the need for access panels.

9.0 Clearances.
9.1 Gas Vents.
Except for double-wall B-vents, which require a 25 mm (1 in) clearance, the clearance between gas appliance vents and PEX tubing shall be at least 150 mm (6 in).

9.2 Recessed Light Fixtures.
Except when the PEX tubing is protected with fiberglass or closed-cell insulation or the recessed light is IC-rated, the clearance between recessed light fixtures and PEX tubing shall be at least 300 mm (12 in).

9.3 Fluorescent Lighting.
When in direct view of the light source, the clearance between fluorescent lighting and PEX tubing shall be at least 1.5 m (5 ft). If the minimum clearance cannot be achieved, the PEX tubing shall be protected with a UV-blocking sleeve.

10.0 Other Considerations.
10.1 Hot-Work Joints.
Hot-work joints (e.g., soldering, brazing, welding, and fusion-welding) shall be
(a) made at least 500 mm (18 in) from PEX tubing in the same water line; and
(b) performed prior to completing the PEX joints.

10.2 Bending Radius.
10.2.1 The free (unsupported) bending radius for PEX tubing, measured at the outside of the bend, shall be not less than six times the actual outside diameter of the tubing, unless otherwise specified by the PEX manufacturer. Supports should be used to facilitate rigid bends and to alleviate stress on PEX joints when bends are needed in close proximity to such joints.

10.2.2 Tighter bends may be used when the PEX tubing is uniformly bent (supported) around a curved bracket or other rigid fixture. In this case, the minimum outside radius of the supported bend shall be as specified by the PEX manufacturer.

10.3 Directional Fittings.
Directional fittings (e.g., 90º and 45º elbows) should only be installed where necessary.

Note: The flexible nature of PEX tubing allows for sweeping bends resulting in less fittings and joints.
10.4 Direct Burial.
PEX tubing and fittings may be used in direct burial applications when allowed in the manufacturer’s written installation instructions.

**Note:** AWWA C904 should be consulted for water service applications.

10.5 Fire-Resistive Construction.
Manufacturer’s installation instructions shall be consulted prior to installation of PEX tubing in fire-resistive constructions. PEX tubing penetrating a wall or floor-and-ceiling fire-rated assembly shall include a means of passive fire protection in accordance with the local codes.

10.6 Sizing and Flow Velocities.
10.6.1 PEX tubing shall be sized in accordance with IAPMO/ANSI UPC 1.

**Note:** Potable water piping sizing is addressed in Chapter 6 and Appendix A of IAPMO/ANSI UPC.

10.6.2 The tubing manufacturer’s pressure-loss data should be referenced when using Appendix A of IAPMO/ANSI UPC 1. In absence of such data, Figures 3 and 4 shall be used.

10.6.3 Flow velocities through the water distribution system, used for calculating flush tank and flush valve fixture units depending on the tubing sizes (see Table 1), shall not exceed

(a) 3.0 m/s (10 ft/s) for cold-water distribution systems; and
(b) 2.4 m/s (8 ft/s) for hot-water distribution systems.

**Note:** The flow velocities in Items (a) and (b) account for the increased velocities through the fittings.

10.6.4 Hot-water recirculation systems shall

(a) be balanced to maintain adequate system temperatures; and
(b) have flow velocities that do not exceed 0.6 m/s (2 ft/s) (see Table 2); and
(c) use only PEX tubing designated for hot, chlorinated water recirculation systems and rated for the maximum percentage of time during which the system is intended to be operated at elevated temperatures, in accordance with ASTM F876.

10.7 Installation Testing.
Installation of PEX water distribution systems may be tested with air when

(a) expressly allowed in the written instructions of the manufacturers of all plastic pipe and fittings installed at the time the PEX piping system is being tested; and
(b) compressed air or other gas testing is not prohibited by the authority having jurisdiction.
### TABLE 1
**CALCULATION OF FLUSH TANK AND FLUSH VALVE FIXTURE UNITS**
(See Section 10.6.3)

<table>
<thead>
<tr>
<th>NOMINAL TUBING SIZE</th>
<th>FLOW VELOCITY: 3.0 m/s (10 ft/s)</th>
<th>FLOW VELOCITY: 2.4 m/s (8 ft/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FLOW VOLUME, L/min (gpm)</td>
<td>FLUSH TANK FIXTURE UNITS</td>
</tr>
<tr>
<td>½</td>
<td>20.8 (5.5)</td>
<td>6</td>
</tr>
<tr>
<td>¼</td>
<td>41.6 (11.0)</td>
<td>15</td>
</tr>
<tr>
<td>1</td>
<td>68.9 (18.2)</td>
<td>26</td>
</tr>
<tr>
<td>1½</td>
<td>103.0 (27.2)</td>
<td>46</td>
</tr>
<tr>
<td>1⅛</td>
<td>143.5 (37.9)</td>
<td>77</td>
</tr>
<tr>
<td>2</td>
<td>246.1 (65.0)</td>
<td>200</td>
</tr>
<tr>
<td>3</td>
<td>533.0 (140.8)</td>
<td>590</td>
</tr>
</tbody>
</table>

### TABLE 2
**TUBING SIZES, FLOWS, AND FRICTION LOSSES FOR HOT-WATER RECIRCULATION SYSTEMS**
(See Section 10.6.4)

<table>
<thead>
<tr>
<th>NOMINAL TUBING SIZE</th>
<th>FLOW VELOCITY, m/s (ft/s)</th>
<th>FLOW VOLUME, L/min (gpm)</th>
<th>FRICTION LOSSES AT 49°C (120°F) kPa/m (psi/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½</td>
<td>0.6 (2)</td>
<td>4.2 (1.1)</td>
<td>0.4411 (0.0195)</td>
</tr>
<tr>
<td>¼</td>
<td>0.6 (2)</td>
<td>8.3 (2.2)</td>
<td>0.2850 (0.0126)</td>
</tr>
<tr>
<td>1</td>
<td>0.6 (2)</td>
<td>13.6 (3.6)</td>
<td>0.2081 (0.0092)</td>
</tr>
<tr>
<td>1½</td>
<td>0.6 (2)</td>
<td>20.4 (5.4)</td>
<td>0.1629 (0.0072)</td>
</tr>
<tr>
<td>2</td>
<td>0.6 (2)</td>
<td>28.4 (7.5)</td>
<td>0.1335 (0.0059)</td>
</tr>
<tr>
<td>3</td>
<td>0.6 (2)</td>
<td>48.8 (12.9)</td>
<td>0.0950 (0.0042)</td>
</tr>
</tbody>
</table>

**Note:**

LB shall be calculated as specified in Figure 2 and divided into three sections, as follows:

\[ LB = L1 + (2 \times L2) \]

where

\[ L1 = \frac{LB}{5}; \text{ and} \]

\[ L2 = \frac{L1}{2}. \]

**FIGURE 2**
**EXPANSION LOOPS**
(See Sections 6.4.2 and 7.3)
FIGURE 3
PRESSURE LOSS OF PEX TUBING AT 16 °C (60°F)
(See Section 10.6.2)
FIGURE 4
PRESSURE LOSS OF PEX TUBING AT 49 °C (120°F)
(See Section 10.6.2)
"The information contained in this appendix is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI’s requirements for an ANS. As such, this appendix may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard."

The following IAPMO Installation Standard is included here for the convenience of the users of the Uniform Plumbing Code. It is not considered as a part of the Uniform Plumbing Code unless formally adopted as such. This Installation Standard is an independent, stand-alone document published by the International Association of Plumbing and Mechanical Officials and is printed herein by the expressed written permission of IAPMO.

**THRUST BLOCKING FOR RUBBER GASKETED AND SOLVENT CEMENT JOINTS**

IAPMO IS 33-2019e1

1 Scope
   1.1 General
      1.1.1 This Standard specifies requirements for the installation of thrust blocking for ductile iron pipe with elastomeric gasketed joints and fittings and PVC piping with solvent cemented or elastomeric gasketed joints intended for cold water building supply and yard piping.
      1.1.2 Thrust blocks covered by this standard prevent separation of joints and pipe movement by transferring the resultant thrust force at a bend to the undisturbed soil behind the thrust block. The bearing strength of the soil is expressed in pounds per square foot. Therefore, the area behind the thrust block must engage enough soil area to resist the resultant thrust force at a change in direction.

1.2 Terminology
   In this Standard,
   (a) “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy to comply with the Standard;
   (b) “should” is used to express a recommendation, but not a requirement;
   (c) “may” is used to express an option or something permissible within the scope of the Standard; and
   (d) “can” is used to express a possibility or a capability.
   Notes accompanying sections of the Standard do not specify requirements or alternative requirements; their purpose is to separate explanatory or informative material from the text. Notes to tables and figures are considered part of the table or figure and can be written as requirements.

1.3 Amendments
   Proposals for amendments to this Standard will be processed in accordance with the standards-writing procedures of IAPMO.

2 Reference Publications
   This Standard refers to the following publications, and where such reference is made, it shall be to the current edition of those publications, including all amendments published thereto.
   IAPMO/ANSI UPC-1 Uniform Plumbing Code

3 Abbreviations
   The following abbreviations apply in this Standard:
   PVC — polyvinyl chloride

4 General
   4.1 Thrust Blocking for Rubber Gasketed Joints
   In lines with rubber gasketed joints, thrust blocks shall be installed at all locations including:
   (a) Changes in direction, as at tees and bends
   (b) Changes in size, as at reducers
   (c) Stops, as at dead ends
   (d) Valves, where thrusts may be expected.
   Note: See examples in Figure 1.

4.2 Sizing
   Piping shall be sized in accordance with the applicable code or jurisdictional requirements.
   Note: For example, Appendix A, “Recommended Rules for Sizing the Water Supply System”, or Section 610.0, “Size of Potable Water Piping” of IAPMO/ANSI UPC-1 may be use for sizing pipe.

4.3 Flow Velocity
   Flow velocity shall not exceed 8 fps (2.4 m/s) for PVC pipe or 10 fps (3 m/s) for other pipe materials.

4.4 Deflection
   Elastomeric gasketed pipe may be deflected in accordance with the manufacturer’s recommendations pro-
vided that it shall not be permanently staked or blocked to maintain this deflection.

4.5 **Maximum Working Pressure**
The pipe and fitting system shall be designed for the maximum working pressure in accordance with Table 1.

5 **Thrust Blocking Sizing and Calculations**

5.1 **Sizes**
Thrust block sizes shall be based on the maximum line pressure, pipe size and the safe bearing load of the soil.

5.2 **Calculation Examples**

5.2.1 **Thrust**

5.2.1.1 **Example 1**
From Table 2, *Thrust at Fittings in pounds at 100 psi of Water Pressure*, the thrust for a NPS 4 Dead End Tee at a pressure of 100 psi is 1620 lb.

5.2.1.2 **Example 2**
The thrust for an NPS 4, Dead End Tee, at a pressure of 150 psi is 2430 lb or 1.5 times the thrust found in Table 2.

The calculation is as follows:
(a) The thrust from Table 2, for an NPS 4, Dead End Tee, at 100 psi, is 1,620 lb.
(b) The actual pressure of the system is 150 psi.
(c) Divide the actual pressure by the table pressure or 150 psi/100 psi is 1.5.
(d) Multiply the thrust from Table 2, for an NPS 4, Dead End Tee, at 100 psi, times the ratio of the actual/table pressure, or 1.5 times 1620 lb for a thrust of 2430 lb.

5.2.1.3 **Example 3**
From Table 3, *Thrust at Fittings in Newtons at 689 kPa of Water Pressure*, the thrust for a DN 125, 90° Bend, at a pressure of 689 kPa is 15,757 N.

5.2.1.4 **Example 4**
The thrust for a DN 125, 90° Bend, at a pressure of 861 kPa is 19,469 N or 1.25 times the force in Table 3.

The calculation is as follows:
(a) The thrust from Table 3, for a DN 127, 90° Bend at a pressure of 689 kPa, is 15,575 N.
(b) The actual pressure of the system is 861 kPa.
(c) Divide the actual pressure by the table pressure or 861 kPa/689 kPa or 1.25.
(d) Multiply the thrust from Table 2, for a DN 125, 90° Bend, at a pressure of 689 kPa times, the ratio of the actual/table pressure, or 1.25 times 15,757 N for a thrust of 19,469 N.

**Note:** 1000 N is equal to 1 kN for a thrust of 19,469 kN.

5.2.2 **Thrust Block Bearing Area**
The thrust block bearing area is determined by dividing the thrust by the safe bearing load of the soil.

**Note:** See examples in Figure 2

5.2.2.1 **Example 5**
From Table 4, *Safe Bearing Loads of Various Soils* the safe bearing load of sand is 2000 lb/ft².

5.2.2.2 **Example 6**
The thrust block bearing area for an NPS 4, Dead End Tee, at a pressure of 100 psi in sand is 0.81 ft².

The calculation is as follows:
(a) From Table 2, *Thrust at Fittings in pounds at 100 psi of Water Pressure*, the thrust for a 4 in Dead End Tee at a pressure of 100 psi is 1620 lb.
(b) From Table 4 the safe bearing load of sand is 2000 lb/ft².
(c) Divide the thrust by the safe bearing load of sand, or 1620 lb/2000 lb/ft² for a thrust block bearing area of 0.81 ft².

5.2.2.3 **Example 7**
The thrust block bearing area for an NPS 4, Dead End Tee at a pressure of 150 psi in sand is 1.22 ft².

The calculation is as follows:
(a) The thrust for an NPS 4, Dead End Tee, at a pressure of 150 psi was found in Example 2 to be 2430 lb.
(b) The soil type is sand and the safe bearing load of sand from Table 4 is 2000 lb/ft².
(c) The required bearing area of the thrust block is determined by dividing the thrust by the safe bearing load or 2430 lb/2000 lb/ft² for a thrust block bearing area of 1.22 ft².

5.2.2.4 **Example 8**
The thrust block bearing area for a DN 125, 90° Bend, at a pressure of 861 kPa in Soft Clay is 2.82 m².

The calculation is as follows:
(a) The thrust for a DN 125, 90° Bend at a pressure of 861 kPa was found in Example 4 to be 19,469 N.
(b) The soil condition is soft clay and the safe bearing load of soft clay from Table 4 is 48 kPa or 48,000 N/m².

**Note:** 1 kPa = 1 kN/m² = 1000 N/m²
(c) The required block bearing area is determined by dividing the thrust by the safe bearing load or 19,469 N/48,000 N/m² for a thrust block bearing area of 0.4 m².
6 Testing Requirements

6.1 Rubber Gasketed Joints

Properly sized thrust blocks, either permanent or temporary, shall be installed at all required points before testing. When concrete thrust blocks are installed, wait at least 24 hours before pressure testing.

6.2 Solvent Cement Joints

The entire system shall be purged before testing to eliminate all solvent cement vapors and air. The system shall not be pressurized until the joints have cured (set) at least as long as recommended by the manufacturer. If the manufacturer's recommendation is not available the cure times in Table 5 shall apply. Systems with solvent cement joints shall be pressure tested filled with water or other fluid. CAUTION: Water Test Only.

7 Identification

A label shall be fastened to the main electrical meter panel stating, “This structure has a nonmetallic water service”.

<table>
<thead>
<tr>
<th>MAXIMUM WORKING PRESSURE kPa (psi)</th>
<th>SIZES</th>
<th>PIPE</th>
<th>FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NPS</td>
<td>DN</td>
<td></td>
</tr>
<tr>
<td>1103 kPa (160 psi)</td>
<td>1/2 to 8</td>
<td>15 to 200</td>
<td>SDR 26</td>
</tr>
<tr>
<td></td>
<td>1/2 to 8</td>
<td>15 to 200</td>
<td>SDR 21</td>
</tr>
<tr>
<td>1379 kPa (200 psi)</td>
<td>1/2 to 4</td>
<td>15 to 100</td>
<td>SDR 17</td>
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<td></td>
<td>1/2 to 8</td>
<td>15 to 200</td>
<td>Schedule 40</td>
</tr>
<tr>
<td>1724 kPa (250 psi)</td>
<td>1/2 to 3</td>
<td>15 to 80</td>
<td>Schedule 40</td>
</tr>
<tr>
<td></td>
<td>1/2 to 8</td>
<td>15 to 200</td>
<td>Schedule 40</td>
</tr>
<tr>
<td>2172 kPa (315 psi)</td>
<td>1/2 to 1-1/2</td>
<td>15 to 40</td>
<td>SDR 13.5</td>
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<tr>
<td></td>
<td>1/2 to 4</td>
<td>15 to 100</td>
<td>Schedule 40</td>
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<tr>
<td>1103 kPa (160 psi)</td>
<td>5 to 8</td>
<td>125 to 200</td>
<td>Schedule 40</td>
</tr>
<tr>
<td>1517 kPa (220 psi)</td>
<td>2 to 4</td>
<td>50 to 100</td>
<td>Schedule 40</td>
</tr>
<tr>
<td>2206 kPa (320 psi)</td>
<td>1/2 to 1-1/2</td>
<td>15 to 40</td>
<td>Schedule 40</td>
</tr>
<tr>
<td>1103 kPa (160 psi)</td>
<td>5 to 8</td>
<td>125 to 200</td>
<td>Schedule 80</td>
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<tr>
<td>1517 kPa (220 psi)</td>
<td>2 to 4</td>
<td>50 to 100</td>
<td>Schedule 80</td>
</tr>
<tr>
<td>2206 kPa (320 psi)</td>
<td>1/2 to 1-1/2</td>
<td>15 to 40</td>
<td>Schedule 80</td>
</tr>
<tr>
<td>1724 kPa (250 psi)</td>
<td>5 to 8</td>
<td>125 to 200</td>
<td>Schedule 80</td>
</tr>
<tr>
<td>2206 kPa (320 psi)</td>
<td>1/2 to 4</td>
<td>15 to 100</td>
<td>Schedule 80</td>
</tr>
</tbody>
</table>
TABLE 2
THRUST AT FITTINGS IN POUNDS AT 100 psi OF WATER PRESSURE
(See Sections 5.2.1.1, 5.2.1.2, and 5.2.2.2)

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>90° BENDS</th>
<th>45° BENDS</th>
<th>22-1/2° BENDS</th>
<th>DEAD ENDS AND TEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2</td>
<td>415</td>
<td>225</td>
<td>115</td>
<td>295</td>
</tr>
<tr>
<td>2</td>
<td>645</td>
<td>350</td>
<td>180</td>
<td>455</td>
</tr>
<tr>
<td>2-1/2</td>
<td>935</td>
<td>510</td>
<td>260</td>
<td>660</td>
</tr>
<tr>
<td>3</td>
<td>1395</td>
<td>755</td>
<td>385</td>
<td>985</td>
</tr>
<tr>
<td>3-1/2</td>
<td>1780</td>
<td>962</td>
<td>495</td>
<td>1260</td>
</tr>
<tr>
<td>4</td>
<td>2,295</td>
<td>1245</td>
<td>635</td>
<td>1620</td>
</tr>
<tr>
<td>5</td>
<td>3,500</td>
<td>1900</td>
<td>975</td>
<td>2,490</td>
</tr>
<tr>
<td>6</td>
<td>4,950</td>
<td>2,710</td>
<td>1385</td>
<td>3,550</td>
</tr>
<tr>
<td>8</td>
<td>8,300</td>
<td>4,500</td>
<td>2,290</td>
<td>5,860</td>
</tr>
<tr>
<td>10</td>
<td>12,800</td>
<td>6,900</td>
<td>3,540</td>
<td>9,050</td>
</tr>
<tr>
<td>12</td>
<td>18,100</td>
<td>9,800</td>
<td>5,000</td>
<td>12,800</td>
</tr>
</tbody>
</table>

TABLE 3
THRUST AT FITTINGS IN NEWTONS (N) AT 689 kPa OF WATER PRESSURE
(See Sections 5.2.1.3, and 5.2.1.4)

<table>
<thead>
<tr>
<th>PIPE SIZE DN</th>
<th>90° BENDS</th>
<th>45° BENDS</th>
<th>22-1/2° BENDS</th>
<th>DEAD ENDS AND TEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>1847</td>
<td>1000</td>
<td>515</td>
<td>1315</td>
</tr>
<tr>
<td>50</td>
<td>2870</td>
<td>1560</td>
<td>800</td>
<td>2025</td>
</tr>
<tr>
<td>65</td>
<td>4160</td>
<td>2270</td>
<td>1160</td>
<td>3940</td>
</tr>
<tr>
<td>80</td>
<td>6210</td>
<td>3360</td>
<td>1715</td>
<td>4385</td>
</tr>
<tr>
<td>90</td>
<td>7925</td>
<td>4280</td>
<td>2205</td>
<td>5610</td>
</tr>
<tr>
<td>100</td>
<td>10,215</td>
<td>5540</td>
<td>2815</td>
<td>7210</td>
</tr>
<tr>
<td>125</td>
<td>15,575</td>
<td>8455</td>
<td>4340</td>
<td>11,080</td>
</tr>
<tr>
<td>150</td>
<td>22,030</td>
<td>12,060</td>
<td>6165</td>
<td>15,800</td>
</tr>
<tr>
<td>200</td>
<td>36,935</td>
<td>20,025</td>
<td>10,190</td>
<td>26,080</td>
</tr>
<tr>
<td>250</td>
<td>56,960</td>
<td>30,705</td>
<td>15,755</td>
<td>40,275</td>
</tr>
<tr>
<td>300</td>
<td>80,545</td>
<td>43,610</td>
<td>22,250</td>
<td>56,960</td>
</tr>
</tbody>
</table>
**TABLE 4**
SAFE BEARING LOADS OF VARIOUS SOILS
(See Sections 5.2.2.1, and 5.2.2.3 and 5.2.2.4)

<table>
<thead>
<tr>
<th>SOIL</th>
<th>Safe Bearing Load</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lbs/ft² (psf)</td>
<td>kN/m² (kPa)</td>
<td></td>
</tr>
<tr>
<td>Mulch, Peat, etc.</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Soft Clay</td>
<td>1000</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Sand</td>
<td>2000</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Sand and Gravel</td>
<td>3000</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>Sand and Gravel Cement with Clay</td>
<td>4000</td>
<td>191</td>
<td></td>
</tr>
<tr>
<td>Hard Shale</td>
<td>10,000</td>
<td>478</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 5**
MINIMUM CURE TIME, IN HOURS (h)*
TEST PRESSURE FOR PIPE
(See Section 6.2)

<table>
<thead>
<tr>
<th>Temperature Range During Cure Period</th>
<th>DN 15 TO 32 (NPS 1/2 TO 1-1/4)</th>
<th>DN 40 TO 80 (NPS 1-1/2 TO 3)</th>
<th>DN 80 TO 200 (NPS 3-1/2 TO 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>60°F - 100°F (16°C - 38°C)</strong></td>
<td>1 h</td>
<td>6 h</td>
<td>2 h</td>
</tr>
<tr>
<td><strong>40°F - 60°F (4°C - 16°C)</strong></td>
<td>2 h</td>
<td>12 h</td>
<td>4 h</td>
</tr>
<tr>
<td><strong>10°F - 40°F (-12°C - 4°C)</strong></td>
<td>8 h</td>
<td>48 h</td>
<td>16 h</td>
</tr>
</tbody>
</table>

*If gaps or loose fits are encountered in the system, double these cure times.
FIGURE 1
LOCATION OF THRUST BLOCKS
(STANDARD AND METRIC COMBINED)
A COMPARISON OF THRUST-BLOCK AREAS
(See Section 4.1)
FIGURE 2
THRUST BLOCK BEARING AREA
(See Section 5.2.2)
Uniform Plumbing Code References for Ductile Iron and PVC Pressure Building Supply and Exterior Cold-Water Piping

The following sections of the 2021 Uniform Plumbing Code apply to ductile iron and PVC pressure building supply and exterior cold-water piping.

Chapter 3  General Regulations
309.0  Workmanship
312.0  Protection of Piping, Materials, and Structures
313.0  Hangers and Supports
314.0  Trenching, Excavation, and Backfill

Chapter 6  Water Supply and Distribution
604.0  Materials (water piping)
Table 604.1  Materials for Building Supply and Water Distribution Piping and Fittings
605.4  Ductile Iron Pipe and Joints
605.12  PVC Plastic Pipe and Joints
605.16.2  Plastic Pipe to Other Materials
609.0  Installation, Testing, Unions, and Location

Abbreviations
IAPMO  International Association of Plumbing and Mechanical Officials
UPC  Uniform Plumbing Code published by IAPMO
AWWA  American Water Works Association
CSA  Canadian Standards Association

Applicable Standards.
ASME B16.4  Gray Iron Threaded Fittings Classes 125 and 250
ASTM D1785  Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241  Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2466  Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467  Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM F1970  Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems
AWWA C110  Ductile Iron and Gray-Iron Fittings
AWWA C111  Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
The information contained in this appendix is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this appendix may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard.

The following Sections B414-18, B417-18, B421C-18, B422C-18, SR614-18, TR418-18, TR420-18, are excerpted in their entirety from the 2018 Handbook for the Installation of Ceramic, Glass, and Stone Tile Installations, with permission from the Tile Council of North America, Inc.

In addition to these, the TCNA Handbook, includes 200+ methods for tile and stone installation based on various installation requirements and application types, as well as product selection guides, field and installation requirements, and guidelines for wet areas. For a complete copy, visit www.TCNAtile.com.

**TCNA HANDBOOK-2018**

FOR CERAMIC, GLASS, AND STONE TILE INSTALLATION
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Recommended Uses
• For showers that do not have prefabricated receptors.
• For areas where wall flatness is critical, such as when tiles with any edge longer than 15° are specified.

Environmental Exposure Classifications
• Res1, 2, 3, 5; Com1, 2, 3, 5.
• For Res4 and Com4, see SR614.
• For installations that may be exposed to staining, specify tile and grout suitable for exposure. Consult product manufacturers; see also “Product Selection Guides.”

Limitations
• Maximum mortar bed thickness (walls)—1” for metal studs, 1½” for wood studs.
• Maximum stud spacing 16” on center.

Membrane Options
• A waterproof membrane (A118.10) or vapor retarder membrane (A108.02-3.8) must be specified for walls to prevent moisture intrusion and protect adjacent building materials. Specifier shall indicate if complete waterproofing of walls is required, including treatment at termination points.
• If a waterproof membrane is applied over the mortar bed walls, membrane over framing members may not be required.
• Check with membrane manufacturer for suitability for applicable conditions, as not all membranes are suitable for steam, high-temperature and/or chemical exposure, or exterior use.
• When glass tile is used, consult glass tile manufacturer for membrane options and recommendations.

Requirements
• Wood studs—dry and well-braced, minimum depth 3 1/2”.
• Metal studs—well-braced; 20 gauge (0.033”) or heavier; minimum depth 3½” for residential applications or 3¾” for commercial applications.
• Mortar bed thickness—⅜” minimum to 1” maximum (metal studs) or 1½” maximum (wood studs)
• Membrane behind mortar bed, when used, must lap over shower pan membrane.
• Slope shower pan membrane ¼” per foot to weep holes in drain.
• Turn shower pan membrane up walls a minimum of 3” above shower curb (6” above floor in showers without curbs).
• Surround drain with pea gravel or other weep protection to prevent mortar from blocking weep holes.

Materials
• Multiple options exist for membranes, mortars, grouts, and other materials and must be clearly specified to be included. If not specifically indicated, optional materials are not included and mortar/grout choice defaults to minimum performance specification indicated. Consider each system component and intended use to determine minimum requirements and to specify options.
• Ceramic tile—ANSI A137.1.
• Glass tile, when used—ANSI A137.2; see also “Glass Tile Selection and Installation Guide,” and consult tile manufacturer for environmental exposure classification recommendations. Not all glass tiles are suitable.
• Cementitious grout—ANSI A118.6 or better or ISO CG1 or better. When glass tile is used, specify grout designated by tile and grout manufacturers.
• Epoxy grout, when used—ANSI A118.3 or ISO RG.
• Cementitious bond coat—Portland cement paste on a mortar bed that is still workable. For a cured mortar bed, follow recommendations below to select appropriate bonding mortar:
  • When a waterproof membrane is not used—ANSI A118.1 or better or ISO C1 or better.
  • When a waterproof membrane is used—ANSI A118.4 or better or ISO C2S1 or better unless ANSI A118.1 or ISO C1 is recommended by membrane manufacturer.
  • When porcelain tile is used—ANSI A118.4 or better or ISO C2 or better.
  • When glass tile is used, specify mortar designated by tile and mortar manufacturers. Bond coat color will impact the final appearance of translucent glass tile. Specifier shall confirm bond coat color is acceptable.
  • Epoxy bond coat, when used—ANSI A118.3 or ISO R1 or better.
  • When glass tile is used, specify epoxy bond coat designated by tile and bond coat manufacturers. Bond coat color will impact the final appearance of translucent glass tile. Specifier shall confirm bond coat color is acceptable.
  • Vapor retarder membrane, when used—ANSI A108.02-3.8.
  • Waterproof membrane, when used—ANSI A118.10.
  • Mortar bed, metal lath, and cleavage membrane—ANSI A108.1A.
• Flexible mildew-resistant sealant—ASTM C920.
• Shower pan membrane—local building code.
• Metal studs—ASTM C645.

**Materials for Green/Sustainable Design**
- See “Green Building Standards and Green Product Selection Guide” and consult manufacturers and suppliers for product sustainability and contribution to green building design.
- Consider specifying tile and installation materials that meet ANSI A138.1, the *American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials*.

**Preparation by Other Trades**
- Wall framing shall meet the general framing requirements of ANSI A108.11-4.0-4.3.
- Apply blocking between the studs to support the shower pan membrane.

**Movement Joint (architect must specify type of joint and show location and details on drawings)**
- Movement joints—mandatory according to EJ171.
- When glass tile is used, adhere to more frequent placement recommendations within the ranges listed in EJ171.

**Installation Specifications**
- Shower pan membrane—ANSI A108.01-3.6.
- Tile—ANSI A108.1A, .1B, or .1C. A108.1B required if waterproof membrane or epoxy bond coat to be used.
- Glass tile—ANSI A108.14, .15, .16, or manufacturer’s directions.
- Cementitious grout—ANSI A108.10.
- Epoxy mortar/grout—ANSI A108.6.
- Movement Joints—EJ171 and ASTM C1193.

**Notes**
- Test shower pan membrane and drainage fitting for leaks before commencing tilework.
- Materials adversely affected by moisture in areas immediately adjacent to showers, tubs, and roman tubs should be properly protected.
- A sloped Portland cement mortar fill or approved preformed slope may be used under shower pan membrane when subfloor is not sloped to drain.
- All horizontal surfaces, for example shower seats, sills, curbs, etc., must slope towards drain or other surface sloped toward drain. Where present, waterproofing also must be sloped.
- When glass tile is used, see “Glass Tile Selection and Installation Guide,” and consult manufacturer for recommendations and requirements.
- For curbless shower receptor, see B421C and B422C.

For the following standards listed, refer to the 2018 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation.
- B441-18 Wood or Metal Studs • Backer Board • Mortar Bed Walls (One Coat Method) • Mortar Bed Floor • Ceramic Tile
- B415-18 Wood or Metal Studs • Cement Backer Board or Fiber-Cement Backer Board Walls • Mortar Bed Floor • Ceramic Tile, Glass Tile
- B420-18 Wood or Metal Studs • Coated Glass Mat Water-Resistant Gypsum Backer Board Walls • Mortar Bed Floor • Ceramic Tile, Glass Tile
- B426-18 Wood or Metal Studs • Cementitious-Coated Extruded Foam Backer Board Walls • Mortar Bed Floor • Ceramic Tile, Glass Tile
- B431-18 Wood or Metal Studs • Fiber-Reinforced Water-Resistant Gypsum Backer Board Walls • Mortar Bed Floor • Ceramic Tile, Glass Tile
- B421-18 Solid Backing • Bonded Waterproof Membrane • Ceramic Tile, Glass Tile
- B422-18 Solid Backing • Bonded Waterproof Membrane • Integrated Bonding Flange • Ceramic Tile, Glass Tile
Requirements

- Waterproof membrane—slope membrane 1/4" per foot to weep holes in drain.
- Wood framing, when used, should be pressure treated and designed to resist deflection and movement.

Preparation by Other Trades

- Test tank, membrane, and drainage fittings for leaks before starting tilework.

Materials for Green/Sustainable Design

- See “Green Building Standards and Green Product Selection Guide” and consult manufacturers and suppliers for product sustainability and contribution to green building design.
- Consider specifying tile and installation materials that meet ANSI A138.1, the American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials.

Installation Methods

- Attach metal lath only above water line.
- Floor—follow F121.
- Walls—follow W221.

Installation Specifications

- Tile—ANSI A108.1A.
- Grout—ANSI A108.10.
- Movement Joints—EJ171 and ASTM C1193.

Note: This detail reflects both concrete and wood substrates. Specify one or the other.
Recommended Uses
• For construction of a shower without a curb.

Environmental Exposure Classifications
• Res1, 2, 3; Com1, 2
• May be suitable for Com3, Res5, and Com5 as determined by membrane and backing material manufacturers.
• For Res4 and Com4, see SR613 and SR614.
• For installations that may be exposed to staining, specify tile and grout suitable for exposure. Consult product manufacturers; see also “Product Selection Guides.”
• For installations that may be exposed to mild chemical attack, specify epoxy grout and tile suitable for exposure. Consult product manufacturers; see also “Product Selection Guides.”

Limitations
• Facilitates construction of a curbless shower without adding floor height at restroom entryway, but does not inherently comply with Americans with Disabilities Act (ADA) Standards for Accessible Design. Follow ADA where ADA compliance is required or desired.

Requirements
• When glass tile is used, consult glass tile manufacturer for tile suitability over non-absorptive surface.
• Bonded waterproof membrane must be continuous, including at changes in plane. Follow membrane manufacturer’s requirements for corners, seaming, and overlap.
• Waterproof membrane inside shower area must extend to full height of tile assembly. Also, the floor and wall waterproofing must continue outside the immediate shower area one foot beyond the high point of the floor, but not beyond the tiled area. Additional waterproofing of floor and/or walls outside the shower area may be needed to effectively contain and evacuate shower water and splash water and to protect building materials. When additional waterproofing of floor and/or walls outside the shower area is desired or required, the building design professional must specify all areas to be waterproofed and indicate membrane termination points.
• A secondary drain may be required outside the immediate shower area to facilitate evacuation of shower water and splash water that is not contained in the shower area due to curbless design. When required or desired, building design professional must specify type and location of secondary drain.
• High point of the floor must be outside the shower area, i.e., beyond shower door or curtain, to facilitate evacuation of shower water and splash water that is not contained in the shower area due to curbless design. Location of the high point of the floor is especially critical when secondary drain is not included outside the shower area.
• Surround drain with pea gravel or other weep protection to prevent mortar from blocking weep holes.
• Refer to appropriate wall method for applicable requirements based on type of backing used.
Slope mortar bed \( \frac{1}{4} \)" per foot toward drain and follow membrane manufacturer’s instructions for connecting membrane to drain.

**Materials**

- **Multiple options exist for membranes, mortars, grouts, and other materials and must be clearly specified to be included.** If not specifically indicated, optional materials are not included and mortar/grout choice defaults to minimum performance specification indicated. Consider each system component and intended use to determine minimum requirements and to specify options.

- Ceramic tile—ANSI A137.1.
- Glass tile, when used—ANSI A137.2; see also “Glass Tile Selection and Installation Guide,” and consult tile manufacturer for environmental exposure classification recommendations. Not all glass tiles are suitable.
- Cementitious grout—ANSI A118.6 or better or ISO CG1 or better. When glass tile is used, specify grout designated by tile and grout manufacturers.
- Epoxy grout, when used—ANSI A118.3 or ISO RG.
- Cementitious bond coat:
  - ANSI A118.4 or better or ISO C2S1 or better unless ANSI A118.1 or ISO C1 is recommended by membrane manufacturer.
  - When glass tile is used, specify mortar designated by tile and mortar manufacturers. Bond coat color will impact the final appearance of translucent glass tile. Specifier shall confirm bond coat color is acceptable.
- Waterproof membrane—ANSI A118.10 and recommended by manufacturer of membrane for use over backing type in intended application.
- Flexible mildew-resistant sealant—ASTM C920.

**Materials for Green/Sustainable Design**

- See “Green Building Standards and Green Product Selection Guide” and consult manufacturers and suppliers for product sustainability and contribution to green building design.
- Consider specifying tile and installation materials that meet ANSI A138.1, the American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials.

**Preparation by Other Trades/Backer Board Installers**

- Depressed slab by others. Depressed area must extend beyond shower area to facilitate a finished floor installation that effectively evacuates shower water and splash water, which are often difficult to contain within a curbless shower.
- Refer to appropriate wall method for applicable preparations by other trades and backer board installers.
- Maximum allowable variation in the tile substrate—for tiles with all edges shorter than 15", maximum allowable variation is \( \frac{1}{4} \)" in 10' from the required plane, with no more than \( \frac{1}{8} \)" variation in 24" when measured from the high points in the surface. For tiles with at least one edge 15" in length, maximum allowable variation is \( \frac{1}{4} \)" in 10' from the required plane, with no more than \( \frac{1}{8} \)" variation in 24" when measured from the high points in the surface.
- Center backer board end or edge joints on framing and stagger joints in adjacent rows so four corners do not come together within the same plane. Space panel ends and edges in accordance with manufacturer’s recommendations.

**Movement Joint (architect must specify type of joint and show location and details on drawings)**

- Movement joints—mandatory according to EJ171.
- When glass tile is used, adhere to more frequent placement recommendations within the ranges listed in EJ171.

**Installation Specifications**

- Tile—ANSI A108.5.
- Glass tile—manufacturer’s directions.
- Cementitious grout—ANSI A108.10.
- Epoxy grout—ANSI A108.6.
- Movement Joints—EJ171 and ASTM C1193.

**Notes**

- Test shower pan membrane/waterproof membrane and drainage fitting for leaks before commencing tilework.
- Materials adversely affected by moisture in areas immediately adjacent to showers, tubs, and roman tubs should be properly protected.
- All horizontal surfaces, for example shower seats, sills, curbs, etc., must slope towards drain or other surface sloped toward drain. Where present, waterproofing also must be sloped.
- When glass tile is used, see “Glass Tile Selection and Installation Guide,” and consult manufacturer for recommendations and requirements.
- Follow applicable plumbing and building codes.
Recommended Uses

- For construction of a shower without a curb.

Environmental Exposure Classifications

- Res1, 2, 3; Com1, 2
- May be suitable for Com3, Res5, and Com5 as determined by membrane and backing material manufacturers.
- For Res4 and Com4, see SR613 and SR614.
- For installations that may be exposed to staining, specify tile and grout suitable for exposure. Consult product manufacturers; see also “Product Selection Guides.”
- For installations that may be exposed to mild chemical attack, specify epoxy grout and tile suitable for exposure. Consult product manufacturers; see also “Product Selection Guides.”

Limitations

- Facilitates construction of a curbless shower without adding floor height at restroom entryway, but does not inherently comply with Americans with Disabilities Act (ADA) Standards for Accessible Design. Follow ADA where ADA compliance is required or desired.

Requirements

- When glass tile is used, consult glass tile manufacturer for tile suitability over non-absorptive surface.
- Bonded waterproof membrane must be continuous, including at changes in plane. Follow membrane manufacturer’s requirements for corners, seaming, and overlap.
- Waterproof membrane inside shower area must extend to full height of tile assembly. Also, the floor and wall waterproofing must continue outside the immediate shower area one foot beyond the high point of the floor, but not beyond the tiled area. Additional waterproofing of floor and/or walls outside the shower area may be needed to effectively contain and evacuate shower water and splash water and to protect building materials. When additional waterproofing of floor and/or walls outside the shower area is desired or required, the building design professional must specify all areas to be waterproofed and indicate membrane termination points.
- A secondary drain may be required outside the immediate shower area to facilitate evacuation of shower water and splash water that is not contained in the shower area due to curbless design. When required or desired, building design professional must specify type and location of secondary drain.
- High point of the floor must be outside the shower area, i.e., beyond shower door or curtain, to facilitate evacuation of...
shower water and splash water that is not contained in the
shower area due to curbless design. Location of the high
point of the floor is especially critical when secondary drain
is not included outside the shower area.
• Refer to appropriate wall method for applicable require-
ments based on type of backing used.
• Slope mortar bed ¼” per foot toward drain and follow mem-
brane and integrated bonding flange manufacturer’s instruc-
tions for connecting membrane to integrated bonding
flange.

Materials
• Multiple options exist for membranes, mortars, grouts,
and other materials and must be clearly specified to be
included. If not specifically indicated, optional materials
are not included and mortar/grout choice defaults to
minimum performance specification indicated. Con-
sider each system component and intended use to deter-
mine minimum requirements and to specify options.
• Ceramic tile—ANSI A137.1.
• Glass tile, when used—ANSI A137.2; see also “Glass Tile
Selection and Installation Guide,” and consult tile manu-
facturer for environmental exposure classification recom-

dendations. Not all glass tiles are suitable.
• Cementitious grout—ANSI A118.6 or better or ISO CG1
or better. When glass tile is used, specify grout designated
by tile and grout manufacturers.
• Epoxy grout, when used—ANSI A118.3 or ISO RG.
• Cementitious bond coat:
  • ANSI A118.4 or better or ISO C2S1 or better unless
ANSI A118.1 or ISO C1 is recommended by membrane
manufacturer.
  • When glass tile is used, specify mortar designated by tile
and mortar manufacturers. Bond coat color will impact the
final appearance of translucent glass tile. Specifier
shall confirm bond coat color is acceptable.
• Waterproof membrane—ANSI A118.10 and recommended
by manufacturer of membrane for use over backing type in
intended application.
• Flexible mildew-resistant sealant—ASTM C920.

Materials for Green/Sustainable Design
• See “Green Building Standards and Green Product Selec-
tion Guide” and consult manufacturers and suppliers for
product sustainability and contribution to green building
design.
• Consider specifying tile and installation materials that meet
ANSI A138.1, the American National Standard Specifi-
cations for Sustainable Ceramic Tiles, Glass Tiles, and Tile
Installation Materials.

Preparation by Other Trades/Backer Board Installers
• Depressed slab by others. Depressed area must extend
beyond shower area to facilitate a finished floor installation
that effectively evacuates shower water and splash water,
which are often difficult to contain within a curbless
shower.
• Refer to appropriate wall method for applicable prepara-
tions by other trades and backer board installers.
• Maximum allowable variation in the tile substrate—for tiles
with all edges shorter than 15”, maximum allowable vari-
aton is ¼” in 10’ from the required plane, with no more than
½” variation in 12” when measured from the high points in
the surface. For tiles with at least one edge 15” in length,
maximum allowable variation is ¼” in 10’ from the required
plane, with no more than ½” variation in 24” when meas-
ured from the high points in the surface.
• Center backer board end or edge joints on framing and stag-
ger joints in adjacent rows so four corners do not come
together within the same plane. Space panel ends and edges
in accordance with manufacturer’s recommendations.

Movement Joint (architect must specify type of joint
and show location and details on drawings)
• Movement joints—mandatory according to EJ171.
• When glass tile is used, adhere to more frequent placement
recommendations within the ranges listed in EJ171.

Installation Specifications
• Tile—ANSI A108.5.
• Glass tile—manufacturer’s directions.
• Cementitious grout—ANSI A108.10.
• Epoxy grout—ANSI A108.6.
• Movement Joints—EJ171 and ASTM C1193.

Notes
• Test shower pan membrane/waterproof membrane and
drainage fitting for leaks before commencing tilework.
• Materials adversely affected by moisture in areas immedi-
ately adjacent to showers, tubs, and roman tubs should be
properly protected.
• All horizontal surfaces, for example shower seats, sills,
curbs, etc., must slope towards drain or other surface sloped
toward drain. Where present, waterproofing also must be
sloped.
• When glass tile is used, see “Glass Tile Selection and Instal-
lation Guide,” and consult manufacturer for recommenda-
tions and requirements.
• Follow applicable plumbing and building codes.
Mortar Curb
- Ceramic tile
- Bond coat
- Mortar bed
- Shower pan membrane
- Studs or cementitious base for curbing
- Reinforcing
- Sloped fill under shower pan membrane
- Wire reinforced mortar bed

Preformed Curb
- Ceramic tile
- Bond coat
- Preformed curb
- Shower pan membrane
- Studs or cementitious base for curbing
- Noncorrosive spiral nail/washer fastener
- Flexible sealant
- Flexible sealant
- Sloped fill under shower pan membrane
- Wire reinforced mortar bed

*Note: Construct curb such that membrane on top of curb (shower pan membrane or bonded waterproof membrane) is sloped toward drain.

Solid Curb
- Ceramic tile
- Bond coat
- Continuous bonded waterproof membrane
- Solid curb
- Reinforced mortar bed

Alternate Receptor Base
- Wood or metal stud
- Ceramic or natural stone tile
- Bond coat
- Backer board
- Folded shower pan membrane
- Wall mortar flush with backer board
- Metal lath
- Wire reinforced mortar bed
- Sloped fill under shower membrane

Drawing depicts use of wall mortar in lieu of shimming out backer board or notching studs to accommodate thickness of folds of shower pan membrane. Vapor retarder or waterproof membrane as required (now shown).
1. Construct curb such that waterproof membrane on top side of curb is sloped toward the drain.
2. Fasteners - min. 3" above curb.
3. Shower pan membrane is sloped min. 1/4" per foot to drain, folded up walls min. 3" above curb, and extends to floor outside of shower.

**Shower Pan Membrane at Curb/Jamb**

1. Space, tape, seal, etc., backer board per manufacturer’s requirements, including for bottom edge of board.
2. Because of varying requirements, vapor retarder behind backer board not shown. Include and install vapor retarder when and as required by building code and backer board manufacturer.
3. Fasteners - Min. 3" above curb.
4. Shower pan membrane is sloped 1/4" per foot to drain, folded up walls min. 3" above curb, and extends to floor outside of shower.
5. Wire mesh for curb - Per ANSI.
6. Construct curb such that waterproof membrane on top side of curb is sloped toward the drain.

**Backer Board Installation Over Shower Pan Membrane**

1. Construct shower seat such that bonded waterproof membrane on backer board on top side of shower seat is sloped min. 1/4" per foot to drain, and extend bonded waterproof membrane beyond seat/wall intersection, and below top edge of shower pan membrane.
2. Shower pan membrane is sloped min. 1/4" per foot to drain and folded up walls.
3. Space, tape, seal, etc., backer board per manufacturer’s requirements, including for bottom edge of board.
4. Because of varying requirements, vapor retarder behind backer board now shown. Include and install vapor retarder when and as required by building code and backer board manufacturer.

**Typical Shower Seat for Backer Board Showers**
**Recommended Uses**

- For steam showers and steam rooms framed with wood or metal studs. Specify mortar bed walls option when wall flatness is critical, such as when tiles with any edge longer than 15" are specified.

**Environmental Exposure Classifications**


- For installations that may be exposed to staining, specify tile and grout suitable for exposure. Consult product manufacturers; see also Notes and “Product Selection Guides.”

**Limitations**

- Duration of use as a steam shower or steam room as determined by membrane and cement backer board (when used) manufacturers; lower membrane water vapor permeance decreases water vapor transmission.
- Maximum stud spacing 16" on center.

**Requirements**

- Steam rooms are highly specialized applications. Design and installation are critical to avoid damage to adjoining materials from vapor migration. Design criteria must include consideration of necessary insulation and temperature and humidity differential.
- Use a tile contractor knowledgeable in steam applications and experienced with the materials specified.
- Bonded waterproof membrane (sheet, liquid, and trowel-on) must be continuous and must adequately limit vapor transmission into adjacent spaces and building materials, according to intended duration of use as a steam shower.
- Steam showers designed for continuous use applications should specify a low perm waterproof membrane (a waterproof membrane meeting ANSI A118.10 and with a water vapor permeance rating of 0.5 perms or less when tested per ASTM E96 Procedure E, tested at 90% relative humidity). When a waterproof membrane with a water vapor permeance rating greater than 0.5 perms is specified, a vapor retarder behind the wall assembly is required, and vapor retarder must have a water vapor permeance rating of 0.1 perm or less when tested per ASTM E96 Procedure A, tested at 50% relative humidity. Consult waterproof membrane manufacturer for water vapor permeance rating and vapor retarder requirements.
- Specifier shall indicate how waterproofing and vapor retarding is to be achieved, including details for membrane penetrations such as penetrations for plumbing, lighting fixtures, fasteners, etc. Specifier shall also indicate where and how to waterproof curbs and jambs and where membrane terminates. Area outside steam shower door is a wet area and should be treated accordingly.
- Check with membrane manufacturer for suitability for applicable conditions, as not all membranes are suitable for steam, high temperature and/or chemical exposure.
- Some waterproof membrane manufacturers require use of a vapor retarder membrane in addition to the waterproof membrane. Consult membrane manufacturer for requirements. When used, vapor retarder membrane must weather lap itself and lap into the shower pan membrane.
- If vapor retarder membrane is required, integrated bonding flange cannot be used.
- Follow waterproof membrane manufacturers’ directions for interface between drain and membrane(s).
- Design professional to specify adequate insulation on walls and ceilings to reduce condensation. Consult insulation manufacturer for application suitability.
- Seal all membrane penetrations with appropriate sealant according to membrane manufacturer’s requirements.
Multiple options exist for membranes, mortars, grouts, and other materials and must be clearly specified to be included. If not specifically indicated, optional materials are not included and mortar/grout choice defaults to minimum performance specification indicated. Consider each system component and intended use to determine minimum requirements and to specify options.

Materials
- Multiple options exist for membranes, mortars, grouts, and other materials and must be clearly specified to be included. If not specifically indicated, optional materials are not included and mortar/grout choice defaults to minimum performance specification indicated. Consider each system component and intended use to determine minimum requirements and to specify options.
- Ceramic tile—ANSI A137.1 and recommended by manufacturer for use in steam showers.
- Cementitious grout—ANSI A118.6 or better or ISO CG1 or better.
- Epoxy grout, when used—ANSI A118.3 or ISO RG.
- Cementitious bond coat:
  - ANSI A118.15 or better or ISO C2S1 or better, unless ANSI A118.1 or ISO C1 is recommended by membrane manufacturer.
- Cement backer board, when used—ANSI A118.9 or ASTM C1325 (Type A).
- Fasteners—noncorrosive and nonoxidizing.
- Hot dipped fasteners meeting ASTM F2329-05 required in wet areas.
- 2" alkali-resistant glass fiber mesh tape.
- Waterproof membrane—ANSI A118.10 and recommended by membrane manufacturer for use in specific application. For continuous use applications, see Requirements for water vapor permeance.
- Vapor retarder membrane, when used—recommended by manufacturer for use in specific application.
- Metal studs, when used—ASTM C645.
- Shower pan membrane—ANSI A118.10, ASTM D4068, or D4551 and meeting applicable building code.
- Mortar bed and reinforcing—ANSI A108.1A.
- Flexible mildew-resistant sealant—ASTM C920 and recommended by manufacturer for use in steam showers.

Materials for Green/Sustainable Design
- See “Green Building Standards and Green Product Selection Guide” and consult manufacturers and suppliers for product sustainability and contribution to green building design.
- Consider specifying tile and installation materials that meet ANSI A138.1, the American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials.

Preparation by Other Trades
- Wall framing shall meet the general framing requirements of ANSI A108.11-4.0-4.3.
- Movement joints at changes in plane, such as where walls and ceiling meet.

Installation Specifications
- Shower pan membrane—ANSI A108.01-3.6.
- Mortar bed and reinforcing—ANSI A108.1A, 1B, and 1C.
- Tile—ANSI A108.5.
- Cementitious grout—A108.10.
- Epoxy grout—A108.6.
- Waterproof membrane and slip joint—ANSI A108.13 and membrane manufacturer’s slip joint directions.
- Movement Joints—EJ171 and ASTM C1193.

Notes
- Use of softened water in steam showers and steam rooms helps reduce grout and tile staining due to iron and/or hard water. Such stains may require harsh chemicals for removal. Select products suitable for water type and maintenance practices that will be used.
- Standard grouts will need to be periodically maintained over the life of the steam shower.
- Steam unit design must take into consideration the affect of Moisture Vapor Transmission (MVT) on opposite side of steam unit walls. MVT can cause efflorescence and can affect paints and other adhered finishes.
Recommended Uses

• For use where old shower pan has failed.

Requirements

• Remove existing shower receptor, shower pan, and wall tile, as required, to install new shower pan.
• Replace any damaged wall and floor substrate materials.
• New shower pan—slope ¼” per foot to weep holes in drain.
• New shower pan to turn up wall a minimum of 3” above curb (6” above floor in showers without curbs).
• New wall membrane/flashing (ANSI A108.02-3.8) placed behind existing wall membrane, out over new shower pan, and fastened to studs.
• Place continuous bead of sealant on existing wall mortar with new wall mortar brought up tight against it.

Materials for Green/Sustainable Design

• See “Green Building Standards and Green Product Selection Guide” and consult manufacturers and suppliers for product sustainability and contribution to green building design.
• Consider specifying tile and installation materials that meet ANSI A138.1, the American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials.

Notes

• See B414 for complete specifications.
Recommended Uses
• For use where old shower pan has failed.

Requirements
• Remove existing shower receptor, shower pan, and wall tile, as required, to install new shower pan.
• Replace any damaged wall and floor substrate materials.
• New shower pan—slope ¼” per foot to weep holes in drain.
• New shower pan to turn up wall a minimum of 3” above curb (6” above floor in showers without curbs).
• New wall membrane/flashing (ANSI A108.02-3.8) placed behind existing wall membrane, out over new shower pan, and fastened to studs.
• Place continuous bead of sealant on existing wall substrate material with new wall substrate material brought up tight against it.

Materials for Green/Sustainable Design
• See “Green Building Standards and Green Product Selection Guide” and consult manufacturers and suppliers for product sustainability and contribution to green building design.
• Consider specifying tile and installation materials that meet ANSI A138.1, the American National Standard Specifica-
APPENDIX J
COMBINATION OF INDOOR AND OUTDOOR COMBUSTION AND
VENTILATION OPENING DESIGN
(The content of this Appendix is based on Annex I of NFPA 54)

J 101.0 General.
J 101.1 Applicability. This appendix provides general guidelines for the sizing of combination indoor and outdoor combustion and ventilation air openings.

J 101.2 Example of Combination Indoor and Outdoor Combustion Air Opening Design. Determine the required combination of indoor and outdoor combustion air opening sizes for the following appliance installation example.

Example Installation: A fan-assisted furnace and a draft-hood-equipped water heater with the following inputs are located in a 15 foot by 30 foot (4572 mm by 9144 mm) basement with an 8 foot (2438 mm) ceiling. No additional indoor spaces can be used to help meet the appliance combustion air needs.

Fan-Assisted Furnace Input: 100 000 British thermal units per hour (Btu/h) (29 kW)
Draft Hood-Equipped Water Heater Input: 40 000 Btu/h (11.7 kW)

Solution:

1. Determine the total available room volume. Appliance room volume:
   15 feet by 30 feet (4572 mm by 9144 mm) with an 8 foot (2438 mm) ceiling = 3600 cubic feet (101.94 m³)

2. Determine the total required volume. The standard method to determine combustion air is used to calculate the required volume. The combined input for the appliances located in the basement is calculated as follows:
   \[
   100 000 \text{ Btu/h (29 kW)} + 40 000 \text{ Btu/h (11.7 kW)} = 140 000 \text{ Btu/h (41 kW)}
   \]

   The standard method requires that the required volume be determined based on 50 cubic feet per 1000 Btu/h (4.83 m³/kW). Using Table J 101.2, the required volume for a 140 000 Btu/h (41 kW) water heater-combined input is 7000 cubic feet (198.22 m³).

(3) Determine ratio of the available volume to the required volume:
   \[
   \frac{3600 \text{ cubic feet}}{7000 \text{ cubic feet}} = 0.51
   \]

(4) Determine the reduction factor to be used to reduce the full outdoor air opening size to the minimum required based on the ratio of indoor spaces:
   \[
   1.00 - 0.51 \text{ (from Step 3)} = 0.49
   \]

(5) Determine the single outdoor combustion air opening size as though all combustion air is to come from outdoors. In this example, the combustion air opening directly communicates with the outdoors:

   \[
   \frac{140 000 \text{ Btu/h}}{3000 \text{ British thermal units per square inch (Btu/in²)}} = 47 \text{ square inches (0.03 m²)}
   \]

(6) Determine the minimum outdoor combustion air opening area:
   Outdoor opening area = 0.49 (from Step 4) x 47 square inches (0.03 m²) = 23 square inches (0.01 m²)

Section 506.5.3(3) requires the minimum dimension of the air opening should not be less than 3 inches (76 mm). [NFPA 54:1.1]

Conclusion: The indoor volume is insufficient to supply combustion air since the total of 3600 cubic feet (101.94 m³) does not meet the required volume of 7000 cubic feet (198.22 m³). Therefore, additional combustion air shall be provided from the outdoors.
### TABLE J 101.2

**STANDARD METHOD: REQUIRED VOLUME, ALL APPLIANCES**

[NFPA 54: TABLE A.9.3.2.1]

<table>
<thead>
<tr>
<th>APPLIANCE INPUT (Btu/h)</th>
<th>REQUIRED VOLUME (cubic feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>250</td>
</tr>
<tr>
<td>10 000</td>
<td>500</td>
</tr>
<tr>
<td>15 000</td>
<td>750</td>
</tr>
<tr>
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<td>14 500</td>
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<tr>
<td>300 000</td>
<td>15 000</td>
</tr>
</tbody>
</table>

For SI units: 1000 British thermal units per hour = 0.293 kW, 1 cubic foot = 0.0283 m³
APPENDIX K
POTABLE RAINWATER CATCHMENT SYSTEMS

K 101.0 General.
K 101.1 Applicability. The provisions of this appendix shall apply to the installation, construction, alteration, and repair of potable rainwater catchment systems.

K 101.2 System Design. Potable rainwater catchment systems in accordance with this appendix shall be designed by a registered design professional or person deemed competent by the Authority Having Jurisdiction to perform potable rainwater catchment system design work. Where required, rainwater catchment systems shall be seismically restrained against earthquakes in accordance with the building code.

K 101.3 Permit. It shall be unlawful for a person to construct, install, or alter, or cause to be constructed, installed, or altered a potable rainwater catchment systems in a building or on a premise without first obtaining a permit to do such work from the Authority Having Jurisdiction.

K 101.4 Product and Material Approval. System components shall be properly identified as to the manufacturer.

K 101.4.1 Plumbing Materials and Systems. Pipe, pipe fittings, traps, fixtures, material, and devices used in a potable rainwater system shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) and shall be in accordance with approved applicable recognized standards referenced within this code, and shall be free from defects. Unless otherwise provided for in this appendix, materials, fixtures, or devices used or entering into the construction of plumbing systems, or parts thereof shall be submitted to the Authority Having Jurisdiction for approval.

K 101.5 Maintenance and Inspection. Potable rainwater catchment systems and components shall be inspected and maintained in accordance with Section K 101.5.1 through Section K 101.5.3.

K 101.5.1 Frequency. Potable rainwater catchment systems and components shall be inspected and maintained in accordance with Table K 101.5.1 unless more frequent inspection and maintenance are required by the manufacturer.

K 101.5.2 Maintenance Log. A maintenance log for potable rainwater catchment systems shall be maintained by the property owner and be available for inspection. The property owner or designated appointee shall ensure that a record of testing, inspection, and maintenance in accordance with Table K 101.5.1 is maintained in the log. The log will indicate the frequency of inspection, and maintenance of each system. A record of the required water quality tests shall be retained for not less than 2 years.

K 101.5.3 Maintenance Responsibility. The required maintenance and inspection of potable rainwater catchment systems shall be the responsibility of the property owner unless otherwise required by the Authority Having Jurisdiction.

K 101.6 Operation and Maintenance Manual. An operation and maintenance manual for potable rainwater catchment systems shall be supplied to the building owner by the system designer. The operating and maintenance manual shall include the following:

1. Detailed diagram of the entire system and the location of system components.
2. Instructions for operating and maintaining the system.
3. Details on maintaining the required water quality as determined by the Authority Having Jurisdiction.
4. Details on deactivating the system for maintenance, repair, or other purposes.
5. Applicable testing, inspection, and maintenance frequencies in accordance with Table K 101.5.1.
6. A method of contacting the manufacturer(s).

K 101.7 Minimum Water Quality Requirements. The minimum water quality for potable rainwater catchment systems shall comply with the applicable water quality requirements as determined by the Authority Having Jurisdiction. In the absence of water quality requirements, the guidelines EPA/625/R-04/108-EPA/600/R-12/618 contains recommended water reuse guidelines to assist regulatory agencies develop, revise, or expand alternate water source water quality standards.

K 101.8 Material Compatibility. In addition to the requirements of this appendix, potable rainwater catchment systems shall be constructed of materials that are compatible with the type of pipe and fitting materials and water conditions in the system.

K 101.9 System Controls. Controls for pumps, valves, and other devices that contain mercury that come in contact with the water supply shall not be permitted.

K 102.0 Connection.
K 102.1 General. No water piping supplied by a potable rainwater catchment system shall be connected to a source of supply without the approval of the Authority Having Jurisdiction, Health Department, or other department having jurisdiction.
Connections to Public or Private Potable Water Systems. Potable rainwater catchment systems shall have no direct connection to a public or private potable water supply or alternate water source system. Potable water from a public or private potable water system is permitted to be used as makeup water to the rainwater storage tank provided the public, or private potable water supply connection is protected by an air gap or reduced-pressure principle backflow preventer in accordance with this code.

Backflow Prevention. The potable rainwater catchment system shall be protected against backflow in accordance with this code.

Potable Rainfall Catchment System Materials. The collection surface for potable applications shall be constructed of a hard, impervious material and shall be approved for potable water use. Roof coatings, paints, and liners shall comply with NSF Protocol P151.

Prohibited. Roof paints and coatings with lead, chromium, or zinc shall not be permitted. Wood roofing material and lead flashing shall not be permitted.

Rainwater Catchment System Drainage Materials. Materials used in rainwater catchment drainage systems, including gutters, downspouts, conductors, and leaders shall be in accordance with the requirements of this code for storm drainage.

Storage Tanks. Rainwater storage shall comply with Section K 105.0.

Water Supply and Distribution Materials. Potable rainwater supply and distribution materials shall comply with the requirements of this code for potable water supply and distribution systems.

Design and Installation.

Collection Surfaces. Rainwater shall be collected from a roof or other cleanable aboveground surfaces specifically designed for rainwater catchment. A rainwater catchment system shall not collect rainwater from:

1. Vehicular parking surfaces
2. Surface water runoff
3. Bodies of standing water

Prohibited Discharges. Overflows, condensate, and bleed-off pipes from roof-mounted equipment and appliances shall not discharge onto roof surfaces that are intended to collect rainwater.

Minimum Water Quality. Upon initial system startup, the quality of the water for the intended application shall be verified at the point(s) of use as determined by the Authority Having Jurisdiction in accordance with Section K 104.3.1 and Section K 104.3.2. Water quality maintenance shall be in accordance with Section K 104.3.3.

Private Potable Water System. In the absence of water quality requirements determined by the Authority Having Jurisdiction, the minimum water quality for a private potable water system at the point of use shall comply with Table K 104.3.1.
K 104.3.2 Public Use Occupancies. The minimum water quality for a potable water system for public use occupancies at the point of use and testing procedures shall comply with the Environmental Protection Agency (EPA) Safe Drinking Water Act for a public water system.

K 104.3.3 Maintenance. Normal system maintenance shall require system testing for Escherichia coli (fecal coliform) and turbidity every 3 months in accordance with Table K 104.3.3. Upon failure of the fecal coliform test, the system shall be re-commissioned involving cleaning, and retesting in accordance with Section K 104.3. Testing for viruses and cysts shall occur once after 3 months of initial operation and once every 12 months thereafter.

Exception: Upon failure of the virus or cyst test, the tests will be repeated every 3 months until the tests results are negative for two consecutive tests.

<table>
<thead>
<tr>
<th>Escherichia coli (fecal coliform)</th>
<th>Non-detectable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protozoan Cysts</td>
<td>Non-detectable</td>
</tr>
<tr>
<td>Viruses</td>
<td>Non-detectable</td>
</tr>
<tr>
<td>Turbidity</td>
<td>&lt;0.3 NTU</td>
</tr>
</tbody>
</table>

K 104.4 Water Quality Devices and Equipment. Devices and equipment used to treat rainwater to maintain the minimum water quality requirements determined by the Authority Having Jurisdiction shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) and approved for the intended application.

K 104.4.1 Filtration Devices. Potable water filters shall comply with NSF/ANSI 53 and shall be installed in accordance with the manufacturer’s installation instructions.

K 104.4.2 Disinfection Devices. Chlorination, ozone, ultraviolet, or other disinfection methods approved by the Authority Having Jurisdiction, or the product is listed and certified according to a microbiological reduction performance standard for drinking water, shall be used to treat harvested rainwater to meet the required water quality permitted. The disinfection devices and systems shall be installed in accordance with the manufacturer’s installation instructions and the conditions of listing. Disinfection devices and systems shall be located downstream of the storage tank.

K 104.4.3 Filtration and Disinfection Systems. Filtration and disinfection systems shall be located after the water storage tank. Where a chlorination system is installed, it shall be installed upstream of filtration systems. Where an ultraviolet disinfection system is installed, a filter not more than 5 microns (5 µm) shall be installed upstream of the disinfection system.

K 104.5 Overhanging Tree Branches and Vegetation. Tree branches and vegetation shall not be located over the roof or other aboveground rainwater collection surface. Where existing tree branch and vegetation growth extends over the rainwater collection surface, it shall be removed in accordance with Section K 101.5.

K 105.0 Rainwater Storage Tanks.

K 105.1 General. Rainwater storage tanks shall be installed in accordance with Section K 105.2 through Section K 105.10.

K 105.2 Construction. Rainwater storage tanks shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight. Storage tanks shall be approved by the Authority Having Jurisdiction for potable water applications, provided such tanks are in accordance with approved applicable standards.

K 105.3 Location. Rainwater storage tanks shall be permitted to be installed above or below grade.

K 105.3.1 Above Grade. Above grade, storage tanks shall be of an opaque material, approved for aboveground use in direct sunlight, or shall be shielded from direct sunlight. Tanks shall be installed in an accessible location to allow for inspection and cleaning. The tank shall be installed on a foundation or platform that is constructed to accommodate the weight and loads when filled to maximum capacity in accordance with the building code.

K 105.3.2 Below Grade. Rainwater storage tanks installed below grade shall be structurally designed to withstand anticipated earth or other loads. Holding tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²) (1465 kg/m²) where the tank is designed for underground installation. Below grade rainwater tanks installed underground shall be provided with manholes. The manhole opening shall be not less than 20 inches (508 mm) in diameter and located not less than 4 inches (102 mm) above the surrounding grade. The surrounding grade shall be sloped away from the manhole. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground where empty. The combined weight of the tank and hold down system shall meet or exceed the buoyancy force of the tank.

K 105.4 Drainage and Overflow. Rainwater storage tanks shall be provided with a means of draining and cleaning. The overflow drain shall not be equipped with a shutoff valve. The overflow outlet shall discharge in accordance with this code for storm drainage systems. Where discharging to the storm drainage system, the overflow drain shall be protected from backflow of the storm drainage system by a backwater valve or other approved method.
K 105.4.1 Overflow Outlet Size. The overflow outlet shall be sized to accommodate the flow of the rainwater entering the tank and not less than the aggregate cross-sectional area of the inflow pipes.

K 105.5 Animals and Insects. Rainwater tank openings to the atmosphere shall be protected to prevent the entrance of insects, birds, or rodents into the tank.

K 105.6 Human Access. Rainwater tank access openings exceeding 12 inches (305 mm) in diameter shall be secured to prevent tampering and unintended entry by either a lockable device or other approved method.

K 105.7 Exposure to Sunlight. Rainwater tank openings shall not be exposed to direct sunlight.

K 105.8 Inlets. A device or arrangement of fittings shall be installed at the inlet of the tank to prevent rainwater from disturbing sediment as it enters the tank.

K 105.9 Primary Tank Outlets. The primary tank outlet shall be located not less than 4 inches (102 mm) above the bottom of the tank, or shall be provided with a floating inlet to draw water from the cistern just below the water surface.

K 105.10 Storage Tank Venting. Where venting using drainage or overflow piping is not provided or is considered insufficient, a vent shall be installed on each tank. The vent shall extend from the top of the tank and terminate not less than 6 inches (152 mm) above grade and shall be not less than \( \frac{11}{2} \) inches (40 mm) in diameter. The vent terminal shall be directed downward and covered with a \( \frac{3}{32} \) of an inch (2.4 mm) mesh screen to prevent the entry of vermin and insect.

K 105.11 Pumps. Pumps serving rainwater catchment systems shall be listed for potable water use. Pumps supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than the minimum residual pressure required by the highest and most remote outlet served. Where the water pressure in the rainwater supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve shall be installed to reduce the pressure to 80 psi (552 kPa) or less to water outlets in the building shall be installed in accordance with this code.

K 105.12 Roof Drains. Primary and secondary roof drains, conductors, leaders, overflows, and gutters shall be designed and installed in accordance with this code.

K 106.0 Freeze Protection.

K 106.1 General. Tanks and piping installed in locations subject to freezing shall be provided with an approved means of freeze protection.

K 106.2 Roof Washer or Pre-Filtration System. Collected rainwater shall pass through a roof washer or pre-filtration system before the water enters the rainwater storage tank. Roof washer systems shall comply with Section K 106.2.1 through Section K 106.2.4.

K 106.2.1 Size. The roof washer shall be sized to direct rainwater containing debris that has accumulated on the collection surface away from the storage tank. ARCSA/ASPE 63 contains additional guidance on acceptable methods of sizing roof washers.
APPENDIX L
SUSTAINABLE PRACTICES

L 101.0 General.
L 101.1 Applicability. The purpose of this appendix is to provide a comprehensive set of technically sound provisions that encourage sustainable practices and works towards enhancing the design and construction of plumbing systems that result in a positive long-term environmental impact. This appendix is not intended to circumvent the health, safety, and general welfare requirements of this code.

L 101.2 Definition of Terms. For the purposes of this code, the definitions in Section L 201.0 shall apply to this appendix.

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 appendix to avoid misunderstanding.

The definitions of terms are arranged alphabetically according to the first word of the term.

L 201.0 Definitions.
L 201.1 General. For the purpose of this appendix, the following definitions shall apply:

Catch Can Test. Method to measure the precipitation rate of an irrigation system by placing catchment containers at various random positions in the irrigation zone for a prescribed amount of time during irrigation application. The volumes of water in the containers are measured, averaged, and calculated to determine precipitation rate. Tests are conducted using irrigation industry accepted practices.

Combination Ovens. A device that combines the function of hot air convection (oven mode) and saturated and superheated steam heating (steam mode), or both, to perform steaming, baking, roasting, rethermalizing, and proofing of various food products. In general, the term combination oven is used to describe this type of equipment, which is self-contained. The combination oven is also referred to as a combination oven/steamer, combi or combo.

Energy Star. A joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. Energy Star is a voluntary program designed to identify and promote energy-efficient products and practices.

Evapotranspiration (ET). The water transpired from vegetation, evaporated from the soil, water, and plant surfaces. Evapotranspiration rates are values expressed in inches (mm) per unit of time (day, week, month, or year). Evapotranspiration rates vary by components of weather conditions, including insolation, humidity, temperatures and wind, and time of year.

Food Steamers (Steam Cookers). A cooking appliance wherein heat is imparted to food in a closed compartment by direct contact with steam. The compartment can be at or above atmospheric pressure. The steam can be static or circulated.

Gang Showers. Shower compartments designed and intended for use by multiple persons simultaneously.

Hydrozone. A grouping of plants with similar water requirements that are irrigated by the same irrigation zone.

Irrigation Control System. An irrigation control system consists of a combination of a programmable controller using one or more inputs or sensors that, in combination, estimate or measure the availability of moisture for plants in order to operate an irrigation system, in such a manner that the system replenishes water as needed while minimizing excess water use. A properly programmed irrigation control system requires initial site specific set-up and will make irrigation schedule adjustments, including run times and required cycles throughout the irrigation season without human intervention.

Irrigation Demand. The amount of water not supplied by natural precipitation that is needed to maintain landscape plant life in good condition. Irrigation demand is calculated by subtracting natural effective precipitation from the ET rate adjusted by the landscape coefficient, which includes the functional purpose and desired quality of the plant being irrigated.

Irrigation Emission Device. The various landscape irrigation equipment terminal fittings or outlets that emit water for irrigating vegetation in a landscape.

Irrigation Zone. The landscape area that is irrigated by a set of landscape irrigation emission devices installed on the same water supply line downstream of a single valve.

Kitchen and Bar Sink Faucets. A faucet that discharges into a kitchen or bar sinks in domestic or commercial installations. Supply fittings that discharge into other type sinks, including clinical sinks, floor sinks, service sinks and laundry trays are not included.

Lavatory. (1) A basin or vessel for washing. (2) A plumbing fixture, as defined in (1), especially placed for use in personal hygiene. Principally not used for laundry purposes and never used for food preparation, or utensils, in food services. (3) A fixture designed for the washing of the hands and face. Sometimes called a wash basin.

Lavatory Faucet. A faucet that discharges into a lavatory basin in a domestic or commercial installation.

Low Application Rate Irrigation. A means of irrigation using low precipitation rate sprinkler heads or low flow emitters in conjunction with cycling irrigation schedules to apply water at a rate less than the soil absorption rate.

Low Flow Emitter. Low-flow irrigation emission device designed to dissipate water pressure and discharge a small uniform flow or trickle of water at a constant flow rate. To be classified as a low flow emitter: drip emitters shall discharge water at less than 4 gallons (15 L) per hour per emitter; micro-spray, micro-jet, and misters shall discharge water at a maximum of 30 gallons (114 L) per hour per nozzle.
Low Precipitation Rate Sprinkler Heads. Landscape irrigation emission devices or sprinkler heads with a maximum precipitation rate of 1 inch per hour (25.4 mm/h) over the applied irrigation area.

Maintenance. The upkeep of property or equipment by the owner of the property in compliance with the requirements of this appendix.

Metering Faucet. A self-closing faucet that dispenses a specific volume of water for each actuation cycle. The volume or cycle duration can be fixed or adjustable.

Modified Evapotranspiration. Numeric values, expressed in inches/hour (in/h), of evapotranspiration rates, derived by altering ETo rates by applying factors of specific needs of the vegetation and local climate conditions. Modified evapotranspiration rates are used as a factor estimating the irrigation water needs of landscapes. Common usage includes reference evapotranspiration as the base rate, modified by coefficients or factors for specific plant types and densities.

Multi-Occupant Spaces. Indoor spaces used for presentations and training, including classrooms and conference rooms.

On-Site Renewable Energy. Energy from renewable energy resources harvested at the building site. [ASHRAE 90.1:3.2]

Precipitation Rate. The sprinkler head application rate of water applied to landscape irrigation zone, measured as inches per hour (mm/h). Precipitation rates of sprinkler heads are calculated according to the flow rate, pattern, and spacing of the sprinkler heads.

Pre-Rinse Spray Valve. A handheld device for use with commercial dishwashing and ware washing equipment that sprays water on dishes, flatware, and other food service items for the purpose of removing food residue before cleaning and sanitizing the items.

Recirculation System. A system of hot water supply and return piping with shutoff valves, balancing valves, circulating pumps, and a method of controlling the circulating system.

Reference Evapotranspiration (ETo). Numeric value, expressed in inches/hour (in/h), calculated as the water necessary to produce maximum biomass based upon a cool-season turf grass 4 inches to 6 inches (102 mm to 152 mm) tall. Common sources for obtaining local reference evapotranspiration rates are local agriculture extension services, state departments of agriculture, water agencies, irrigation professionals, the United States Geological Survey, and internet websites.

Renewable Energy Resources. Energy from solar, wind, biomass or hydro, or extracted from hot fluid or steam heated within the earth. [ASHRAE 90.1:3.2]

Reverse Osmosis Reject Water. Water that does not pass through a membrane of a reverse osmosis system.

Run Out. The developed length of pipe that extends away from the circulating loop system to a fixture(s).

Self Closing Faucet. A faucet that closes itself after the actuation or control mechanism is deactivated. The actuation or control mechanism can be mechanical or electronic.

Single Occupant Spaces. Private offices, workstations in open offices, reception workstations, and ticket booths.

Soil Absorption Rate. The rate of the soil’s ability to allow water to percolate or infiltrate the soil and be retained in the root zone of the soil expressed as inches per hour (mm/h).

Sprinkler Head. Landscape irrigation emission device discharging water in the form of sprays or rotating streams, not including low flow emitters.

Storage Tank. The central component of the rainwater, stormwater, or dry weather runoff catchment system. Also known as a cistern or rain barrel.

Stormwater. Natural precipitation that has contacted a surface at grade or below grade and has not been put to beneficial use.

Stormwater Catchment System. A system that collects and stores stormwater for beneficial use.

Submeter. A meter installed subordinate to a site meter. Also known as a dedicated meter.

WaterSense. A voluntary program of the U.S., Environmental Protection Agency, designed to identify and promote water-efficient products and practices.

Water Closet. A fixture with a water-containing receptor that receives liquid and solid body waste and on actuation conveys the waste through an exposed integral trap into a drainage system. Also referred to as a toilet.

Water Factor (WF). A measurement and rating of appliance water efficiency, most often used for residential and light commercial clothes washers, as follows:

Water Factor (WF), Clothes Washer. The quantity of water in gallons used to complete a full wash and rinse cycle per measured cubic foot capacity of the clothes container.

L 301.0 General Regulations.

L 301.1 Installation. Plumbing systems covered by this appendix shall be installed in accordance with this code, other applicable codes, and the manufacturer’s installation instructions.

L 301.2 Qualifications. Where permits are required, the Authority Having Jurisdiction shall have the authority to require contractors, installers, or service technicians to demonstrate competency. Where determined by the Authority Having Jurisdiction, the contractor, installer or service technician shall be licensed to perform such work.

L 302.0 Disposal of Liquid Waste.

L 302.1 Disposal. It shall be unlawful for a person to cause, suffer, or permit the disposal of sewage, human excrement, or other liquid wastes, 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.

L 302.2 Connections to Plumbing System Required. Equipment and appliances, used to receive or discharge liquid wastes or sewage, shall be connected properly to the drainage system of the building or premises, in accordance with the requirements of this code.
L 303.0 Abandonment.  
L 303.1 General. An abandoned system or part thereof covered under the scope of this appendix shall be disconnected from remaining systems, drained, plugged, and capped in an approved manner.

L 401.0 Water Conservation and Efficiency.  
L 401.1 Scope. The provisions of this section establish the means of conserving potable and nonpotable water used in and around a building.

L 402.0 Water-Conserving Plumbing Fixtures and Fittings.  
L 402.1 General. The maximum water consumption of fixtures and fixture fittings shall comply with the flow rates specified in Table L 402.1, and Section L 402.2 through Section L 402.10.

<table>
<thead>
<tr>
<th>TABLE L 402.1</th>
<th>MAXIMUM FIXTURE AND FIXTURE FITTINGS FLOW RATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIXTURE TYPE</td>
<td>FLOW RATE</td>
</tr>
<tr>
<td>Showerheads</td>
<td>2.0 gpm at 80 psi¹</td>
</tr>
<tr>
<td>Kitchen faucets residential¹</td>
<td>1.8 gpm at 60 psi</td>
</tr>
<tr>
<td>Lavatory faucets residential²</td>
<td>1.5 gpm at 60 psi</td>
</tr>
<tr>
<td></td>
<td>0.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Metering faucets</td>
<td>0.25 gallons/cycle</td>
</tr>
<tr>
<td>Metering faucets for wash fountains</td>
<td>One 0.25 gallons/cycle fixture fitting for each 20 inches rim space</td>
</tr>
<tr>
<td>Wash fountains</td>
<td>One 2.2 gpm at 60 psi fixture fitting for each 20 inches rim space</td>
</tr>
<tr>
<td>Water Closets</td>
<td>1.28 gallons/flush²</td>
</tr>
<tr>
<td>Urinals</td>
<td>0.5 gallons/flush³</td>
</tr>
<tr>
<td>Commercial Pre-Rinse Spray Valves</td>
<td>1.3 gpm at 60 psi</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 inch = 25.4 mm, 1 gallon = 3.785 L.

Notes:  
¹ Shall be listed to EPA WaterSense Specification for Showerheads. For multiple showerheads serving one shower compartment, see Section L 402.6.1.  
² Shall be listed to EPA WaterSense Specification for Tank-Type Toilet or Specification for Flushometer-Valve Water Closets.  
³ Shall be listed to EPA WaterSense Flushing Urinal Specification. Nonwater urinals shall comply with specifications listed in Section L 402.3.1.  
⁴ See Section L 402.4.  
⁵ Shall be listed to EPA WaterSense High-Efficiency Lavatory Faucet Specification.

L 402.2 Water Closets. No water closet shall have an effective flush volume exceeding 1.28 gallons per flush (gpf) (4.8 Lpf).

L 402.2.1 Gravity, Pressure Assisted, and Electro-Hydraulic Tank Type Water Closets. Gravity, pressure assisted, and electro-hydraulic tank-type water closets shall have a maximum effective flush volume of not more than 1.28 gallons (4.8 Lpf) of water per flush in accordance with ASME A112.19.2/CSA B45.1 or ASME A112.19.14 and shall be listed to the EPA WaterSense Specification for Tank-Type Toilets. The effective flush volume for dual flush toilets is defined as the composite, average flush volume of two reduced flushes and one full flush.

L 402.2.2 Flushometer-Valve Activated Water Closets. Flushometer-valve activated water closets shall have a maximum flush volume of not more than 1.28 gallons (4.8 Lpf) of water per flush in accordance with ASME A112.19.2/CSA B45.1 or CSA B45.5/IAPMO Z124. Flushing urinals shall be listed to the EPA WaterSense Specification for Flushometer-Valve Water Closets.

L 402.3 Urinals. Urinals shall have a maximum flush volume of not more than 0.5 gallon (1.9 Lpf) of water per flush in accordance with ASME A112.19.2/CSA B45.1 or CSA B45.5/IAPMO Z124. Nonwater urinals shall be listed to the EPA WaterSense Flushing Urinal Specification.

L 402.3.1 Nonwater Urinals. Nonwater urinals shall comply with ASME A112.19.3/CSA B45.4, ASME A112.19.19, or CSA B45.5/IAPMO Z124. Nonwater urinals shall be cleaned and maintained in accordance with the manufacturer’s instructions after installation. Where nonwater urinals are installed, they shall have a water distribution line roughed-in to the urinal location at a height not less than 56 inches (1422 mm) to allow for the installation of an approved backflow prevention device in the event of a retrofit. Such water distribution lines shall be installed with shutoff valves located as close as possible to the distributing main to prevent the creation of dead ends. Where nonwater urinals are installed, not less than one water supplied fixture rated at not less than 1 drainage fixture unit (DFU) shall be installed upstream on the same drain line to facilitate drain line flow and rinsing.

L 402.4 Residential Kitchen Faucets. The maximum flow rate of residential kitchen faucets shall not exceed 1.8 gallons per minute (gpm) (6.8 L/m) at 60 pounds-force per square inch (psi) (414 kPa). Kitchen faucets are permitted to temporarily increase the flow above the maximum rate, but not to exceed 2.2 gpm (8.3 L/m) at 60 psi (414 kPa), and shall revert to a maximum flow rate of 1.8 gpm (6.8 L/m) at 60 psi (414 kPa) upon valve closure.

L 402.5 Lavatory Faucets. The maximum water flow rate of faucets shall comply with Section L 402.5.1 and Section L 402.5.2.

L 402.5.1 Lavatory Faucets in Residences, Apartments, and Private Bathrooms in Lodging Facilities, Hospitals, and Patient Care Facilities. The flow rate for lavatory faucets installed in residences, apartments, and private bathrooms in lodging, hospitals, and patient care facilities (including skilled nursing and long-term care facilities) shall not exceed 1.5 gpm (5.7 L/m) at 60 psi (414 kPa) in accordance with ASME A112.18.1/CSA B125.1 and shall be listed to the EPA WaterSense High Efficiency Lavatory Faucet Specification.
L 402.5.2 Lavatory Faucets in Other Than Residences, Apartments, and Private Bathrooms in Lodging Facilities. Lavatory faucets installed in bathrooms of buildings or occupancies other than those specified in Section L 402.5.1 shall be in accordance with Section L 402.5.2(1) or Section L 402.5.2(2).

1. The flow rate shall not exceed 0.5 gpm (1.9 L/m) at 60 psi (414 kPa) in accordance with ASME A112.18.1/CSA B125.1.

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

L 402.6 Showerheads. Showerheads shall not exceed 2.0 gpm (7.6 L/m) at 80 psi (552 kPa), and shall be listed to ASME A112.18.1/CSA B125.1 and the EPA WaterSense Specification for Showerheads.

L 402.6.1 Multiple Showerheads Serving One Shower Compartment. The total allowable flow rate of water from multiple showerheads flowing at a given time, with or without a diverter, including rain systems, waterfalls, bodysprays, and jets, shall not exceed 2.0 gpm (7.6 L/m) per shower compartment, where the floor area of the shower compartment is less than 1800 square inches (1.161 m²). For each increment of 1800 square inches (1.161 m²) of floor area after that or part thereof, additional showerheads are allowed, provided the total flow rate of water from flowing devices shall not exceed 2.0 gpm (7.6 L/m) for each such increment.

Exceptions:

1. Gang showers in nonresidential occupancies. Single showerheads or multiple shower outlets serving one showering position in gang showers shall not have more than 2.0 gpm (7.6 L/m) total flow.

2. Where provided, shower compartments required for persons with disabilities in accordance with Chapter 17 shall not have more than 4.0 gpm (15 L/m) total flow, where one outlet is the hand shower.

L 402.6.2 Bath and Shower Diverters. The rate of leakage out of the tub spout of bath and shower diverters while operating in the shower mode shall not exceed 0.1 gpm (0.4 L/m) in accordance with ASME A112.18.1/CSA B125.1.

L 402.6.3 Shower Valves. Shower valves shall comply with the temperature control performance requirements of ASSE 1016 or ASME A112.18.1/CSA B125.1 where tested at 2.0 gpm (7.6 L/m).

L 402.7 Recirculating Shower Systems. Recirculating shower systems shall comply with IAPMO IGC 330.

L 402.8 Bath and Shower Flow-Reduction Devices. Bath and shower flow-reduction devices shall comply with IAPMO IGC 244.

L 402.8.1-0 3.1 Commercial Pre-Rinse Spray Valves. The flow rate for a pre-rinse spray valve installed in a commercial kitchen to remove food waste from cookware and dishes before cleaning shall not be more than 4.25 gpm (16 L/m) at 60 psi (414 kPa), the maximum flow rate, as specified in Table L 402.9. Where pre-rinse spray valves with maximum flow rates of 1.0 gpm (3.8 L/m) or less are installed, the static pressure shall not be less than 30 psi (207 kPa). Commercial kitchen pre-rinse spray valves shall be equipped with an integral automatic shutoff. Pre-rinse spray valves shall be listed to the EPA WaterSense Commercial Pre-rinse Spray Valve Specification.

L 402.9-0 3.10 Emergency Safety Showers and Eye Wash Stations. Emergency safety showers and emergency eyewash stations shall not be limited to their water supply flow rates.

L 402.10 Drinking Fountains. Drinking fountains shall be self-closing.

**TABLE L 402.9**

<table>
<thead>
<tr>
<th>PRODUCT CLASS BY SPRAY FORCE</th>
<th>MAXIMUM FLOW RATE (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Class 1 (&lt; 5.0 ounces-force)</td>
<td>1.00</td>
</tr>
<tr>
<td>Product Class 2 (&gt; 5.0 ounces-force and &lt; 8.0 ounces-force)</td>
<td>1.20</td>
</tr>
<tr>
<td>Product Class 3 (&gt; 8.0 ounces-force)</td>
<td>1.28</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 3.785 L/min, 1 ounce-force = 0.0625 pound-force.

L 403.0 Appliances.

L 403.1 Dishwashers. Residential and commercial dishwashers shall comply with the Energy Star program requirements.

L 403.2 Clothes Washers. Residential clothes washers shall comply with the Energy Star program requirements. Commercial clothes washers shall comply with Energy Star program requirements, where such requirements exist.

L 404.0 Occupancy Specific Water Efficiency Requirements.

L 404.1 Commercial Food Service. Commercial food service facilities shall comply with the water efficiency requirements in Section L 404.2 through Section L 404.7.5.

L 404.2 Ice Makers. Ice makers shall be air cooled and shall be in accordance with Energy Star for commercial ice machines.

L 404.3 Food Steamers. Boilerless type steamers shall consume not more than 2.0 gallons (7.6 L) per compartment. Boiler type steamers shall not consume more than 1.5 gallons (5.7 L) per pan per hour.

L 404.4 Combination Ovens. Combination ovens shall not use water in the convection mode except when utilizing a moisture nozzle for food products in the oven. The total amount of water used by the moisture nozzle in the convection mode shall not exceed a half a gallon per hour per oven cavity. When operating in the steamer mode, combination ovens shall not consume more than 1.5 gallons per hour (gph) (5.7 L/h) per pan.

L 404.5 Grease Interceptors. Grease interceptor maintenance procedures shall not include post-pumping/cleaning
refill using potable water. Refill shall be by connected appliance accumulated discharge only.

L 404.6 Dipper Well Faucets. Where dipper wells are installed, the water supply to a dipper well shall have a shut-off valve and flow control. The flow of water into a dipper well shall be limited by not less than one of the following methods:

1) Water flow shall not exceed the water capacity of the dipper well in one minute at a supply pressure of 60 psi (414 kPa), and the maximum flow shall not exceed 2.2 gpm (8.3 L/m) at a supply pressure of 60 psi (414 kPa). The water capacity of a dipper well shall be the maximum amount of water that the fixture can hold before water flows into the drain.

2) The volume of water dispensed into a dipper well in each activation cycle of a self-closing fixture fitting shall not exceed the water capacity of the dipper well, and the maximum flow shall not exceed 2.2 gpm (8.3 L/m) at a supply pressure of 60 psi (414 kPa).

L 404.7 Food Waste Devices. Where installed, food waste devices shall be in accordance with Section L 404.7.1 through Section L 404.7.5.

L 404.7.1 Pulpers and Mechanical Strainers. The water use for pulpers or mechanical strianers shall not exceed 3 gpm (11.4 L/m). A flow restrictor shall be installed on the water supply to limit the water flow.

L 404.7.2 Food Waste Disposers. The water use for the food waste grinder shall not exceed 8 gpm (30.3 L/m) under full load condition and 1 gpm (3.8 L/m) under no-load condition. Flow restrictors shall be installed on the water supply to limit the water flow rate to a maximum of 8 gpm (30.3 L/m). A load sensing device shall be installed to monitor current demand and regulate water flow.

L 404.7.3 Time Out and Shut Off. Pulpers, mechanical strianers, and food waste disposers shall have a time out system with push button to reactivate. The maximum allowable run time cycle shall be 10 minutes.

L 404.7.4 Sink Drain Outlets. Where a strainer or basket is installed, they shall be readily removable.

L 404.7.5 Strainer Baskets. Strainer (scrapper) baskets shall either fit over a sink compartment or be attached to a drain system. The strainer baskets shall be readily removable for emptying.

L 404.8 Medical and Laboratory Facilities. Medical and laboratory facilities shall comply with the water efficiency requirements in Section L 404.9 through Section L 404.11.

L 404.9 Steam Sterilizers. Controls shall be installed to limit the discharge temperature of condensate or water from steam sterilizers to 140°F (60°C) or less. A venturi-type vacuum system shall not be utilized with vacuum sterilizers.

L 404.10 X-Ray Film Processing Units. Processors for X-ray film exceeding 6 inches (152 mm) in any dimension shall be equipped with water recycling units.

L 404.11 Exhaust Hood Liquid Scrubber Systems. Liquid scrubber systems for exhaust hoods and ducts shall be of the recirculation type. Liquid scrubber systems for perchloric acid exhaust hoods and ducts shall be equipped with a timer-controlled water recirculation system. The collection sump for perchloric acid exhaust systems shall be designed to drain automatically after the wash down process has completed.

L 404.0 Leak Detection and Control.

L 405.1 General. Where installed, leak detection and control devices shall comply with IAPMO IGC 115 or IAPMO IGC 249. Leak detection and control devices help protect property from water damage and also conserve water by shutting off the flow when leaks are detected.

L 406.0 Fountains and Other Water Features.

L 406.1 Use of Alternate Water Source for Special Water Features. Special water features such as ponds and water fountains shall be provided with reclaimed (recycled) water, rainwater, or on-site treated nonpotable water where the source and capacity are available on the premises and approved by the Authority Having Jurisdiction.

L 407.0 Meters.

L 407.1 Required. A water meter shall be required for buildings connected to a public water system, including municipally supplied reclaimed (recycled) water. In other than single-family houses, multifamily structures of three stories or fewer above grade, and modular houses, a separate meter or submeter shall be installed in the following locations:

1) The water supply for irrigated landscape with an accumulative area exceeding 2500 square feet (232.3 m²).

2) The water supply to a water-using process where the consumption exceeds 1000 gallons per day (gal/d) (0.0438 L/s), except for manufacturing processes.

3) The water supply to each building on a property with multiple buildings where the water consumption exceeds 500 gals/d (0.021 L/s).

4) The water supply to an individual tenant space on a property where one or more of the following applies:
   (a) Water consumption exceeds 500 gals/d (0.021 L/s) for that tenant.
   (b) Tenant space is occupied by a commercial laundry, cleaning operation, restaurant, food service, medical office, dental office, laboratory, beauty salon, or barbershop.
   (c) Total building area exceeds 50 000 square feet (4645 m²).

5) The makeup water supplies to a swimming pool.

L 407.2 Approval. Dedicated meters, other than water utility meters shall be approved by the Authority Having Jurisdiction for the intended use.

L 407.3 Consumption Data. A means of communicating water consumption data from submeters to the water consumer shall be provided.

L 407.4 Access. Meters and submeters shall be accessible.
L 408.0 Condensate Recovery.

L 408.1 General. Condensate is permitted to be used as on-site treated nonpotable water when collected, stored, and treated in accordance with Section 1506.0.

L 408.1.1 Condensate Drainage Recovery. Condensate from air-conditioning, boiler and steam systems used to supply water for non-potable water systems shall be in accordance with Section 1506.0.

L 409.0 Water-Powered Sump Pumps.

L 409.1 General. Sump pumps powered by potable or reclaimed (recycled) water pressure shall be used as an emergency backup pump and shall comply with IAPMO PS 119. The water-powered pump shall be equipped with a battery powered alarm having a minimum rating of 85 dBA at 10 feet (3048 mm). Water-powered pumps shall have a water efficiency factor of pumping at least 1.4 gallons (5.3 L) of water to a height of 10 feet (3048 mm) for every gallon of water used to operate the pump, measured at a water pressure of 60 psi (414 kPa). Pumps shall be labeled as to the gallons of water pumped per gallon of potable water consumed.

Water-powered stormwater sump pumps shall be equipped with a reduced pressure principle backflow prevention assembly.

L 410.0 Water Softeners and Treatment Devices.

L 410.1 Water Softeners. Water softeners shall be listed to NSF/ANSI 44. Water softeners shall have a rated salt efficiency exceeding 3400 grains (GR) (222 kg) of total hardness exchange per pound (0.5 kg) of salt, based on sodium chloride (NaCl) equivalency, and shall not generate more than 4 gallons (15.1 L) of water per 1000 grains (0.0647 kg) of hardness removed during the service cycle.

L 410.2 Water Softener Limitations. In residential buildings, where the supplied potable water hardness is equal to or less than 8 grains per gallon (gr/gal) (137 mg/L) measured as total calcium carbonate equivalents, water softening equipment that discharges water into the wastewater system during the service cycle shall not be allowed, except as required for medical purposes.

L 410.3 Point-of-Use Reverse Osmosis Water Treatment Systems. Reverse osmosis water treatment systems installed in residential occupancies shall be equipped with automatic shutoff valves to prevent discharge when there is no call for producing treated water. Reverse osmosis water treatment systems shall be listed in accordance with NSF/ANSI 58 and ASSE 1086.

L 411.0 Landscape Irrigation Systems.

L 411.1 General. Where landscape irrigation systems are installed, they shall be in accordance with Section L 411.2 through Section L 411.14. Requirements limiting the amount or type of plant material used in landscapes shall be established by the Authority Having Jurisdiction.

Exception: Plants grown for food production.

L 411.2 Backflow Protection. Potable water and supplies to landscape irrigation systems shall be protected from backflow in accordance with this code and the Authority Having Jurisdiction.

L 411.3 Use of Alternate Water Sources for Landscape Irrigation. Where available by pre-existing treatment, storage, or distribution network, and where approved by the Authority Having Jurisdiction, alternative water source(s) shall be utilized for landscape irrigation. Where adequate capacity and volumes of pre-existing alternative water sources are available, the irrigation system shall be designed to use a minimum of 75 percent of alternative water for the annual irrigation demand before supplemental potable water is used.

L 411.4 Irrigation Control Systems. Where installed as part of a landscape irrigation system, irrigation control systems shall:

(1) Automatically adjust the irrigation schedule to respond to plant water needs determined by weather or soil moisture conditions. Shall be listed to the EPA WaterSense Specification for Weather-Based Irrigation Controllers or the EPA WaterSense Specification for Soil Moisture-Based Irrigation Controllers.

(2) Utilize sensors to suspend irrigation during a rainfall.

(3) Utilize sensors to suspend irrigation where adequate soil moisture is present for plant growth.

(4) Have the capability to program multiple and different run times for each irrigation zone to enable cycling of water applications and durations to mitigate water flowing off of the intended irrigation zone.

(5) The site-specific settings of the irrigation control system affecting the irrigation and shall be posted at the control system location. The posted data, where applicable to the settings of the controller, shall include:

(a) Precipitation rate for each zone.

(b) Plant evapotranspiration coefficients for each zone.

(c) Soil absorption rate for each zone.

(d) Rain sensor settings.

(e) Soil moisture setting.

(f) Peak demand schedule including run times for each zone and the number of cycles to mitigate runoff and monthly adjustments or percentage.

L 411.5 Low Flow Irrigation. Irrigation zones using low flow irrigation emitters shall comply with ASABE/ICC 802 Landscape Irrigation Sprinkler and Emitter Standard and shall be equipped with filters sized according to the manufacturer’s recommendation for the specific low flow emitter, and with a pressure regulator installed upstream of the irrigation emission devices as necessary to reduce the operating water pressure in accordance with the manufacturers’ equipment requirements.

L 411.6 Mulched Planting Areas. Only low flow emitters are allowed to be installed in mulched planting areas with vegetation taller than 12 inches (305 mm).
L 411.7 System Performance Requirements. The landscape irrigation system shall be designed and installed to:

1. Prevent irrigation water from runoff out of the irrigation zone.
2. Prevent water in the supply line drainage from draining out between irrigation events.
3. Not allow irrigation water to be applied onto or enter non-targeted areas including adjacent property and vegetation areas, adjacent hydrozones not requiring the irrigation water to meet its irrigation demand, non-vegetative areas, impermeable surfaces, roadways, and structures.

L 411.8 Narrow or Irregularly Shaped Landscape Areas. Narrow or irregularly shaped landscape areas, less than 4 feet (1219 mm) in any direction across opposing boundaries, shall not be irrigated by an irrigation emission device except low flow emitters.

L 411.9 Sloped Areas. Where soil surface rises more than 1 foot (305 mm) per 4 feet (1219 mm) of length, the irrigation zone system average precipitation rate shall not exceed 0.75 inches (19.1 mm) per hour as verified through either of the following methods:

1. Manufacturer documentation that the precipitation rate for the installed sprinkler head does not exceed 0.75 inches (19.1 mm) per hour where the sprinkler heads are installed not closer than the specified radius and where the water pressure of the irrigation system is not more than the manufacturer’s recommendations.
2. Catch can test in accordance with the requirements of the Authority Having Jurisdiction and where emitted water volume is measured with a minimum of six catchment containers at random places within the irrigation zone for a minimum of 15 minutes to determine the average precipitation rate, expressed as inches per hour (mm/h).

L 411.10 Sprinkler Head Installations. All installed sprinkler heads shall comply with ASABE/ICC 802 or other approved standard(s).

L 411.10.1 Sprinkler Heads in Common Irrigation Zones. Sprinkler heads installed in irrigation zones served by a common valve shall be limited to applying water to plants with similar irrigation needs, and shall have matched precipitation rates (identical inches of water application per hour as rated or tested, plus or minus 5 percent).

L 411.10.2 Sprinkler Head Pressure Regulation. Sprinkler heads shall utilize pressure regulating devices (as part of an irrigation system or integral to the sprinkler head-body) to maintain manufacturer’s recommended operating pressure for each sprinkler and nozzle type. Sprinkler bodies with integral pressure regulation shall be listed to the EPA WaterSense Specification for Spray Sprinkler Bodies.

L 411.10.3 Pop-up Type Sprinkler Heads. Where pop-up type sprinkler heads are installed, the sprinkler heads shall rise to a height above vegetation level and of not less than 4 inches (102 mm) above the soil level where emitting water.

L 411.11 Irrigation Zone Performance Criteria. Irrigation zones shall be designed and installed to ensure the average precipitation rate of the sprinkler heads over the irrigated area does not exceed 1 inch per hour (25.4 mm/h) as verified through either of the following methods:

1. Manufacturer’s documentation that the precipitation rate for the installed sprinkler head does not exceed 1 inch per hour (25.4 mm/h) where the sprinkler heads are installed not closer than the specified radius and where the water pressure of the irrigation system is not more than the manufacturer’s recommendations.
2. Catch can test in accordance with the requirements of the Authority Having Jurisdiction and where emitted water volume is measured with a minimum of six catchment containers at random places within the irrigation zone for a minimum of 15 minutes to determine the average precipitation rate, expressed as inches per hour (mm/h).

L 411.12 Depth of Irrigation Pipe. Irrigation pipe downstream from the backflow preventer shall be buried at a minimum depth according to Section L 411.12.1 and Section L 411.12.2.

L 411.12.1 Landscape Areas. Irrigated landscaped areas not exceeding 10 000 square feet (929 m²) shall have irrigation main lines buried a minimum of 12 inches (305 mm) and irrigation lateral lines buried a minimum of 8 inches (203 mm). Irrigated landscaped areas greater than 10 000 square feet (929 m²) shall have irrigation main lines buried a minimum of 18 inches (457 mm) and irrigation lateral lines buried a minimum of 12 inches (305 mm).

L 411.12.2 Vehicular Surfaces. Irrigation pipe installed under vehicular paving and pervious pavers, including landscaped fire lanes, shall be sleeved with a minimum of one 1-inch pipe (25 mm) size greater than the irrigation pipe and buried at a minimum depth of 24 inches (610 mm) in all cases.

L 411.13 Backfill. All excavation for irrigation pipe installation shall be backfilled in thin layers to 12 inches (305 mm) with clean earth, which shall not contain stones, boulders, cinderfill, frozen earth, construction debris, or other materials that would damage or break the piping. Fill shall be properly compacted. Suitable precautions shall be taken to ensure permanent stability for pipe laid in filled or made ground.

L 411.14 Qualifications. The Authority Having Jurisdiction shall have the authority to require landscape irrigation contractors, installers, or designers to demonstrate competency. Where required by the Authority Having Jurisdiction, the contractor, installer, or designer shall be certified to perform such work.

L 412.0 Trap Seal Protection. L 412.1 Water Supplied Trap Primers. Water supplied trap primers shall be electronic or pressure activated and shall use not more than 30 gallons (114 L) per year per drain. Where an alternate water source, as defined by this code, is used for fixture flushing or other uses in the same room, the alternate water source shall be used for the trap primer water supply.

Exception: Flushometer tailpiece trap primers in accordance with ASSE 1044 or IAPMO PS 76.
L 412.2 Drainage Type Trap Seal Primer Devices. Drainage type trap seal primer devices shall not be limited in the amount of water they discharge.

L 413.0 Vehicle Wash Facilities.
L 413.1 Automatic. The maximum make-up water use for automobile washing shall not exceed 40 gallons (151 L) per vehicle for in-bay automatic car washes and 35 gallons (132 L) for conveyor and express type car washes.
L 413.2 Self-Service. Spray wands and foamy brushes shall use not more than 3.0 gpm (0.19 L/s).
L 413.3 Reverse Osmosis. Spot-free reverse osmosis discharge (reject) water shall be recycled.
L 413.4 Towel Ringers. Towel ringers shall have a positive shutoff valve. Spray nozzles shall be replaced annually.
Exception: Bus and large commercial vehicle washes are exempt from the requirements of this section.

L 501.0 Water Heating Design, Equipment, and Installation.
L 501.1 Scope. The provisions of this section shall establish the means of conserving potable and nonpotable water and energy associated with the generation and use of hot water in a building. This includes provisions for the hot water distribution system, which is the portion of the potable water distribution system between a water heating device and the plumbing fixtures, including dedicated return piping and appurtenances to the water heating device in a recirculation system.
L 501.2 Insulation. Hot water supply and return piping shall be thermally insulated. The wall thickness of the insulation shall be equal to the nominal diameter of the pipe up to 2 inches (50 mm). The wall thickness shall be not less than 2 inches (51 mm) for nominal pipe diameters exceeding 2 inches (50 mm). The conductivity of the insulation [k-factor (Btu•in/(h•ft•°F))], measured radially, shall not be more than 0.28 [Btu•in/(h•ft•°F)] [0.04 W/(m•K)]. Hot water piping to be insulated shall be installed such that insulation is continuous, and similar fixtures, structural members, or a wall where the pipe passes through to connect to a fixture within 24 inches (610 mm).

Exceptions:
1. Where the hot water pipe is installed in a wall that is not of a width to accommodate the pipe and insulation, the insulation thickness shall be permitted to have the maximum thickness that the wall is capable of accommodating and not less than ½ of an inch (12.7 mm) thick.
2. Hot water supply piping exposed under sinks, lavatories, and similar fixtures.
L 501.3 Recirculation Systems. Recirculation systems shall comply with Section L 501.3.1 and Section L 501.3.2.
L 501.3.1 For Low-Rise Residential Buildings. Circulating hot water systems shall be arranged so that the circulating pump(s) are capable of being turned off (automatically or manually) where the hot water system is not in operation. [ASHRAE 90.2-2007:7.2]
L 501.3.2 For Pumps Between Boilers and Storage Tanks. Where used to maintain storage tank water temperature, recirculating pumps shall be equipped with controls limiting operation to a period from the start of the heating cycle to a maximum of 5 minutes after the end of the heating cycle. [ASHRAE 90.1:7.4.4.4]
L 501.4 Recirculation Pump Controls. Pump controls shall include on-demand activation or time clocks combined with temperature sensing. Time clock controls for pumps shall not let the pump operate more than 15 minutes every hour. Temperature sensors shall stop circulation where the temperature set point is reached and shall be located on the circulation loop at or near the last fixture. The pump, pump controls, and temperature sensors shall be accessible. Pump operation shall be limited to the building’s hours of operation.
L 501.4.1 Hot Water On-Demand Pumping Systems. Hot water on-demand pumping systems manually actuated or automatically activated hot water pumping systems shall comply with IAPMO PS 115.
L 501.5 Temperature Maintenance Controls. Systems designed to maintain usage temperatures in hot-water pipes, such as recirculating hot water systems or heat trace, shall be equipped with automatic time switches or other controls that are capable of being set to switch off the usage temperature maintenance system during extended periods where hot water is not required. [ASHRAE 90.1:7.4.4.2]
L 501.6 System Balancing. Systems with multiple recirculation zones shall be balanced to distribute hot water uniformly, or they shall be operated with a pump for each zone. The circulation pump controls shall comply with the provisions of Section L 501.4.
L 501.7 Flow Balancing Valves. Flow balancing valves shall be a factory preset automatic flow control valve, a flow regulating valve, or a balancing valve with memory stop.
L 501.8 Air Elimination. Provision shall be made for the elimination of air from the return system.
L 501.9 Gravity or Thermosyphon Systems. Gravity or thermosyphon systems are prohibited.

L 502.0 Service Hot Water – Low-Rise Residential Buildings.
L 502.1 General. The service water heating system for single-family houses, multi-family structures of three stories or fewer above grade, and modular houses shall comply with Section L 502.2 through Section L 502.7.3. The service water heating system of all other buildings shall comply with Section L 503.0.
L 502.2 Water Heaters and Storage Tanks. Residential-type water heaters, pool heaters, and unfired water heater storage tanks shall comply with the minimum performance requirements specified by federal law.

Unfired storage water heating equipment shall have a heat loss through the tank surface area of less than 6.5 British thermal units per square foot hour [Btu/(ft²•h)] (20.5 W/m²). [ASHRAE 90.2-2007:7.1]

L 502.3 Recirculation Systems. Recirculation systems shall comply with the provisions of Section L 501.3.

L 502.4 Central Water Heating Equipment. Service water heating equipment (central systems) that do not fall under the requirements for residential-type service water heating equipment addressed in Section L 502.2 shall comply with the applicable requirements for service water-heating equipment found in Section L 503.0. [ASHRAE 90.2-2007:7.3]

L 502.5 Insulation. Insulation for hot water and return piping shall comply with the provisions of Section L 501.2.

L 502.6 Hard Water. Where water has hardness equal to or exceeding 9 grains per gallon (gr/gal) (154 mg/L) measured as total calcium carbonate equivalents, the water supply line to water heating equipment in new one- and two-family dwellings shall be roughed-in to allow for the installation of water treatment equipment.

L 502.7 Maximum Volume of Hot Water. The maximum volume of water contained in hot water distribution pipes shall be in accordance with Section L 502.7.1 or Section L 502.7.2. The water volume shall be calculated using Table L 502.7.

L 502.7.1 Maximum Volume of Hot Water Without Recirculation or Heat Trace. The maximum volume of water contained in hot water distribution pipe between the water heater and any fixture fitting shall not exceed 32 ounces (oz) (946 mL). Where a fixture fitting shutoff valve (supply stop) is installed ahead of the fixture fitting, the maximum volume of water is permitted to be calculated between the water heater and the fitting shutoff valve (supply stop).

L 502.7.2 Maximum Volume of Hot Water with Recirculation or Heat Trace. The maximum volume of water contained in the branches between the recirculation loop or electrically heat traced pipe, and the fixture fitting shall not exceed 16 oz (473 mL). Where a fixture fitting shutoff valve (supply stop) is installed ahead of the fixture fitting, the maximum volume of water is permitted to be calculated between the recirculation loop or electrically, heat traced pipe and the fixture fitting shutoff valve (supply stop).

Exception: Whirlpool bathtubs or bathtubs that are not equipped with a shower are exempted from the requirements of Section L 502.7.

L 502.7.3 Hot Water System Submeters. Where a hot water pipe from a circulation loop or electric heat trace line is equipped with a submeter, the hot water distribution system downstream of the submeter shall have either an end-of-line hot water circulation pump or shall be electrically heat traced. The maximum volume of water in a branch from the circulation loop or electric heat trace line downstream of the submeter shall not exceed 16 oz (473 mL).

Where there is no circulation loop or electric heat traced line downstream of the submeter, the submeter shall be located within 2 feet (610 mm) of the central hot water system; or the branch line to the submeter shall be circulated or heat traced to within 2 feet (610 mm) of the submeter. The maximum volume from the submeter to each fixture shall not exceed 32 oz (946 mL).

The circulation pump controls shall comply with the provisions of Section L 501.4.

L 503.0 Service Hot Water – Other Than Low-Rise Residential Buildings.

L 503.1 General. The service hot water, other than single-family houses, multifamily structures of three stories or fewer above grade, and modular houses shall comply with this section.

L 503.1.1 New Buildings. Service water-heating systems and equipment shall comply with the requirements of this section as described in Section L 503.2. [ASHRAE 90.1:7.1.1.1]
L 503.1.2 Additions to Existing Buildings. Service water heating systems and equipment shall comply with the requirements of this section.

Exception: Where the service water-heating to an addition is provided by existing service water-heating systems and equipment, such systems and equipment shall not be required to be in accordance with this appendix. However, new systems or equipment installed shall be in accordance with specific requirements applicable to those systems and equipment. [ASHRAE 90.1:7.1.1.2]

L 503.1.3 Alterations to Existing Buildings. Building service water-heating equipment installed as a direct replacement for existing building service water-heating equipment shall be in accordance with the requirements of Section L 503.0 applicable to the equipment being replaced. New and replacement piping shall comply with Section L 503.3.3.

Exception: Compliance shall not be required where there is insufficient space or access to meet these requirements. [ASHRAE 90.1:7.1.1.3]

L 503.2 Compliance Paths. Service water heating systems and equipment shall comply with Section L 503.2.1 and Section L 503.2.2.

L 503.2-L 503.2.1 Requirements for All Compliance Paths. Compliance shall be achieved in accordance with the requirements of Service water heating systems and equipment shall comply with Section L 503.1, Section L 503.3, Section L 503.4-L 503.3.2, and Section L 503.5. [ASHRAE 90.1:7.2.1]

L 503.2.2 Additional Requirements for Service Water Heating. Service water heating systems and equipment shall comply with Section L 503.4-L 503.2.1 through Section L 503.4.3. [ASHRAE 90.1:7.2.2]

L 503.2.1 Energy Cost Budget Method. Projects using the energy cost budget method of ASHRAE 90.4 for demonstrating compliance with the standard shall be in accordance with the requirements of Section L 503.1 in conjunction with the energy cost budget method of ASHRAE 90.4. [ASHRAE 90.1:7.4.1]

L 503.3 Mandatory Provisions. The mandatory provisions of Section L 503.3.1 through Section L 503.3.7 shall be followed.

L 503.3.1 Load Calculations. Service water-heating system design load for the purpose of sizing systems and equipment shall be determined in accordance with manufacturer’s published sizing guidelines or generally accepted engineering standards and handbooks acceptable to the adopting authority (e.g., ASHRAE Handbook - HVAC Applications). [ASHRAE 90.1:7.4.1]

L 503.3.2 Equipment Efficiency. Water-heating equipment, hot-water supply boilers used solely for heating potable water, pool heaters, and hot water storage tanks shall comply with the criteria listed in Table L 503.3.2. Where multiple criteria are listed, all criteria shall be met. The omission of minimum performance requirements for certain classes of equipment does not preclude the use of such equipment where appropriate.

Equipment not listed in Table L 503.3.2 has no minimum performance requirements.

Exceptions: Water heaters and hot-water supply boilers having more than 140 gallons (530 L) of storage capacity are not required to meet the standby loss (SL) requirements of Table L 503.3.2 where:

1. The tank surface is thermally insulated to R-12.5.
2. A standing pilot light is not installed.
3. Gas- or oil-fired storage water heaters have a flue damper or fan-assisted combustion. [ASHRAE 90.1:7.4.2]

L 503.3.3 Service Hot Water Piping Insulation. The following piping shall be insulated in accordance with Table L 503.3.3:

1. Recirculating system piping, including the supply and return piping of a circulating tank type water heater.
2. The first 8 feet (2438 mm) of outlet piping for a constant temperature nonrecirculating storage system.
3. The first 8 feet (2438 mm) of branch piping connecting to recirculated, heat-traced, or impedance heated piping.
4. The inlet piping between the storage tank and a heat trap in a nonrecirculating storage system.
5. Piping that is externally heated (such as heat trace or impedance heating). [ASHRAE 90.1:7.4.3]

L 503.3.4 Hot Water System Design. Hot water systems shall comply with Section L 503.3.4(1) and Section L 503.3.4(2).

1. Recirculation systems shall comply with the provisions of Section L 501.3.
2. The maximum volume of water contained in hot water distribution lines between the water heater and the fixture stop or connection to showers, kitchen faucets, and lavatories shall be determined in accordance with Section L 502.7.

L 503.3.5 Service Water Heating System Controls. Service water heating system controls shall comply with Section L 503.3.5(1) and Section L 503.3.5(2).

1. Temperature controls shall be provided that allow for storage temperature adjustment from 120°F (49°C) or lower to a maximum temperature compatible with the intended use.

Exception: Where the manufacturer’s installation instructions specify a higher minimum thermostat setting to minimize condensation and resulting corrosion. [ASHRAE 90.1:7.4.4.1]

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

L 503.3.6 Pools. Pool heating systems shall comply with Section L 503.3.6(1) through Section L 503.3.6(3).

1. Pool heaters shall be equipped with a readily accessible ON/OFF switch to allow shutting off the heater without adjusting the thermostat setting. Pool
## TABLE L 503.3.2
### PERFORMANCE REQUIREMENTS FOR WATER-HEATING EQUIPMENT MINIMUM EFFICIENCY REQUIREMENTS

[ASHRAE 90.1: TABLE 7.8]

<table>
<thead>
<tr>
<th>EQUIPMENT TYPE</th>
<th>SIZE CATEGORY (INPUT)</th>
<th>SUBCATEGORY OR RATING CONDITION</th>
<th>PERFORMANCE REQUIRED</th>
<th>TEST PROCEDURE²,³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric table-top water heaters</td>
<td>≤12 kW</td>
<td>Resistance &lt;4000 (Btu/h)/gal ≥20 gal and &lt;120 gal</td>
<td>See footnote 7—For applications outside U.S., see footnote (h). For U.S. applications, see footnote (7).</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td></td>
<td>&lt;12 kW²</td>
<td>Resistance &gt;20 gal</td>
<td>See footnote 7</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>&gt;12 kW³</td>
<td>Resistance ≥20 gal</td>
<td>0.3 + 27√Vₐm %/h</td>
<td>Section G.2 of CSA-Z21.10.2</td>
</tr>
<tr>
<td></td>
<td>≤24 Amps and ≤250 Volts</td>
<td>Heat Pump</td>
<td>See footnote 7</td>
<td>—</td>
</tr>
<tr>
<td>Electric water heaters</td>
<td>≤12 kW</td>
<td>&lt;4000 (Btu/h)/gal ≥20 gal and &lt;55 gal</td>
<td>For applications outside U.S., see footnote (8). For U.S. applications, see footnote (7).</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td></td>
<td>&gt;12 kW</td>
<td>&lt;4000 (Btu/h)/gal ≥55 gal and ≤120 gal</td>
<td>For applications outside U.S., see footnote (8). For U.S. applications, see footnote (7).</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td>Electric storage water heaters</td>
<td>≤12 kW</td>
<td>&lt;4000 (Btu/h)/gal ≥20 gal and ≤55 gal</td>
<td>For applications outside U.S., see footnote (8). For U.S. applications, see footnote (7).</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td></td>
<td>&gt;12 kW</td>
<td>&gt;12 kW²</td>
<td>SL ≤ 0.3 + 27Vₐm %/h</td>
<td>10 CFR 431.106</td>
</tr>
<tr>
<td>Electric instantaneous water heaters</td>
<td>&gt;12 kW and ≤58.6 kW³</td>
<td>≥4000 (Btu/h)/gal ≥2 gal and &lt;180°F</td>
<td>Very Small DP: UEF = 0.80 Low DP: UEF = 0.80 Medium DP: UEF = 0.80 High DP: UEF = 0.80</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td></td>
<td>≤58.6 kW²</td>
<td>≥4000 (Btu/h)/gal ≥10 gal</td>
<td>No requirement</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td></td>
<td>≤75 000 Btu/h</td>
<td>&lt;4000 (Btu/h)/gal ≥20 gal and ≤55 gal</td>
<td>For applications outside U.S., see footnote (8). For U.S. applications, see footnote (7).</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
<td></td>
<td>≥75 000 Btu/h and ≤105 000 Btu/h²</td>
<td>&lt;4000 (Btu/h)/gal ≥120 gal and &lt;180°F</td>
<td>Very Small DP: UEF = 0.2674 – (0.0009 × Vₐm) Low DP: UEF = 0.5362 – (0.0012 × Vₐm) Medium DP: UEF = 0.6002 – (0.0011 × Vₐm) High DP: UEF = 0.6597 – (0.0009 × Vₐm)</td>
<td>Appendix E of 10 CFR 430</td>
</tr>
<tr>
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<td>&gt;105 000 Btu/h²</td>
<td>&lt;4000 (Btu/h)/gal ≥20 gal and ≤55 gal</td>
<td>No requirement</td>
<td>—</td>
</tr>
<tr>
<td>Gas storage water heaters</td>
<td>≤25 000 Btu/h to 105 000 Btu/h²</td>
<td>&lt;4000 (Btu/h)/gal &lt;4000 (Btu/h)/gal</td>
<td>80% Eₜ SL &lt; (Q/800 + 110VT) SLₜ, Btu/h</td>
<td>Sections G.1 and G.2 of CSA-Z21.10.2</td>
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<tr>
<td></td>
<td>&gt;105 000 Btu/h²</td>
<td>&lt;4000 (Btu/h)/gal ≥20 gal and ≤55 gal</td>
<td>No requirement</td>
<td>—</td>
</tr>
<tr>
<td>EQUIPMENT TYPE</td>
<td>SIZE CATEGORY (INPUT)</td>
<td>SUBCATEGORY OR RATING CONDITION</td>
<td>PERFORMANCE REQUIRED1</td>
<td>TEST PROCEDURE2,3</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------------------</td>
<td>---------------------------------</td>
<td>------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Gas instantaneous water heaters</td>
<td>&gt;50 000 Btu/h and ≤200 000 Btu/h</td>
<td>≥4000 (Btu/h)/gal and &lt;2 gal</td>
<td>See footnote 7 For applications outside U.S., see footnote (8). For U.S. applications, see footnote (7).</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>≥200 000 Btu/h4,6</td>
<td>≥4000 (Btu/h)/gal and &lt;10 gal</td>
<td>80% $E_T$</td>
<td>Sections G.1 and G.2 of CSA Z21.10.3 10 CFR 431.106</td>
</tr>
<tr>
<td></td>
<td>≥200 000 Btu/h6</td>
<td>≥4000 (Btu/h)/gal and ≥10 gal</td>
<td>SL ≤ $((Q/800 + 110\sqrt{V})$, Btu/h</td>
<td>—</td>
</tr>
<tr>
<td>Oil storage water heaters</td>
<td>≤105 000 Btu/h</td>
<td>&lt;4000 (Btu/h)/gal and ≤50 gal</td>
<td>0.59 - 0.0005$/V$ EF For applications outside U.S., see footnote (8). For U.S. applications, see footnote (7).</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>&gt;105 000 Btu/h and ≤140 000 Btu/h</td>
<td>≤120 gal and ≤180°F</td>
<td>Very Small DP: UEF = 0.2932 - (0.00015 × Vr) Low DP: UEF = 0.3386 - (0.00018 × Vr) Medium DP: UEF = 0.6194 - (0.00016 × Vr) High DP: UEF = 0.6740 - (0.00013 × Vr)</td>
<td>Sections G.1 and G.2 of CSA Z21.10.3 10 CFR 431.106</td>
</tr>
<tr>
<td></td>
<td>≥105 000 Btu/h and &gt;140 000 Btu/h</td>
<td>&lt;4000 (Btu/h)/gal</td>
<td>80% $E_T$ SL ≤ $((Q/800 + 110\sqrt{V})$, Btu/h</td>
<td>—</td>
</tr>
<tr>
<td>Oil instantaneous water heaters</td>
<td>≤210 000 Btu/h</td>
<td>≥4000 (Btu/h)/gal and &lt;2 gal</td>
<td>See footnote 7 80 % $E_T$ EF ≥ 0.59 - 0.0005 × V</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>&gt;210 000 Btu/h</td>
<td>≥4000 (Btu/h)/gal and &lt;10 gal</td>
<td>80% $E_T$</td>
<td>Sections G.1 and G.2 of CSA Z21.10.3 10 CFR 431.106</td>
</tr>
<tr>
<td></td>
<td>&gt;210 000 Btu/h</td>
<td>≥4000 (Btu/h)/gal and ≥10 gal</td>
<td>78% $E_T$ SL ≤ $((Q/800 + 110\sqrt{V})$, Btu/h</td>
<td>—</td>
</tr>
<tr>
<td>Hot-water supply boilers, gas and oil6</td>
<td>≥300 000 Btu/h and &lt;12 500 000 Btu/h</td>
<td>≥4000 (Btu/h)/gal and &lt;10 gal</td>
<td>80% $E_T$</td>
<td>Sections G.1 and G.2 of CSA Z21.10.3 10 CFR 431.106</td>
</tr>
<tr>
<td>Hot-water supply boilers, gas6</td>
<td>≥300 000 Btu/h and &lt;12 500 000 Btu/h</td>
<td>≥4000 (Btu/h)/gal and ≥10 gal</td>
<td>80% $E_T$ SL ≤ $((Q/800 + 110\sqrt{V})$, Btu/h</td>
<td>—</td>
</tr>
<tr>
<td>Hot-water supply boilers, oil</td>
<td>≥300 000 Btu/h and &lt;12 500 000 Btu/h</td>
<td>≥4000 (Btu/h)/gal and ≥10 gal</td>
<td>78% $E_T$ SL ≤ $((Q/800 + 110\sqrt{V})$, Btu/h</td>
<td>—</td>
</tr>
</tbody>
</table>
### TABLE L 503.3.2

**PERFORMANCE REQUIREMENTS FOR WATER-HEATING EQUIPMENT MINIMUM EFFICIENCY REQUIREMENTS**

*ASHRAE 90.1: TABLE 7.8*

<table>
<thead>
<tr>
<th>EQUIPMENT TYPE</th>
<th>SIZE CATEGORY</th>
<th>SUBCATEGORY OR RATING CONDITION</th>
<th>PERFORMANCE REQUIRED</th>
<th>TEST PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pool heaters, oil and-gas</td>
<td>All</td>
<td>—</td>
<td>See footnote 7</td>
<td>ASHRAE 146</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>82% $E_f$ for commercial pool heaters and for applications outside U.S. For U.S. applications, see footnote (7)</td>
<td>Appendix P of 10 CFR 430</td>
</tr>
<tr>
<td>Heat pump pool heaters</td>
<td>All</td>
<td>50°F db 44.2°F wb Outdoor air 80.0°F entering water</td>
<td>4.0 COP</td>
<td>AHRI 1160</td>
</tr>
<tr>
<td>Unfired storage tanks</td>
<td>All</td>
<td>—</td>
<td>R-12.5</td>
<td>(none)</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon = 3.785 L, 1000 British thermal units per hour = 0.293 kW. °C = (°F-32)/1.8

**Notes:****

1. Thermal efficiency ($E_t$) is a minimum requirement, while standby loss (SL) is a maximum $Btu/h$ ($kW$) based on a 70°F (21°C) temperature difference between stored water and ambient requirements. In the SL equation, $V$ is the rated volume in gallons and $Q$ is the nameplate input rate in $Btu/h$ ($kW$). $V_n$ is the measured volume in the tank in gallons. Standby loss for electric water heaters is in terms of %/h and denoted by the term “S,” and standby loss for gas and oil water heaters is in terms of $Btu/h$ and denoted by the term “SL.” Draw pattern (DP) refers to the inlet draw profile in the Uniform Energy Factor (UEF) test. UEF and Energy Factor (EF) are minimum requirements. In the UEF standard equations, $Q$ refers to the rated volume in gallons.

2. ASHRAE 90.1 contains a complete specification, including the year version, of the referenced test procedure.


4. Electric instantaneous water heaters with input rates below capacity >40,946 $Btu/h$ (12 kW) and <200,000 $Btu/h$ (58.6 kW) shall be in accordance with the requirements for where the water heater either:
   - (a) has a storage volume >2 gallons (7.6 L);
   - (b) is designed to provide outlet hot water at temperatures of greater than 180°F (82°C), or higher;
   - (c) uses three-phase power.

5. Electric instantaneous water heaters with input rates less than 40,946 $Btu/h$ (12 kW) shall be in accordance with these requirements where the water heater is designed to heat water to temperatures of 180°F (82°C) or higher.

6. Gas storage water heaters with input capacity >75,000 $Btu/h$ (22 kW) and ≤105,000 $Btu/h$ (30.8 kW) must comply with the requirements for the >105,000 $Btu/h$ (30.8 kW) if the water heater either:
   - (a) has a storage volume >120 gallons (454 L);
   - (b) is designed to provide outlet hot water at temperatures greater than 180°F (82.2°C); or
   - (c) uses three-phase power.

7. Oil storage water heaters with input capacity >105,000 $Btu/h$ (30.8 kW) and ≤140,000 $Btu/h$ (41.0 kW) must comply with the requirements for the >140,000 $Btu/h$ (41.0 kW) if the water heater either:
   - (a) has a storage volume >120 gallons (454 L);
   - (b) is designed to provide outlet hot water at temperatures greater than 180°F (82.2°C); or
   - (c) uses three-phase power.

8. Refer to Section L 503.4.3 for additional requirements for gas storage and instantaneous water heaters and gas hot-water supply boilers.

9. In the U.S., the efficiency requirements for water heaters or gas pool heaters in this category or subcategory are regulated as consumer products by the U.S. Department of Energy. Those requirements and applicable test procedures are found in the Code of Federal Regulations 10 CFR Part 430.

10. Water heaters or gas pool heaters in this category or subcategory are regulated as consumer products by the USDOE as defined in 10 CFR 430.

11. Where this standard is being applied to a building outside the U.S. and Canada and water heaters in this subcategory are being installed in that building, those water heaters shall meet the local efficiency requirements. If there are no local efficiency standards for residential water heaters, consideration should be given to using the USDOE efficiency requirements shown in Appendix F, Table F-2 of ASHRAE 90.1.

### Exceptions:

1. Where public health standards require 24-hour pump operation.

2. Where pumps are required to operate solar and waste heat recovery pool heating systems. [ASHRAE 90.1:7.4.5.3]

### L 503.3.7 Heat Traps.

Vertical pipe risers serving storage water heaters and storage tanks not having integral heat traps and serving a nonrecirculating system shall have heat traps on both the inlet and outlet piping as close as practical to the storage tank. A heat trap is a means to...
APPENDIX L

TABLE L 503.3.3
MINIMUM PIPING INSULATION THICKNESS FOR HEATING AND HOT-WATER SYSTEMS
(STEAM, STEAM CONDENSATE, HOT-WATER HEATING, AND DOMESTIC WATER SYSTEMS)\(^1, 2, 3, 4, 5\)

[ASHRAE 90.1: TABLE 6.8.3-1]

<table>
<thead>
<tr>
<th>FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)</th>
<th>CONDUCTIVITY</th>
<th>MEAN RATING TEMPERATURE (°F)</th>
<th>≥NOMINAL PIPE SIZE OR TUBE SIZE (inches)</th>
<th>INSULATION THICKNESS (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CONDUCTIVITY Btu(\text{in}/(\text{h} \cdot \text{ft}^2 \cdot °\text{F}))</td>
<td>TEMPORATURE</td>
<td>&lt;1</td>
<td>1 to &lt;1½</td>
</tr>
<tr>
<td>&gt;350</td>
<td>0.32 to 0.34</td>
<td>250</td>
<td>4.5</td>
<td>5.0</td>
</tr>
<tr>
<td>251 to 350</td>
<td>0.29 to 0.32</td>
<td>200</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>201 to 250</td>
<td>0.27 to 0.30</td>
<td>150</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>141 to 200</td>
<td>0.25 to 0.29</td>
<td>125</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>105 to 140</td>
<td>0.22 to 0.28</td>
<td>100</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

For SI units: °C=(°F-32)/1.8, 1 British thermal unit inch per hour square foot degree Fahrenheit = \([0.1 \text{ W/(m} \cdot \text{K})]\), 1 inch = 25 mm

Notes:
1 For insulation outside the stated conductivity range, the minimum thickness \((T)\) shall be determined as follows:
\[ T = r \left\{ 1 + \frac{t}{r} \right\}^{\frac{k}{K}} - 1 \]

Where:
- \(T\) = minimum insulation thickness (inches) (mm).
- \(r\) = actual outside radius of pipe (inches) (mm).
- \(t\) = insulation thickness listed in this table for applicable fluid temperature and pipe size.
- \(k\) = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature [Btu•in/(h•ft•°F)] [W/(m•K)].
- \(K\) = the upper value of the conductivity range listed in this table for the applicable fluid temperature.

2 These thicknesses are based on energy efficiency considerations only. Additional insulation is sometimes required relative to safety issues or surface temperature.

3 For piping 1½ inches (40 mm) or less, and located in partitions within conditioned spaces, reduction of insulation thickness by 1 inch (25.4 mm) shall be permitted before thickness adjustment required in Footnote 1, but not a thickness less than 1 inch (25.4 mm).

4 For direct-buried heating and hot water system piping, reduction of insulation thickness by 1½ inch (38 mm) shall be permitted before thickness adjustment required in Footnote 1, but not a thickness less than 1 inch (25.4 mm).

5 Table L 503.3.3 is based on steel pipe. Non-metallic pipes, Schedule 80 thickness or less shall use the table values. For other non-metallic pipes having a thermal resistance more than that of steel pipe, reduced insulation thicknesses shall be permitted where documentation is provided showing that the pipe with the proposed insulation has no more heat transfer per foot (mm) than a steel pipe of the same size with the insulation thickness shown in Table L 503.3.3.

counteract the natural convection of heated water in a vertical pipe run. The means is either of the following:

1. A device specifically designed for the purpose or an arrangement of tubing that forms a loop of 360 degrees (6.28 rad).

2. Piping that, from the point of connection to the water heater (inlet or outlet) includes a length of piping directed downward before connection to the vertical piping of the supply water or hot-water distribution system, as applicable. [ASHRAE 90.1:7.4.6]

L 503.4 Prescriptive Path. The prescriptive path for space or water heating efficiency shall comply with Section L 503.4.1 through Section L 503.4.5.

L 503.4.1 Space Heating and Service Water Heating. The use of a gas-fired or oil-fired space heating boiler system, otherwise in accordance with Section L 503.0, to provide the total space heating and service water heating for a building is allowed where one of the following conditions is met:

1. The single space-heating boiler, or the component of a modular or multiple boiler system that is heating the service water, has a standby loss in Btu/h (kW) not exceeding \((13.3 \times pmd + 400)/n\), where \(pmd\) is the probable maximum demand in gallons per hour, determined in accordance with the procedures described in generally accepted engineering standards and handbooks, and \((n)\) is the fraction of the year where the outdoor daily mean temperature exceeds \(64.9°\text{F} (18.28°\text{C})\).

The standby loss is to be determined for a test period of 24 hours duration while maintaining a boiler water temperature of not less than \(90°\text{F} (50°C)\) above ambient, with an ambient temperature between \(60°\text{F} (16°C)\) and \(90°F (32°C)\). For a boiler with a modulating burner, this test shall be conducted at the lowest input.

2. It is demonstrated to the satisfaction of the Authority Having Jurisdiction that the use of a single heat source will consume less energy than separate units.

3. The energy input of the combined boiler and water heater system is less than 150 000 British thermal units per hour (Btu/h) (44 kW). [ASHRAE 90.1:7.5.1]

L 503.4.2 Service Water Heating Equipment. Service water-heating equipment used to provide the additional function of space heating as part of a combination (integrated) system shall satisfy all stated requirements for the service water-heating equipment. [ASHRAE 90.1:7.5.2]

L 503.4.3 Buildings with High-Capacity Service Water Heating Systems. New buildings with gas service water heating systems with a total installed gas water-heating input capacity of 1 000 000 Btu/h (293...
kW) or more, shall have gas service water-heating equipment with a thermal efficiency \( (E_t) \) of not less than 90 percent. Multiple units of gas water-heating equipment shall be permitted to comply with this requirement where the water-heating input provided by the equipment, with thermal efficiency \( (E_t) \) of more or less than above and below 90 percent, provides an input capacity-weighted average thermal efficiency of not less than 90 percent.

**Exceptions:**

1. Where 25 percent of the annual service water-heating requirement is provided by site-solar renewable energy or site-recovered energy.
2. Water heaters installed in individual dwelling units.
3. Individual gas water heaters with input capacity, not more than 100,000 Btu/h (29.3 kW). [ASHRAE 90.1:7.5.3]

**L 503.4.4 Heat Recovery for Service Water Heating.** Condenser heat recovery systems shall be installed for heating or preheating of service hot water provided all of the following are true:

1. The facility operates 24 hours a day.
2. The total installed heat rejection capacity of the water-cooled systems exceeds 6,000,000 Btu/h (1758 kW) of heat rejection.
3. The design service water-heating load exceeds 1,000,000 Btu/h (293 kW). [ASHRAE 90.1:6.5.6.2.1]

**L 503.4.5 Capacity.** The required heat recovery system shall have the capacity to provide the smaller of:

1. Sixty percent of the peak heat-rejection load at design conditions.
2. Preheat of the peak service hot-water draw to 85°F (29°C).

**Exceptions:**

1. Facilities that employ condenser heat recovery for space heating with a heat recovery design exceeding 30 percent of the peak water-cooled condenser load at design conditions.
2. Facilities that provide 60 percent of their service water heating from site-solar or site-recovered energy or other sources of renewable energy. [ASHRAE 90.1:6.5.6.2.2]

**L 503.5 Submittals.** The Authority Having Jurisdiction shall require submittal of compliance documentation and supplemental information in accordance with Section 104.3.1 of this code.

**L 504.0 Solar Water Heating Systems.**

**L 504.1 General.** The erection, installation, alteration, addition to, use or maintenance of solar water heating systems shall be in accordance with this section and the Uniform Solar Energy and Hydronics Code.

**L 504.2 Annual Inspection and Maintenance.** Solar energy systems that utilize a heat transfer fluid shall annually be inspected unless inspections are required on a more frequent basis by the solar energy system manufacturer.
## TABLE L 701.2(1)
### WATER USE BASELINE

<table>
<thead>
<tr>
<th>FIXTURE TYPE</th>
<th>MAXIMUM FLOW-RATE CONSUMPTION</th>
<th>DURATION</th>
<th>ESTIMATED DAILY USES PER PERSON</th>
<th>OCCUPANTS³, ⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Showerheads</td>
<td>2.5 gpm at 80 psi</td>
<td>8 minutes</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Private or Private Use Lavatory Faucets</td>
<td>2.2 gpm at 60 psi</td>
<td>0.25 minutes</td>
<td>4</td>
<td>–</td>
</tr>
<tr>
<td>Residential Kitchen Faucets</td>
<td>2.2 gpm at 60 psi</td>
<td>4 minutes</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Wash Fountains</td>
<td>One 2.2 gpm at 60 psi fixture fitting for every 20 inches rim space</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Lavatory Faucets in other than Residences, Apartments, and Private Bathrooms in Lodging Facilities</td>
<td>0.5 gpm</td>
<td>0.25 minutes</td>
<td>4</td>
<td>–</td>
</tr>
<tr>
<td>Metering Faucets</td>
<td>0.25 gallons/cycle</td>
<td>–</td>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td>Metering Faucets for Wash Fountains</td>
<td>One 0.25 gallon per cycle fixture fitting for every 20 inches rim space</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Water Closets</td>
<td>1.6 gallons per flush</td>
<td>1 flush</td>
<td>1 male¹</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 female</td>
<td>–</td>
</tr>
<tr>
<td>Urinals</td>
<td>1.0 gallons per flush</td>
<td>1 flush</td>
<td>2 male</td>
<td>–</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.8947 kPa, 1 gallon = 3.785 L, 1 inch = 25.4 mm

**Notes:**

1 The daily use number shall be increased to three where urinals are not installed in the room.
2 The maximum flow rate or consumption is from the Energy Policy Act.
3 For residential occupancies, the number of occupants shall be based on two persons for the first bedroom and one additional person for each additional bedroom.
4 For nonresidential occupancies, refer to Table 422.1 for occupant load factors.
5 Where determining calculations, assume one use per person for metering or self-closing faucets.
<table>
<thead>
<tr>
<th>NONRESIDENTIAL BUILDINGS</th>
<th>FIXTURE TYPE</th>
<th>CONSUMPTION (gallons per minute)</th>
<th>DAILY USES</th>
<th>DURATION (minutes)</th>
<th>OCCUPANTS</th>
<th>DAILY WATER USES (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.6 gpf (gallons per flush) toilet - male</td>
<td>1.6</td>
<td>1</td>
<td>1</td>
<td>150</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>1.6 gpf toilet - female</td>
<td>1.6</td>
<td>3</td>
<td>1</td>
<td>150</td>
<td>720</td>
</tr>
<tr>
<td></td>
<td>1.0 gpf urinal - male</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Commercial lavatory faucet - 0.5 gpm</td>
<td>0.5</td>
<td>3</td>
<td>0.25</td>
<td>300</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>Kitchen sink - 2.2 gpm</td>
<td>2.2</td>
<td>1</td>
<td>0.25</td>
<td>300</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>Showerhead - 2.5 gpm</td>
<td>2.5</td>
<td>0.1</td>
<td>8</td>
<td>300</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td><strong>Total Daily Volume</strong></td>
<td><strong>2138</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Annual Work Days</strong></td>
<td><strong>260</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Annual Usage</strong></td>
<td><strong>555 750</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NONRESIDENTIAL BUILDINGS</th>
<th>FIXTURE TYPE</th>
<th>CONSUMPTION (gallons per minute)</th>
<th>DAILY USES</th>
<th>DURATION (minutes)</th>
<th>OCCUPANTS</th>
<th>DAILY WATER USES (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.6 gpf toilet - male</td>
<td>1.28</td>
<td>1</td>
<td>1</td>
<td>150</td>
<td>192</td>
</tr>
<tr>
<td></td>
<td>1.6 gpf toilet - female</td>
<td>1.28</td>
<td>3</td>
<td>1</td>
<td>150</td>
<td>576</td>
</tr>
<tr>
<td></td>
<td>1.0 gpf urinal - male</td>
<td>0.5</td>
<td>2</td>
<td>1</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Commercial lavatory faucet - 0.5 gpm</td>
<td>0.5</td>
<td>3</td>
<td>0.25</td>
<td>300</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>Kitchen sink - 2.2 gpm</td>
<td>2.2</td>
<td>1</td>
<td>0.25</td>
<td>300</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>Showerhead - 2.5 gpm</td>
<td>2.5</td>
<td>0.1</td>
<td>8</td>
<td>300</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td><strong>Total Daily Volume</strong></td>
<td><strong>1796</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Annual Work Days</strong></td>
<td><strong>260</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Annual Usage</strong></td>
<td><strong>466 830</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Annual Savings</strong></td>
<td><strong>88 920</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>% Reduction</strong></td>
<td><strong>-16.0 percent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Notes:
1. Consumption values shown as underlined reflect the maximum consumption values associated with the provisions called out in the IAPMO Green Plumb- ing & Mechanical Code Supplement.
2. Where metering faucets are used, insert the flow rate of the faucet in the “Consumption” column and insert the cycle time in the “Duration” column (assume 1 cycle per use).
3. To determine estimated savings, insert occupant values (same as Baseline) and consumption values based on fixtures and fixture fittings installed.
## TABLE L 701.2(2) (continued)

### WATER SAVINGS CALCULATOR\(^1,\ 2\)

<table>
<thead>
<tr>
<th>NONRESIDENTIAL BUILDINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIXTURE TYPE</td>
</tr>
<tr>
<td>1.6 gpf toilets</td>
</tr>
<tr>
<td>Lavatory faucet - 2.2 gpm</td>
</tr>
<tr>
<td>Kitchen sink - 2.2 gpm</td>
</tr>
<tr>
<td>Showerhead - 2.5 gpm</td>
</tr>
</tbody>
</table>

**Total Daily Volume** 123

Annual Work Days 44 822

### NONRESIDENTIAL BUILDINGS

<table>
<thead>
<tr>
<th>FIXTURE TYPE</th>
<th>CONSUMPTION (gallons per minute)</th>
<th>DAILY USES</th>
<th>DURATION (minutes)</th>
<th>OCCUPANTS</th>
<th>DAILY WATER USES (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6 gpf toilet - male</td>
<td>1.28</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Lavatory faucet - 1.5 gpm</td>
<td>1.5</td>
<td>8</td>
<td>0.25</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Kitchen sink - 2.2 gpm</td>
<td>2.2</td>
<td>6</td>
<td>0.25</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Showerhead - 2.5 gpm</td>
<td>2.5</td>
<td>0.75</td>
<td>8</td>
<td>4</td>
<td>60</td>
</tr>
</tbody>
</table>

**Total Daily Volume** 111

Annual Usage 40 442

Annual Savings 4380

% Reduction -9.8 percent

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

**Notes:**

1. Consumption values shown as underlined reflect the maximum consumption values associated with the provisions called out in the IAPMO Green Plumbing & Mechanical Code Supplement.

2. To determine estimated savings, insert occupant values (same as Baseline) and consumption values based on fixtures and fixture fittings installed.

**Notes and instructions for Table L 701.2(2):**

Table L 701.2(2) is an example of a calculator that is capable of helping estimate water savings in residential and nonresidential structures. The “Duration” of use and “Daily Uses” values that appear in the table are estimates and based on previous studies. The first example shown below is a commercial office building with 300 occupants, 150 females, and 150 males. The second example is a 3 bedroom residential building. To obtain and use a working copy of this calculator, follow the download and use instructions below.

Instructions for download:
1. Go to the IAPMO website at www.iapmogreen.org to download the water savings calculator. The calculator is a Microsoft Office Excel file (1997 or later), your computer must be capable of running MS Excel.
2. Follow the instructions for downloading and running the file.

Instructions for use:
1. In the Baseline Case section, insert the number of total occupants, male occupants and female occupants that apply to the building in the “Occupants” column. Unless specific gender ratio values are provided, assume a 50/50 gender ratio.
2. Copy and paste these same values in the “Occupants” column of the Calculator section.
3. In the Calculator section, insert the consumption values (flow rates in gpm or gallons per flush or per cycle) in the “Consumption” column.
4. Estimated water savings regarding percent savings versus baseline values, gallons per day and gallons per year will be automatically calculated.
APPENDIX M
PEAK WATER DEMAND CALCULATOR

M 101.0 General.
M 101.1 Applicability. This appendix provides a method for estimating the demand load for the building water supply and principal branches for single- and multi-family dwellings with water-conserving plumbing fixtures, fixture fittings, and appliances.

M 102.0 Demand Load.
M 102.1 Water-Conserving Fixtures. Plumbing fixtures, fixture fittings, and appliances shall not exceed the design flow rate in Table M 102.1.

<table>
<thead>
<tr>
<th>FIXTURE AND APPLIANCE</th>
<th>MAXIMUM DESIGN FLOW RATE (gallons per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar Sink</td>
<td>1.5</td>
</tr>
<tr>
<td>Bathtub</td>
<td>5.5</td>
</tr>
<tr>
<td>Bidet</td>
<td>2.0</td>
</tr>
<tr>
<td>Clothes Washer*</td>
<td>1.3</td>
</tr>
<tr>
<td>Combination Bath/Shower</td>
<td>5.5</td>
</tr>
<tr>
<td>Dishwasher*</td>
<td>2.2</td>
</tr>
<tr>
<td>Kitchen Faucet</td>
<td></td>
</tr>
<tr>
<td>Laundry Faucet (with aerator)</td>
<td>2.0</td>
</tr>
<tr>
<td>Lavatory Faucet</td>
<td>1.5</td>
</tr>
<tr>
<td>Shower, per head</td>
<td>2.0</td>
</tr>
<tr>
<td>Water Closet, 1.28 GPF Gravity Tank</td>
<td>3.0</td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.06 L/s
* Clothes washers and dishwashers shall have an energy star label.

M 102.2 Water Demand Calculator. The estimated design flow rate for the building supply and principal branches and risers shall be determined by the IAPMO Water Demand Calculator available for download at http://www.iapmo.org/WEStand/Pages/WaterDemandCalculator.aspx

M 102.3 Meter and Building Supply. To determine the design flow rate for the water meter and building supply, enter the total number of indoor plumbing fixtures and appliances for the building in Column [B] of the Water Demand Calculator and run Calculator. See Table M 102.3 for an example.

M 102.4 Fixture Branches and Fixture Supplies. To determine the design flow rate for fixture branches and risers, enter the total number of plumbing fixtures and appliances for the fixture branch or riser in Column [B] of the Water Demand Calculator and run Calculator. The flow rate for one fixture branch and one fixture supply shall be the design flow rate of the fixture according to Table M 102.1.

M 102.5 Continuous Supply Demand. Continuous supply demands in gallons per minute (gpm) for lawn sprinklers, air conditioners, hose bibbs, etc., shall be added to the total estimated demand for the building supply as determined by Section M 102.3. Where there is more than one hose bibb installed on the plumbing system, the demand for only one hose bibb shall be added to the total estimated demand for the building supply. Where a hose bibb is installed on a fixture branch, the demand of the hose bibb shall be added to the design flow rate for the fixture branch as determined by Section M 102.4.

M 102.6 Other Fixtures. Fixtures not included in Table M 102.1 shall be added in Rows 12 through 14 in the Water Demand Calculator as Other Fixture. The probability of use and flow rate for Other Fixtures shall be added by selecting the comparable probability of use and flow rate from Columns [C] and [E].

M 102.7 Size of Water Piping per Appendix A. Except as provided in Section M 102.0 for estimating the demand load for single- and multi-family dwellings, the size of each water piping system shall be determined in accordance with the procedure set forth in Appendix A. After determining the permissible friction loss per 100 feet (30 480 mm) of pipe in accordance with Section A 104.0 and the demand flow in accordance with the Water Demand Calculator, the diameter of the building supply pipe, branches and risers shall be obtained from Chart A 105.1(1) through Chart A 105.1(7), whichever is applicable, in accordance with Section A 105.0 and Section A 106.0. Velocities shall be in accordance with Section A 107.0. Appendix I (IS 31), Figure 3 and Figure 4 shall be permitted when sizing PEX systems.

M 102.7.1 Minimum Fixture Branch Size. The minimum fixture branch size shall be ½ inch (15 mm) in diameter.
Solution: Step 1 of 2 – Find Demand Load for the Building Supply.

The Water Demand Calculator [WDC] in Figure 2 is used to determine the demand load expected from indoor water use. The WDC has white-shaded cells and light gray-shaded cells. The values in the light gray cells are derived from a national survey of indoor water use at homes with efficient fixtures and cannot be changed. The white-shaded cells accept input from the designer. For instance, fixture counts from the given information are entered in Column [B]; the corresponding recommended fixture flow rates are already provided in Column [D]. The flow rates in Column [D] may be reduced only if the manufacturer specifies a lower flow rate for the fixture. Column [E] establishes the upper limits for the flow rates entered into Column [D]. Clicking the Run Water Demand Calculator button gives 8.5 gpm (0.54 L/s) as the estimated indoor water demand for the whole building. This result appears in the dark gray box of the WDC in Figure 2.
Solution: Step 2 of 2 – Determine the Pipe Size of the Building Supply.

Chart A 105.1(1) for copper piping systems (from Appendix A of the UPC, shown in Figure 3) is used to determine the pipe size, based on given friction loss, given maximum allowable pipe velocity, given pipe material and the demand load computed in Step 1. In Figure 3, the intersection of the given friction loss (15 psi) (103 kPa) and the maximum allowable pipe velocity (10 ft/s) (3.05 m/s) is labeled point A. The vertical line that descends from point A to the base of the chart intersects four nominal sizes for L-copper pipe. These intersection points are labeled B, C, D, E and correspond to pipe sizes of 1 inch (25 mm), ¾ inch (20 mm), ½ inch (15 mm) and ¼ inch (10 mm), respectively. A horizontal line from points B, C, D, E to the right-hand side of the chart gives maximum flow rates of 24 gpm (1.5 L/s), 12 gpm (0.757 L/s), 4.5 gpm (0.28 L/s), and 2.3 gpm (0.145 L/s), respectively. These results are summarized in Table 1 which shows that a ¾ inch (20 mm) type L copper line is the minimum size that can convey the peak water demand of 8.5 gpm (0.54 L/s).

### Table 1

<table>
<thead>
<tr>
<th>POINT IN FIGURE 3</th>
<th>PIPE DIAMETER (INCH)</th>
<th>MAXIMUM FLOW (GPM)</th>
<th>OK FOR BUILDING SUPPLY*</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>⅛</td>
<td>2.3</td>
<td>No</td>
</tr>
<tr>
<td>D</td>
<td>⅛</td>
<td>4.5</td>
<td>No</td>
</tr>
<tr>
<td>C</td>
<td>¼</td>
<td>12</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>24</td>
<td>Yes</td>
</tr>
</tbody>
</table>

For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s
* For Building in Examples 1, 2, 3, and 4.
Example 2: Indoor and Outdoor Water Use – Find the pipe size for the building supply [Figure 1, Pipe Section 4] if the building in Example 1 adds two outdoor fixtures (hose bibb, each with a fixture flow of 2.0 gpm) (0.13 L/s).

Solution: Step 1 of 2 – Find Demand Load for the Building Supply.

The WDC has been developed exclusively for peak indoor water use which can be viewed as a high-frequency short dura-
tion process. Because fixtures for outdoor water use may operate continuously for very long periods, they are not included in the WDC. To account for water use from one or more outdoor fixtures, add the demand of the single outdoor fixture with the highest flowrate to the calculated demand for indoor water use. With two hose bibbs, the demand of only one hose bibb is included. Hence, in this example, the total demand for the whole house is 8.5 gpm (0.54 L/s) + 2.0 gpm (0.13 L/s) = 10.5 gpm (0.662 L/s).

**Solution: Step 2 of 2 – Determine the Pipe Size of the Building Supply.**

Table 1 shows that at 10.5 gpm (0.662 L/s) the building supply shall be ¾ inch (20 mm) in diameter.

**Example 3: Indoor, Outdoor and Other Fixture Water Use**

– Find the pipe size for the water supply [Figure 1, Pipe Section 4] if the building in Example 2 adds a kitchen pot filler and a dog bath each with a faucet flow rate of 5.5 gpm (0.35 L/s).

**Solution: Step 1 of 2 – Find Demand Load for the Building Supply.**

The kitchen pot filler and dog bath are not listed in Column [A] of the WDC. To accommodate cases such as this, the WDC provides up to three additional rows for “Other Fixtures”. Enter the kitchen pot filler and dog bath in Column [A] of the WDC and enter the feature count for each in Column [B]. Find an indoor fixture that has a similar probability of use in Column [C] and add that to the column. Finally, enter the flow rate of the kitchen pot filler and dog bath in Column [D]. The estimated indoor water demand for the whole building is 11 gpm, as shown in the WDC in Figure 4.

As illustrated in Example 2, the hose bibb will increase the total demand for the whole house to 13 gpm (0.820 L/s).

Note that a reset button is provided to clear any numbers in Column [B] from a previous calculation.

**Solution: Step 2 of 2 – Determine the Pipe Size of the Building Supply.**

Table 1 shows that at 13 gpm (0.820 L/s) the building supply shall be 1 inch (25 mm) in diameter.

**Example 4: Sizing Branches and Risers**

– For individual hot and cold branches, repeat Steps 1 and 2. For example, for the hot water branch at the water heater [Figure 1, Pipe Section 3], enter all the fixtures and appliances that use hot water into the Water Demand Calculator (toilets will be excluded) as seen in Figure 5. Use the calculated demand load to find the pipe size in Step 2. Table 1 shows that at 7.7 (0.49 L/s) gpm, the hot water branch shall be ¾ inch (20 mm) in diameter.

For each additional hot and cold branch [Figure 1, Pipe Sections 1 and 2], enter the number of fixtures and appliances served by that branch into the WDC and use that demand in Step 2 to determine the branch size. If the branch serves a hose bibb, add the demand of the hose bibb to the calculated demand flow for the branch. As discussed in Example 2, the hose bibb is not to be entered into the WDC, since the Calculator is for indoor uses only.

When there is only one fixture or appliance served by a fixture branch, the demand flow shall not exceed the fixture flow rate in Column [E] of the Water Demand Calculator. The fixture flow rate would be used in Step 2 to determine the size of the fixture branch and supply.

---

**TABLE 1**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Bar Sink</td>
<td>0</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2 Bathtub</td>
<td>0</td>
<td>1.0</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>3 Bidet</td>
<td>0</td>
<td>1.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>4 Clothes Washer</td>
<td>1</td>
<td>5.5</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>5 Combination Bath/Shower</td>
<td>1</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>6 Dishwasher</td>
<td>1</td>
<td>0.5</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>7 Kitchen Faucet</td>
<td>1</td>
<td>2.0</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>8 Laundry Faucet</td>
<td>0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>9 Lavatory Faucet</td>
<td>1</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>10 Shower, per head</td>
<td>0</td>
<td>4.5</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>11 Water Closet, 1.28 GPF Gravity Tank</td>
<td>1</td>
<td>1.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>12 Pot Filler</td>
<td>1</td>
<td>2.0</td>
<td>5.5</td>
<td>6.0</td>
</tr>
<tr>
<td>13 Dog Bath</td>
<td>1</td>
<td>1.0</td>
<td>5.5</td>
<td>6.0</td>
</tr>
<tr>
<td>14 Other Fixture 3</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>

**Total Number of Fixtures**

99th Percentile Demand Flow = **11.0 GPM**

For SI units: 1 gallon per minute = 0.66 L/s, 1 gallon = 3.785 L.

**FIGURE 4**

WATER DEMAND CALCULATOR TO ACCOMMODATE OTHER FIXTURES (EXAMPLE 3).
## APPENDIX M

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Bar Sink</td>
<td>0</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2 Bathtub</td>
<td>0</td>
<td>1.0</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>3 Bidet</td>
<td>0</td>
<td>1.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>4 Clothes Washer</td>
<td>1</td>
<td>5.5</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>5 Combination Bath/Shower</td>
<td>1</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>6 Dishwasher</td>
<td>1</td>
<td>0.5</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>7 Kitchen Faucet</td>
<td>1</td>
<td>2.0</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>8 Laundry Faucet</td>
<td>0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>9 Lavatory Faucet</td>
<td>1</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>10 Shower, per head</td>
<td>0</td>
<td>4.5</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>11 Water Closet, 1.28 GPF Gravity Tank</td>
<td>0</td>
<td>1.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>12 Other Fixture 1</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>6.0</td>
</tr>
<tr>
<td>13 Other Fixture 2</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>6.0</td>
</tr>
<tr>
<td>14 Other Fixture 3</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Total Number of Fixtures</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99th Percentile Demand Flow</td>
<td>= 7.7 GPM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For SI units: 1 gallon per minute = 0.66 L/s, 1 gallon = 3.785 L

**FIGURE 5**

WATER DEMAND CALCULATOR FOR THE HOT WATER BRANCH (EXAMPLE 4).
APPENDIX N

IMPACT OF WATER TEMPERATURE ON THE POTENTIAL FOR SCALDING AND LEGIONELLA GROWTH

N 101.0 General.

N 101.1 Applicability. This appendix provides guidelines on the impact of water temperature in minimizing both scalding and Legionella growth potential associated with occupiable commercial, institutional, multi-unit residential, and industrial building plumbing systems.

This Appendix shall not include single-family residential buildings. This appendix shall not be considered a risk management guidance document for scalding or Legionella.

Note: Published documents which address Legionella risk management include ASHRAE 188, ASHRAE Guideline 12, or as required by the Authority Having Jurisdiction.

There are additional factors associated with the potential for scalding and Legionella growth other than temperature.

For scalding potential, other factors include, but are not limited to, user age, health, body part, length of contact time, and water source.

For Legionella growth potential other factors include, but are not limited to, water source and plumbing system: size, design, circulation rate, water age, disinfectant residual, piping material and component complexity.

N 102.0 Definitions.

N 102.1 General. For the purpose of this appendix, the following definitions shall apply:

Biofilm. Microorganisms and the slime they secrete that grow on any continually moist surface.

Cold Water. Water at a temperature less than 77°F (25°C).

Control. The management to maintain compliance with established criteria.

Disinfection. Chemical or physical control measures or procedures used to kill or inactivate pathogens.

Disinfecting Hot Water. Water at a temperature not less than 160°F (71°C).

Doped. See Risk.

Halogenation. A chemical reaction that involves the addition of one or more halogens, including, but not limited to, chlorine, bromine, or iodine, commonly used to disinfect water systems.

Hot Water. Water at a temperature not less than 130°F (54°C) and less than 140°F (60°C).

Legionella Growth Potential. The likelihood that Legionella bacteria will reproduce.

Monitor. Observing and checking the progress or quality of (something) or measuring the physical and chemical characteristics of control measures.

Risk. The potential to cause harm resulting from exposure.

Tepid Cold Water. Water at a temperature not less than 77°F (25°C) and less than 85°F (29°C).

Tepid Water. Water at a temperature not less than 85°F (29°C) and less than 110°F (43°C).

Very Hot Water. Water at a temperature not less than 140°F (60°C) and less than 160°F (71°C).

Warm Water. Water at a temperature not less than 110°F (43°C) and less than 120°F (49°C).


Very Hot Water. Water at a temperature not less than 140°F (60°C) and less than 160°F (71°C).

N 103.0 Building Water System Design Documentation.

N 103.1 Required-Design Documentation. Construction documents shall be required for new construction, renovation, refurbishment, replacement, or repurposing of an occupiable building water system, including a water management plan, and shall be submitted to the Authority Having Jurisdiction.

N 103.2 Onsite Documentation. Documentation shall be maintained onsite and shall be readily accessible to the Authority Having Jurisdiction.

N 104.0 Potential Exposure.

N 104.1 Legionella Growth Potential. The Authority Having Jurisdiction shall have the authority to require documentation to address Legionella growth potential, where water temperatures in a water distribution system are within ranges shown in Table N 104.1 that pose a Legionella growth potential.

N 104.2 Scald Potential. Where the water distribution system’s water temperature(s) range poses a scald potential in accordance with Table N 104.1, Figure N 104.1, protection shall be provided in accordance with Chapter 4.

N 105.0 Disinfection.

N 105.1 Disinfection Documentation. Where required by the Authority Having Jurisdiction, documentation for disinfection of all building water systems shall be provided by the registered design professional in the construction documents.

Methods for new construction and any repaired system disinfection shall include, but not be limited to, the chlorination-
tion methods and procedures for flushing and disinfection in accordance with Section 609.10.

Other or alternative water treatment methods for disinfection shall include, but not be limited to, one of the following methods:

1. **Copper-Silver Ionization.** Copper-silver ionization methods and procedures, including the following documentation:
   - Copper and silver ionization concentrations shall be included in the documentation.
   - Methods and documentation for monitoring ion levels.
   - Electrode cleaning cycles and methods shall be reported.

2. **Ultraviolet Light.** Ultraviolet light methods shall include the following documentation:
   - Locations of ultraviolet light units.
   - Cleaning cycles and methods of the quartz sleeves and housing shall be documented.

### N 105.2 Chemical Disinfection.

Chemical biocide treatment shall be permitted to be used in accordance with the following:

1. Oxidizing biocides in accordance with manufacturer’s guidelines.
2. Non-oxidizing biocides in accordance with manufacturer’s guidelines.
3. Alternating the use of different types of biocides, dose, and frequency is recommended.

4. These treatment methods can be used for continuous, online disinfection or shock treatment online or offline.
5. Biocides intended for potable water applications shall be listed in accordance with NSF 60 and approved by the Authority Having Jurisdiction.

### N 105.3 Non-Chemical Treatment.

Non-chemical treatment devices shall be permitted to be used in accordance with manufacturer’s guidelines.

1. **Thermal Shock.** Thermal treatment using heat shock at 158°F (70°C) for 30 minutes shall be permitted in accordance with applicable guidelines and the Authority Having Jurisdiction.

### N 105.4 Frequency of Cleaning and Disinfection.

Where a water management plan is implemented, the frequency of cleaning and disinfection logs shall be readily accessible to the water management team and the Authority Having Jurisdiction.

### N 105.5 Control Measures.

Control measures for Legionella prevention shall be evaluated for potential consequences that affect overall health risks.

### N 201.0 Supply System Legionella Test Levels.

1. **General.** The minimum remediation action for water supply systems shall be in accordance with Table N 201.1.

### N 202.0 Emergency Response Plan.

1. **General.** An emergency response plan shall be provided when required by the Authority Having Jurisdiction and shall include, but not be limited to, the following:

---

**FIGURE N 104.1**

**WATER TEMPERATURE RANGES AND LEGIONELLA GROWTH POTENTIAL**

For SI units: °C = (°F-32)/1.8

*Temperature ranges reported are experimentally determined in a laboratory setting in the absence of a realistic microbial community. Legionella can survive for longer periods of time at temperatures higher and lower than the growth temperature ranges indicated due to changes in their metabolic state and/or protection from thermal disinfection within biofilm or amoeba host organisms.
(1) Procedures to be followed if there are cases of Legionellosis associated with the plumbing system.

(2) Procedures to be followed if the plumbing system reaches greater than or equal to 30 percent of test sites positive for Legionella.

(3) Testing for Legionella shall be performed. Procedures shall include the type of tests to be performed, sampling, and the interpretation of test results.

(4) Procedures for emergency disinfection.

(5) Procedures for other actions identified by the water management plan to prevent exposure to contaminated water.

### Table N 104.1-104.2

**CORRELATION BETWEEN WATER TEMPERATURE RANGES, LEGIONELLA, AND SCALD POTENTIAL**

<table>
<thead>
<tr>
<th>WATER DESCRIPTION</th>
<th>TEMPERATURE (°F)</th>
<th>SCALD POTENTIAL*</th>
<th>LEGIONELLA GROWTH POTENTIAL^</th>
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<tbody>
<tr>
<td>Cold</td>
<td>&lt;77</td>
<td>None</td>
<td>Minimal</td>
</tr>
<tr>
<td>Tepid Cold</td>
<td>≥77 and &lt;85</td>
<td>None</td>
<td>Low</td>
</tr>
<tr>
<td>Tepid</td>
<td>≥85 and &lt;110</td>
<td>Hyperthermia is possible after long exposure in a bathtub or whirlpool tub.</td>
<td>High</td>
</tr>
<tr>
<td>Warm</td>
<td>≥110 and &lt;120</td>
<td>Minimal</td>
<td>Moderate</td>
</tr>
<tr>
<td>Tempered Hot</td>
<td>≥120 and &lt;130</td>
<td>At 120°F, greater than 5 minutes for second-degree burn, and 10 minutes to third-degree burn; At 124°F, two minutes for second-degree burn, and 4 minutes, 10 seconds for third-degree burn.</td>
<td>Low</td>
</tr>
<tr>
<td>Hot</td>
<td>≥130 and &lt;140</td>
<td>At 130°F, 18 seconds for second-degree burn, and 30 seconds for third-degree burn.</td>
<td>None</td>
</tr>
<tr>
<td>Very Hot</td>
<td>≥140 and &lt;160</td>
<td>High</td>
<td>None</td>
</tr>
<tr>
<td>Disinfecting Hot</td>
<td>≥160</td>
<td>Immediate</td>
<td>None</td>
</tr>
</tbody>
</table>

For SI units: °C = (°F-32)/1.8

**Notes**

* The infant, elderly, and infirmed have a higher potential for scalding at temperatures lower than listed.

^ Temperature ranges reported are experimentally determined in a laboratory setting in the absence of a realistic microbial community. Legionella can survive for longer periods of time at temperatures higher and lower than the growth temperature ranges indicated due to changes in their metabolic state and/or protection from thermal disinfection within biofilm or amoeba host organisms.
# TABLE N 201.1

## LEGIONELLA REMEDIATION ACTIONS DOMESTIC WATER SYSTEMS

<table>
<thead>
<tr>
<th>PERCENTAGE OF POSITIVE LEGIONELLA TEST SITES</th>
<th>REMEDIATION ACTION(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30</td>
<td>• Maintain environmental assessment and Legionella monitoring in accordance with the water management plan.</td>
</tr>
</tbody>
</table>
| ≥ 30                                        | • Immediately institute short-term control measures\(^2\) in accordance with the direction of a qualified professional\(^3\), and notify the Authority Having Jurisdiction, if required.  
  • The water system shall be re-sampled no sooner than 7 days and no later than 4 weeks after disinfection to determine the efficacy of the treatment.  
  • For persistent results, as determined by the Authority Having Jurisdiction, showing = 30 percent positive sites, long-term control measures\(^4\) shall be implemented in accordance with the direction of a qualified professional\(^3\) and the Authority Having Jurisdiction.  
  • Retreat and retest. If retest is = 30 percent positive, repeat short-term control measures\(^2\).  
  • With receipt of results < 30 percent positive\(^4\), resume monitoring in accordance with the water management plan.  
  • For persistent results, as determined by the Authority Having Jurisdiction, showing = 30 percent positive sites, long-term control measures\(^4\) shall be implemented in accordance with the direction of a qualified professional\(^3\) and the Authority Having Jurisdiction. |

### Notes:

1. In the event that one or more cases of legionellosis are, or may be, associated with the facility, the sampling interpretation shall be in accordance with the direction of a qualified professional and the Authority Having Jurisdiction.
2. Short-term control measures are temporary interventions that may include, but are not limited to, heating and flushing the water system, hyperchlorination, or the temporary installation of treatment such as copper silver ionization (CSI).
3. Control measures shall be conducted in accordance with the direction of a qualified professional. A qualified professional is an Authority Having Jurisdiction licensed professional engineer; certified industrial hygienist; certified water technologist; environmental consultant or water treatment professional with training and experience performing assessments and sampling in accordance with current standard industry protocols.
4. Positive samples should be minimized.
5. Long-term control measures may include supplemental disinfection treatments.

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PREPRINT

UNIFORM PLUMBING CODE - PREPRINT
APPENDIX O
NON-SEWERED SANITATION SYSTEMS

O 101.0 General.
O 101.1 Applicability. The provisions of this appendix shall apply to the installation of non-sewered sanitation systems.

O 201.0 Definitions.
O 201.1 General. For the purpose of this appendix, the following definitions shall apply:
Conditioned Space. An area, room, or space normally occupied and being heated or cooled for human habitation by any equipment.
Non-Sewered Sanitation System. A prefabricated integrated sewage treatment unit that is not connected to a public sewer or private sewage disposal system.

O 301.0 Installation.
O 301.1 General. The installation of non-sewered sanitation systems shall be in accordance with the manufacturer’s installation instructions and with Section O 301.2 through Section O 301.7.
O 301.2 Operating Conditions. A non-sewered sanitation system in either a conditioned or unconditioned space shall be installed where the ambient temperature, ambient humidity, and altitude (atmospheric pressure) are in accordance with the manufacturer’s installation instructions or product listing.
O 301.3 Clearances for Servicing and Maintenance. A non-sewered sanitation system shall be located to permit access and sufficient clearance for service and maintenance. Unless otherwise specified by the manufacturer’s installation instructions, not less than 30 inches (762 mm) in depth, width, and height of working space shall be provided at any access panel.
O 301.4 Backflow Prevention. A domestic water supply connection to a non-sewered sanitation system shall be protected in accordance with this code.
O 301.5 Effluent Storage. Any container or vessel for the storage of effluent discharged from a non-sewered sanitation system and not integral to such system shall be installed in accordance with the plumbing code.
O 301.6 Systems Employing Combustion. A non-sewered sanitation system employing combustion shall comply with the mechanical code.
O 301.7 Connection to Plumbing System Not Required. Unless the Authority Having Jurisdiction determines otherwise, a non-sewered sanitation system is not required to be connected to the drainage system of the building or premises.

O 401.0 Manual Required.
O 401.1 Operation and Maintenance Manual. Non-sewered sanitation systems shall have an operation and maintenance manual provided by the manufacturer.
O 501.0 System Output. The use or disposal of all substances exiting the non-sewered sanitation system shall be determined by the Authority Having Jurisdiction.
APPENDIX P
PROFESSIONAL QUALIFICATIONS

P 101.0 General.
P 101.1 Scope. The provisions of this appendix address minimum qualifications for installers, inspectors, or employers for systems covered within the scope of this code.

P 102.0 Qualifications.
P 102.1 General. Where permits are required, the Authority Having Jurisdiction shall have the authority to require contractors, installers, or service technicians to demonstrate competency. Where determined by the Authority Having Jurisdiction, the contractor or technicians shall be licensed or certified to perform such work. Professional qualifications shall be required for an individual to demonstrate the required level of competency.

P 102.2 Inspectors and Plans Examiners. Professional qualification for plumbing inspectors and plumbing plans examiners shall be qualified in accordance with ASSE/IAPMO/ANSI Series 16000.

P 102.2.1 Qualification for Plumbing Inspector. Professional qualification for plumbing inspectors shall be in accordance with ASSE 16010.

P 102.2.2 Qualification for Plumbing Plan Examiner. Professional qualification for plumbing plans examiners shall be in accordance with ASSE 16040.

P 102.3 Service Plumber Technician. Professional qualification for plumbing service technicians shall be qualified to ASSE/IAPMO/ANSI Series 13000.

P 102.3.1 Qualification for Service Plumbers. Professional qualification for service plumbers shall be in accordance ASSE 13010.

P 102.4 Cross-Connection Control. Professional qualification for cross-connection control professionals shall be in accordance with ASSE/IAPMO/ANSI Series 5000.

P 102.4.1 Qualification for Backflow Testers. Professional qualification for backflow assembly testers shall be in accordance with ASSE 5110.

P 102.4.2 Qualification for Surveyors. Professional qualification for cross-connection assembly surveyors shall be qualified in accordance with ASSE 5120.

P 102.4.3 Qualification for Repairers. Professional qualification for backflow prevention assembly repairers shall be in accordance with ASSE 5130.

P 102.4.4 Qualification for Fire Protection Systems. Professional qualification for backflow assembly testers of fire protection systems shall be in accordance with ASSE 5140.

P 102.4.5 Qualification for Program Administrator. Professional qualification for backflow prevention administrator shall be in accordance with ASSE 5150.

P 102.5 Medical Gas Systems. Professional qualification for medical gas systems personnel shall be in accordance with ASSE/IAPMO/ANSI Series 6000.

P 102.5.1 Qualification for Medical Gas Installers. Professional qualification for medical gas system installers shall be in accordance with ASSE 6010.

P 102.5.2 Qualification for Bulk Medical Gas/Cryogenic Fluid Installers. Professional qualification for bulk medical gas/cryogenic fluid installers shall be in accordance ASSE 6015.

P 102.5.3 Qualification for Medical Gas Systems Inspectors. Professional qualification for medical gas systems inspectors shall be in accordance with ASSE 6020.

P 102.5.4 Qualification for Medical Gas System Verifiers. Professional qualification for medical gas system verifiers shall be in accordance with ASSE 6030.

P 102.5.5 Qualification for Bulk Medical Gas/Cryogenic Fluid Central Supply System Verifiers. Professional qualification for bulk medical gas/cryogenic fluid central supply system verifiers shall be in accordance with ASSE 6035.

P 102.5.6 Qualification for Medical Gas Systems Maintenance. Professional qualification for medical gas systems maintenance personnel shall be in accordance with ASSE 6040.

P 102.6 Residential Potable Water Fire Sprinkler System Installers and Inspectors for One- and Two-Family Dwellings. Professional qualification for residential potable water fire protection system installers and inspectors for one- and two-family dwellings shall be in accordance with ASSE/IAPMO/ANSI Series 7000.

P 102.6.1 Qualification for Installers. Professional qualification for persons who provide layout, detail and calculations for residential potable water fire protection systems for one- and two-family dwellings and install such systems shall be in accordance with ASSE 7010.

P 102.6.2 Qualification for Inspectors. Professional qualification for inspectors of residential potable water fire protection systems shall be in accordance with ASSE 7020.

P 102.7 Water Management and Infection Control Risk Assessment for Building Systems. Professional qualification for construction and maintenance personnel and employers to identify and manage potentially hazardous exposure to bloodborne, waterborne and airborne pathogens. Also includes qualifications for members of a water safety team involved in the development of a risk assessment analysis, and water management and sampling plan, for protection from Legionella and other waterborne pathogens and persons who conduct a facility risk assessment and implement a water...
safety and management program to reduce the risk of infections due to Legionella. Qualifications are in accordance with ASSE/IAPMO/ANSI Series 12000.

P 102.7.1 Environment of Care, Infection Control and Construction Risk Assessment Professional Qualification Standard. Professional qualification for general knowledge of the environment of care, infection control and construction risk assessment procedures to protect facility operations, occupants, workers or any individual who has the potential for harm caused by construction activities shall be in accordance with ASSE 12010.

P 102.7.2 Environment of Care, Infection Control and Construction Risk Assessment Professional Qualification Standard for Construction and Maintenance Employers. Professional qualification for general knowledge of the environment of care, infection control and construction risk assessment requirements and procedures to protect facility operations, occupants, workers, or any individual who has the potential for harm caused by construction activities shall be in accordance with ASSE 12020. It also provides general knowledge of employer responsibilities to the worker and to the facility.

P 102.7.3 Water Quality Program Professional Qualifications Standard for Employers and Designated Representatives. Professional qualification for employers and designated representatives implementing water quality programs shall be in accordance with ASSE 12060.

P 102.7.4 Qualification for Water Quality Program Plumbers. Professional qualification for plumbers implementing a water quality program shall be in accordance with ASSE 12061.

P 102.7.5 Qualification for Water Quality Program and Pipefitters. Professional qualification for pipefitters implementing a water quality program shall be in accordance with ASSE 12062.

P 102.7.6 Qualification for Water Quality Program, Sprinkler Fitters. Professional qualification for sprinkler fitters implementing a water quality program shall be in accordance with ASSE 12063.

P 102.7.7 Legionella Water Safety and Management Specialist. Professional qualification for persons who conduct a facility risk assessment and implement a water safety and management program to reduce the risk of infections due to Legionella shall be in accordance with ASSE 12080.

P 102.8 Rainwater Catchment System Personnel. Professional qualification for designers and installers of rainwater catchment systems, and inspectors of rainwater/stormwater catchment systems shall be in accordance with ASSE/IAPMO/ANSI Series 21000.

P 102.8.1 Qualification for Installer. Professional qualification for rainwater catchment systems installers shall be in accordance with ASSE 21110.
APPENDIX Q
INDOOR CANNABIS AND HORTICULTURE FACILITIES

Q 101.0 Indoor Cannabis and Horticulture Facilities.
Q 101.1 General. Plumbing for indoor horticulture spaces, including cannabis facilities, shall be in accordance with this code. This appendix shall apply to indoor horticulture within new and existing buildings.

Q 102.0 Definitions.
Cannabis Facility. A business, facility, or establishment where retail Cannabis is grown, cultivated, tested, stored, dried, extracted, weighed, packaged, sold, or processed, including dispensaries, cultivators, manufacturers, distributors, or testing laboratories.
Fertigation. The process of injecting nutrients into the irrigation water.
Indoor Horticulture. The cultivation and processing of floricultural and horticultural plants, including cannabis, in an indoor space by controlling various interior environmental variables including, but not limited to, temperature, air quality, humidity, artificial lighting, nutrients, and carbon dioxide.

Q 103.0 Requirements.
Q 103.1 Horticulture Facilities Water Supply. Potable water lines supplying water for irrigation purposes shall be provided with back-flow preventers to protect the domestic water supply from contamination in accordance with Table 603.2.
Q 103.1.1 Alternate Water Supply. Where permitted, recycled and reclaimed water shall be permitted to be used for indoor horticulture in accordance with Chapter 15 or Chapter 16. Water tanks used for fertigation shall be listed for chemical use. Tanks stored in exterior shall not be clear or translucent to prevent algae growth.
Q 103.2 Floor Drains and Receptors. Fertigation water shall discharge through floor drains or other approved receptors receiving the waste from grow tables. Drains shall be trapped and vented in accordance with Chapter 10.
Exception: Class 1, Division 1 (C1/D1) rooms shall not contain floor drains.
Q 103.2.1 Floor Drain Material. Floor drain material shall be in accordance with Section 418.1.
Q 103.3 Emergency Equipment Stations. Eyewash stations shall be required in accordance with Section 416.2.
Q 103.4 Nutrient Supply Equipment. Nutrient water tanks shall be installed in accordance with the manufacturer’s instructions. Potable water to nonpotable water connections shall be protected by an air gap or a reduced zone pressure (RZP) backflow device.
Q 103.5 Nonpotable Water Tank. Nonpotable water storage tanks used for irrigation shall be in accordance with Chapter 15 or Chapter 16.
### USEFUL TABLES

#### CONVERSION TABLES

**UNIT CONVERSIONS**

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<th>TO OBTAIN</th>
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<td>Kelvin (k)</td>
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<td>Fahrenheit (°F)</td>
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### USEFUL TABLES

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### UNIT CONVERSIONS (continued)

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<td>British thermal units per hour (Btus/hour)</td>
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<td>Watts</td>
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### SI SYMBOLS AND PREFIXES

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AREAS AND CIRCUMFERENCES OF CIRCLES

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EQUAL PERIPHERIES

\[
S = 0.7854 D \\
D = 1.2732 S
\]

EQUAL AREAS

Area of square (S') = 1.2732 x area of circle
Area of square (S) = 0.6366 x area of circle

C = πD = 2πR
C = 3.5446 \( \times \) area
D = 0.3183 C = 2R
D = 1.1283 \( \times \) area
Area = πR^2 = 0.7854 D^2
Area = 0.07958 C^2 = \( \frac{\pi D^2}{4} \)
The following formula should be used for where Schedule 80 IPS CPVC sizes 2½" through 10” exceed Chart A 105.1(7):

Head loss formula: \( H_L = 0.2083 \left( \frac{100}{C} \right) 1.852 \times Q^{1.852} / d_I^{4.8655} \)

Where:
- \( H_L \) = frictional head loss (feet of water per 100 feet)
- \( C \) = Hazen-Williams factor (150 for CPVC)
- \( Q \) = flow rate (gal/min)
- \( d_I \) = inside diameter of pipe (inches)

Note: head loss in feet of water per 100 feet can be multiplied by 0.4335 to obtain pressure drop in psi

Velocity formula: \( V_W = 0.4085 \frac{Q}{d_I^2} \)

Where:
- \( V_W \) = velocity of water (feet per second)
FLOW IN PARTLY FILLED (ONE-HALF FULL) PIPES
(BASED ON MANNING'S FORMULA WITH n = .012)

\[ \text{gpm} \times 6.31 = \text{L/s} \]
\[ \text{ft/sec} \times .305 = \text{m/s} \]
\[ \text{in.} \times 25.4 = \text{mm} \]

For 3/4 Full
Multiply \( Q \times 1.9 \)
\( V \times 1.15 \)

FLOW (gallons per minute)

SLOPE (feet/feet)
FLOW IN PARTLY FILLED (FULL) PIPES
(BASED ON MANNING’S FORMULA WITH n = .012)

\[ \text{gpm} \times 6.31 = \text{L/s} \]
\[ \text{ft/sec} \times 0.305 = \text{m/s} \]
\[ \text{in.} \times 25.4 = \text{mm} \]
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