

CHAPTER 1

ADMINISTRATION

101.0 Title, Scope, and General.

101.1 Title. This document shall be known as the “Oregon Plumbing Specialty Code,” may be cited as such, and will be referred to herein as “this code.”

101.2 Purpose. This code provides minimum plumbing requirements and standards for the protection of the public health, safety, and welfare.

The purpose of this code is not to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefited by the terms of this code.

101.2.1 Statutory and Administrative Rule References. This code is adopted pursuant to Oregon Revised Statute (ORS) and the administrative rules adopted thereunder (OAR). Where in any specific case this code and the statutes or rules specify different requirements, the statute or rule shall govern. Statutes related to this code include, but are not limited to, ORS chapters 447, 455 and 693.

Statutes referenced may be obtained from the Building Codes Division, 1535 Edgewater St NW, Salem OR 97304, or P.O. Box 14470, Salem OR 97309 at a nominal cost or read online at <http://www.BCD.oregon.gov/statutes.html>.

101.3 Plans Required. The building official shall be permitted to require the submission of plans, specifications, drawings, and such other information as required by OAR 918-780-0040, prior to the commencement of, and at any time during the progress of, any work regulated by this code.

The issuance of a permit upon plans and specifications shall not prevent the building official from thereafter requiring the correction of errors in said plans and specifications or from preventing construction operations being carried on thereunder when in violation of this code or of any other pertinent rule or from revoking any certificate of approval when issued in error.

101.3.1 Alternative Materials, Design and Methods of Construction and Equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

101.3.2 Request for Ruling. ORS 455.060 provides for state rulings on acceptable materials, designs and methods of construction. When a ruling has been issued, ORS 455.060(4) applies.

ORS 455.060 is not part of this code but is reproduced here for the reader’s convenience:

455.060 Rulings on acceptability of material, design or method of construction; effect of approval; fees.

- (1) Any person who desires to use or furnish any material, design or method of construction or installation in the state, or any building official, may request the Director of the Department of Consumer and Business Services to issue a ruling with respect to the acceptability of any material, design or method of construction about which there is a question under any provision of the state building code. Requests shall be in writing and, if made by anyone other than a building official, shall be made and the ruling issued prior to the use or attempted use of such questioned material, design or method.
- (2) In making rulings, the director shall obtain the approval of the appropriate advisory board as to technical and scientific facts and shall consider the standards and interpretations published by the body that promulgated any nationally recognized model code adopted as a specialty code of this state.
- (3) A copy of the ruling issued by the director shall be certified to the person making the request. Additional copies shall be transmitted to all building officials in the state. The director shall keep a permanent record of all such rulings, and shall furnish copies thereof to any interested person upon payment of such fees as the director may prescribe.
- (4) A building official or inspector shall approve the use of any material, design or method of construction approved by the director pursuant to this section if the requirements of all other local ordinances are satisfied. [Formerly 456.845]

101.4 Scope. The provisions of this code shall apply to the erection, installation, alteration, repair, relocation, replacement, addition to, or use, of plumbing systems as provided in ORS 447.020 and OAR 918-008-0000.

ORS 447.020 is not part of this code but is reproduced here for the reader’s convenience:

447.020 Plumbing to conform to state building code; rules; enforcement.

- (1) All installations of plumbing and drainage in buildings and structures in this state and all potable water supply, drainage, and waste installations, within or serving buildings or structures, except in temporary construction camps, and except as otherwise provided in ORS 447.010 to 447.156 and 447.992, shall be made in accordance with the requirements of ORS 447.010 to 447.156 and 447.992 and ORS chapter 455.
- (2) The Director of the Department of Consumer and Business Services with the approval of the State Plumbing Board shall

make rules pursuant to ORS chapter 183 for the purpose of setting standards for plumbing and defining compliance with the provisions of ORS 447.010 to 447.156 and 447.992 particularly pertaining to installation of piping, protection and adequacy of the water supply, workmanship and materials, traps and cleanouts, domestic hot water storage tanks and devices, drinking fountains, solar heating and cooling systems, approval of devices, equipment and fixtures, hangers and supports, drainage and venting, house drains and house sewers, storm water drains, special wastes, light and ventilation of water closets and bathrooms, and excavation and grading.

- (3) The director shall appoint an adequate staff experienced and trained to serve as plumbing inspectors to enforce rules adopted under this section. [Amended by 1957 c.300 §2; 1971 c.753 §48; 1973 c.734 §2; 1973 c.835 §222; 1981 c.438 §29; 1993 c.744 §66; 2001 c.683 §26]

OAR 918-008-000 is not part of this code but is reproduced here for the reader's convenience:

918-008-0000

Purpose and Scope.

- (1) The Department of Consumer and Business Services, Building Codes Division, adopts model building codes, standards and other publications by reference, as necessary, through administrative rule to create the state building code. When a matter is included in a specialty code or referenced publication that is in conflict with Oregon Revised Statutes or Oregon Administrative Rules, the statute or rule applies and the code or standard provision does not. All remaining parts or application of the code or standard remain in effect.
- (2) Unless required by law, matters generally not authorized for inclusion in a specialty code or referenced standard include, but are not limited to: licensing or certification requirements, or other qualifications and standards for businesses or workers; structures or equipment maintenance requirements; matters covered by federal or state law; and matters that conflict with other specialty codes or publications adopted by the department.
- (3) OAR 918-008-0000 to OAR 918-008-0070 provides the process for adopting and amending the state building code that is consistent across all program areas.
- (4) The state building code is derived from the most appropriate version of base model codes, which are updated periodically.
- (5) The Oregon specialty code amendment process begins approximately midway into a code cycle.
- (6) An appropriate advisory board approves or forwards the adoption of the Oregon specialty code and amendments to the Department for adoption.
- (7) Notwithstanding sections (3) through (6) of this rule, the division may adopt supplemental code amendments as authorized by OAR 918-008-0028.

[Publications: Publications referenced are available from the agency.]

Stat. Auth.: ORS 447.020, 455.030 & 479.730
 Stats. Implemented: ORS 447.020, 455.030 & 479.730
 Hist.: BCD 26-1994, f. & cert. ef. 11-15-94; BCD 6-1997, f. & cert. ef. 4-1-97; BCD 3-2006(Temp), f. & cert. ef. 3-1-06 thru 8-27-06; BCD 9-2006, f. 6-30-06, cert. ef. 7-1-06; BCD 1-2014, f. 1-22-14, cert. ef. 4-1-14

Municipalities, as defined in ORS 455.010(5), may establish administrative procedures in accordance with ORS 455.020(4), and may amend specific sections of Chapter 1, as identified throughout this chapter. When the requirements of this Chapter conflict with any administrative requirements through out this code this Chapter shall prevail.

101.4.1 Repairs and Alterations. In existing buildings or premises in which plumbing installations are to be altered, repaired, or renovated, deviations from the provisions of this code are permitted, provided such deviations are found to be necessary and are first approved by the building official.

101.4.1.1 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 any changes necessary to conform to 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.

101.4.1.2 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 required by this code.

101.4.2 Existing Construction. No provision of this code shall be deemed to require a change in a portion of a plumbing or drainage system or other work regulated by this code in or on an existing building or lot where such work was installed and is maintained in accordance with law in effect prior to the effective date of this code, except where such plumbing or drainage system or other work regulated by this code is determined by the building official to be in fact dangerous, unsafe, insanitary, or a nuisance and a menace to life, health, or property.

101.4.3 Conflicts Between Codes. Where the requirements of this plumbing code conflict with the requirements of the other codes, this code shall prevail.

101.4.4 Additions, Alterations, or Repairs. Additions, alterations, repairs, and replacement of plumbing systems shall comply with the provisions for new systems except as otherwise provided in Sections 101.5 and 101.4.1.1.

101.4.5 Appendices. The provisions in the appendices shall not be considered part of this code unless formally adopted as such.

101.5 Application to Existing Plumbing System.

101.5.1 Additions, Alterations, or Repairs. Additions, alterations, or repairs shall be permitted to be made to a plumbing system without requiring the existing plumbing system to be in accordance with the requirements of this code, provided the addition, alteration, or repair is in accordance with that required for a new plumbing system. Additions, alterations, or repairs shall not cause an existing system to become unsafe, insanitary, or overloaded.

101.5.2 Health and Safety. Where compliance with the provisions of this code fail 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 building official.

101.5.3 Existing Installation. 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.

101.5.4 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 Structural Code, shall comply to the requirements of this code that may be applicable to the new use or occupancy.

101.5.5 Moved Buildings. Plumbing systems that are part of buildings or structures moved into this jurisdiction shall comply with the provisions of this code for new installations, except as provided for in Section 103.5.5.2.

Moved buildings or structures containing plumbing regulated by this code shall comply with the provisions of the code for new installations, except that required plumbing testing shall not require the removal of existing walls and floors. Drainage waste and vent systems shall be tested by running or flooding of the piping system or by an equivalent means of testing acceptable to the building official. Plumbing systems and fixtures serving buildings or structures moved within the state shall comply with ORS 455.410.

ORS 455.410 is not part of this code but is reproduced here for the reader's convenience:

455.410 Relocated buildings; substantial compliance required; permits.

- (1) Existing buildings or structures which are removed from their foundation and relocated to another site within this state shall be in substantial compliance as defined in subsections (2) and (3) of this section.
- (2) "Substantial compliance" means compliance with local construction codes in effect as of the original permit date of the building or structure, or where there was no permitting required at the time of original construction, with basic health

and safety standards, as described in the closest dated Uniform Housing Code, as published by the International Conference of building officials as of the date of construction. Only the insulation, overhead and underneath the structure, shall be upgraded to the current insulation requirements of the state building code, or to the maximum extent possible subject to the design of the structure. Nothing in this statute shall be construed to mean that all heating, plumbing and electrical systems shall be replaced with systems meeting current standards for new construction, except that any life-threatening deficiencies in those systems shall be repaired, notwithstanding that the cost of rehabilitation may exceed 50 percent of the value of the structure before rehabilitation.

- (3) All foundation and basement construction on the structure and any remodeling at the new location shall be constructed subject to all applicable local current building and safety codes, or where none exist, with the applicable standards as described in the Uniform Housing Code described in subsection (2) of this section.
- (4) All moved houses shall be provided with either battery-operated or hard-wired smoke detection devices located in accordance with the provisions of the state building code.
- (5) Nothing in this section is intended to permit any person to move a structure unless the person first consults the appropriate building inspection authority and obtains all required permits. [Formerly 456.756; 1989 c.1068 §1]

102.0 Organization and Enforcement.

Note: Unless amended by a municipality under authority of ORS 455.040, Section 102.0 applies.

102.1 Duties and Powers of the Building Official. The building official shall be the Authority duly appointed to enforce this code.

102.1.1 The building official is hereby authorized and directed to enforce the provisions of this code. The building official shall have the authority to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of this code. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code or statewide code interpretations.

In accordance with the ORS chapter 455 and 693 the building official shall have the authority to appoint inspectors and plan examiners and other employees.

102.1.2 Right of Entry. Where it is necessary to make an inspection to enforce the provisions of this code, or where the building official has reasonable cause to believe that there exists in any building or upon any premises any condition or violation of this code that makes the building or premises unsafe, insanitary, dangerous, or hazardous, the building official shall be permitted to enter the building or premises at all reasonable times to inspect or to perform the duties imposed by this code, provided that if such building or premises is

occupied, the building official shall present credentials to the occupant and request entry. Where such building or premises is unoccupied, the building official 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 building official has recourse to every remedy provided by law to secure entry.

Where the building official shall have first obtained a proper 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 proper request is made as herein provided, to promptly permit entry herein by the building official for the purpose of inspection and examination pursuant to this code.

102.1.3 Stop Orders. Where work is being done contrary to the provisions of this code, the building official 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 building official to proceed with the work.

102.1.4 Authority to Disconnect Utilities in Emergencies. The building official 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.

102.1.5 Authority to Condemn. Where the building official 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 building official 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.

102.1.6 Liability. See ORS 30.265 for regulations relating to liability.

ORS 30.265 is not part of this code but is reproduced here for the reader's convenience:

30.265 Scope of liability of public body, officers, employees and agents; liability in nuclear incident.

- (1) Subject to the limitations of ORS 30.260 to 30.300, every public body is subject to civil action for its torts and those of its officers, employees and agents acting within the scope of their employment or duties, whether arising out of a governmental or proprietary function or while operating a motor vehicle in a ridesharing arrangement authorized under ORS 276.598.

- (2) The sole cause of action for a tort committed by officers, employees or agents of a public body acting within the scope of their employment or duties and eligible for representation and indemnification under ORS 30.285 or 30.287 is an action under ORS 30.260 to 30.300. The remedy provided by ORS 30.260 to 30.300 is exclusive of any other action against any such officer, employee or agent of a public body whose act or omission within the scope of the officer's, employee's or agent's employment or duties gives rise to the action. No other form of civil action is permitted.
- (3) If an action under ORS 30.260 to 30.300 alleges damages in an amount equal to or less than the damages allowed under ORS 30.271, 30.272 or 30.273, the sole cause of action for a tort committed by officers, employees or agents of a public body acting within the scope of their employment or duties and eligible for representation and indemnification under ORS 30.285 or 30.287 is an action against the public body. If an action is filed against an officer, employee or agent of a public body, and the plaintiff alleges damages in an amount equal to or less than the damages allowed under ORS 30.271, 30.272 or 30.273, the court upon motion shall substitute the public body as the defendant. Substitution of the public body as the defendant does not exempt the public body from making any report required under ORS 742.400.
- (4) If an action under ORS 30.260 to 30.300 alleges damages in an amount greater than the damages allowed under ORS 30.271, 30.272 or 30.273, the action may be brought and maintained against an officer, employee or agent of a public body, whether or not the public body is also named as a defendant. An action brought under this subsection is subject to the limitations on damages imposed under ORS 30.271, 30.272 or 30.273, and the total combined amount recovered in the action may not exceed those limitations for a single accident or occurrence without regard to the number or types of defendants named in the action.
- (5) Every public body is immune from liability for any claim for injury to or death of any person or injury to property resulting from an act or omission of an officer, employee or agent of a public body when such officer, employee or agent is immune from liability.
- (6) Every public body and its officers, employees and agents acting within the scope of their employment or duties, or while operating a motor vehicle in a ridesharing arrangement authorized under ORS 276.598, are immune from liability for:
 - (a) Any claim for injury to or death of any person covered by any workers' compensation law.
 - (b) Any claim in connection with the assessment and collection of taxes.
 - (c) Any claim based upon the performance of or the failure to exercise or perform a discretionary function or duty, whether or not the discretion is abused.
 - (d) Any claim that is limited or barred by the provisions of any other statute, including but not limited to any statute of ultimate repose.

- (e) Any claim arising out of riot, civil commotion or mob action or out of any act or omission in connection with the prevention of any of the foregoing.
 - (f) Any claim arising out of an act done or omitted under apparent authority of a law, resolution, rule or regulation that is unconstitutional, invalid or inapplicable except to the extent that they would have been liable had the law, resolution, rule or regulation been constitutional, valid and applicable, unless such act was done or omitted in bad faith or with malice.
- (7) This section applies to any action of any officer, employee or agent of the state relating to a nuclear incident, whether or not the officer, employee or agent is acting within the scope of employment, and provided the nuclear incident is covered by an insurance or indemnity agreement under 42 U.S.C. 2210.
- (8) Subsection (6)(c) of this section does not apply to any discretionary act that is found to be the cause or partial cause of a nuclear incident covered by an insurance or indemnity agreement under the provisions of 42 U.S.C. 2210, including but not limited to road design and route selection. [1967 c.627 §§2,3,10; 1969 c.429 §1; 1975 c.609 §12; 1977 c.823 §2; 1981 c.490 §4; 1985 c.731 §31; 1987 c.705 §7; 1991 c.861 §1; 2005 c.22 §19; 2007 c.803 §4; 2011 c.270 §1]

102.2 Violations and Penalties.

102.2.1 Violations. It shall be unlawful for a person, firm, or corporation to erect, construct, enlarge, alter, repair, move, improve, remove, convert, demolish, equip, or use plumbing or permit the same to be done in violation of this code. The building official is authorized to serve a notice of violation or order on the person responsible for violation of this code. Prohibited acts are described in ORS 455.450.

ORS 455.450 is not part of this code but is reproduced here for the reader’s convenience:

455.450 Prohibited acts.

A person may not:

- (1) Violate, or procure or assist in the violation of, any final order of the Director of the Department of Consumer and Business Services, an advisory board, a state administrative officer or any local appeals board, building official or inspector, concerning the application of the state building code in a particular case or concerning a license, certificate, registration or other authorization.
- (2) Engage in, or procure or assist any other person to engage in, any conduct or activity for which a permit, label, license, certificate, registration or other formal authorization is required by any specialty code, any provision of ORS 446.003 to 446.200, 446.225 to 446.285, 446.395 to 446.420, 446.566 to 446.646, 446.666 to 446.746, 479.510 to 479.945, 479.950 and 480.510 to 480.670, this chapter or ORS chapter 447, 460 or 693, or any rule adopted or order issued for the administration and enforcement of those provisions, without first having obtained such permit, label, license, certificate, registration or other formal authorization.

- (3) Violate, or procure or assist in the violation of, any standard, specification, requirement, prohibition or other technical provision set forth in the state building code or an applicable local building code or in any rule or order of the Department of Consumer and Business Services, an advisory board, a local governing body or local building official. [Formerly 456.885 (1); 2007 c.306 §3]

102.2.2 Penalties. A person, firm, or corporation violating a provision of this code shall be subject to penalties as described in ORS 445.895 or as adopted by the municipality. Municipal authority to levy penalties is limited to violations of code application.

ORS 455.895 is not part of this code but is reproduced here for the reader’s convenience:

455.895 Civil penalties.

- (1) (a) The State Plumbing Board may impose a civil penalty against a person as provided under ORS 447.992 and 693.992. Amounts recovered under this paragraph are subject to ORS 693.165.
- (b) The Electrical and Elevator Board may impose a civil penalty against a person as provided under ORS 479.995. Amounts recovered under this paragraph are subject to ORS 479.850.
- (c) The Board of Boiler Rules may impose a civil penalty against a person as provided under ORS 480.670. Amounts recovered under this paragraph are subject to ORS 480.670.
- (2) The Department of Consumer and Business Services, or an appropriate advisory board, if any, may at its discretion impose a civil penalty against any person who violates the state building code or ORS 446.003 to 446.200, 446.225 to 446.285, 446.395 to 446.420, 446.566 to 446.646, 446.666 to 446.746, 479.510 to 479.945, 479.950 or 480.510 to 480.670, or this chapter or ORS chapter 447, 460 or 693, or any rule adopted or order issued for the administration and enforcement of those statutes. Except as provided in subsections (3), (4) and (9) of this section or ORS 446.995, a civil penalty imposed under this section must be in an amount determined by the appropriate advisory board or the department of not more than \$5,000 for each offense or, in the case of a continuing offense, not more than \$1,000 for each day of the offense.
- (3) Each violation of ORS 446.003 to 446.200 or 446.225 to 446.285, or any rule or order issued under ORS 446.003 to 446.200 or 446.225 to 446.285, constitutes a separate violation with respect to each manufactured structure or with respect to each failure or refusal to allow or perform an act required thereby, except that the maximum civil penalty may not exceed \$1 million for any related series of violations occurring within one year from the date of the first violation.
- (4) The department may impose a civil penalty of not more than \$25,000 against a public body responsible for administering and enforcing a building inspection program. As used in this subsection, “public body” has the meaning given that term in ORS 174.109.

- (5) The maximum penalty established by this section for a violation may be imposed only upon a finding that the person has engaged in a pattern of violations. The department, by rule, shall define what constitutes a pattern of violations. Except as provided in subsections (1) and (10) of this section, moneys received from any civil penalty under this section are appropriated continuously for and shall be used by the department for enforcement and administration of provisions and rules described in subsection (2) of this section.
- (6) Civil penalties under this section shall be imposed as provided in ORS 183.745.
- (7) A civil penalty imposed under this section may be remitted or reduced upon such terms and conditions as the department or the appropriate advisory board considers proper and consistent with the public health and safety. In any judicial review of a civil penalty imposed under this section, the court may, in its discretion, reduce the penalty.
- (8) Any officer, director, shareholder or agent of a corporation, or member or agent of a partnership or association, who personally participates in or is an accessory to any violation by the partnership, association or corporation of a provision or rule described in subsection (2) of this section is subject to the penalties prescribed in this section.
- (9) In addition to the civil penalty set forth in subsection (1) or (2) of this section, any person who violates a provision or rule described in subsection (2) of this section may be required by the department or the appropriate advisory board to forfeit and pay to the General Fund of the State Treasury a civil penalty in an amount determined by the department or advisory board that does not exceed five times the amount by which such person profited in any transaction that violates a provision or rule described in subsection (2) of this section.
- (10) If a civil penalty is imposed for a violation of a provision of ORS 446.566 to 446.646 and the violation relates to a filing or failure to file with a county assessor functioning as agent of the department, the department, after deducting an amount equal to the department's procedural, collection and other related costs and expenses, shall forward one-half of the remaining civil penalty amount to the county in which the manufactured structure is located at the time of the violation. [1991 c.792 §4; 1991 c.734 §111; 1999 c.1045 §19; 2001 c.411 §21; 2003 c.14 §286; 2003 c.655 §76; 2007 c.549 §6; 2007 c.898 §1; 2013 c.324 §11]

103.0 Permits and Inspections.

Note: Unless amended by a municipality under authority of ORS 455.040, Section 103.0 applies.

103.1 Permits.

103.1.1 Permits Required. It shall be unlawful for a person, firm, or corporation to make a installation, alteration, repair, replacement, or remodel a plumbing system regulated by this code except as permitted in Section 103.1.2, OAR Chapter 918, Division 100, and OAR 918-

780-0035, or to cause the same to be done without first obtaining a separate plumbing permit for each separate building or structure.

OAR 918-780-0035 is not part of this code but is reproduced here for the reader's convenience:

918-780-0035

Exempt Ordinary Minor Plumbing Repairs.

- (1) Effective April 1, 2006, state building code provisions for permit or inspection of ordinary minor plumbing repairs follow:
 - (a) A registered plumbing contractor and any person exempt from licensing under ORS 693.020 are exempted from permit or inspection for ordinary minor plumbing repairs as defined in section (2) for residential and commercial structures;
 - (b) The term "any person" is defined by ORS 693.020 and includes but is not limited to individuals, corporations, partnerships, public and municipal corporations, political subdivisions, any Oregon state and federal government agencies.
- (2) The term "ordinary minor plumbing repairs" is defined as follows:
 - (a) Includes repair, replacement or maintenance of existing plumbing fixtures, appliances, appurtenances and related water supply and drain attachments for the purpose of restoring a plumbing installation to a safe and sanitary operating condition.
 - (b) Does not include new construction, replacement of water heaters, or underground plumbing.
- (3) In addition to the exemption in section (1), a registered plumbing contractor does not need a permit or inspection for emergency repair or replacement of the following: freeze-damaged, leaking-exposed, or concealed piping not exceeding five feet of new piping per structure for a period of 180 days, provided the repair or replacement does not involve any changes or alterations to the existing plumbing system.

[Publications: Publications referenced are available from the agency.]

Stat. Auth.: ORS 447.072 & 447.076

Stats. Implemented: ORS 447.072 & 447.076

Hist.: BCD 21-2003, f. 12-31-03, cert. ef. 1-1-04; BCD 6-2006, f. & cert. ef. 4-4-06

103.1.2 Exempt Work. 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 any other laws or ordinances of this jurisdiction. A permit shall not be required for the following:

103.1.2.1 The stopping of leaks in drains, soil, waste, or vent pipe, provided, however, that a trap, drain pipe, soil, waste, or vent pipe become defective and it becomes necessary to remove and replace the same with new material, the same shall be con-

sidered as new work and a permit shall be procured and inspection made as provided in this code.

103.1.2.2 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.

103.2 Application for Permit.

103.2.1 Application. To obtain a permit, the applicant shall first file an application therefore in writing on a form furnished by the building official for that purpose. Such application shall:

103.2.1.1 Identify and describe the work to be covered by the permit for which application is made.

103.2.1.2 Describe the land upon which the proposed work is to be done by legal description, street address, or similar description that will readily identify and definitely locate the proposed building or work.

103.2.1.3 Indicate the use or occupancy for which the proposed work is intended.

103.2.1.4 Be accompanied by plans, diagrams, computations, and other data as required in Section 103.2.2.

103.2.1.5 Be signed by the permittee or the permittee's authorized agent, who may be required to submit evidence to indicate such authority.

103.2.1.6 Give such other data and information in accordance with the building official.

103.2.2 Plans and Specifications. Where required under OAR 918-780-0040, plans, engineering calculations, diagrams, and other data shall be submitted in two or more sets with each application for a permit. The building official shall be permitted to require plans, computations, and specifications to be prepared by, and the plumbing designed by, an engineer and/or architect licensed by the state to practice as such.

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

OAR 918-780-0040 is not part of this code but is reproduced here for the reader's convenience:

918-780-0040

Plumbing Plan Reviews.

- (1) A jurisdiction providing plumbing code plan review services may only require plumbing plan review for a complex structure. For purposes of this rule, a "complex structure" is a plumbing system designed, constructed or reconstructed to accommodate any of the following:
 - (a) The installation or alteration of a medical gas and vacuum system for health care facilities;

- (b) The installation or alteration of chemical drainage waste and vent systems containing chemical agents potentially detrimental to the integrity of a plumbing system;
 - (c) The installation or alteration of wastewater pretreatment systems for building sewers;
 - (d) The installation of vacuum drainage waste and vent systems;
 - (e) The installation or alteration of reclaimed wastewater systems;
 - (f) The installation of a commercial booster pump system needed to maintain a minimum residual water pressure in a structure supplied by a municipal source;
 - (g) The installation of a plumbing system requiring a building water service line with an interior diameter or nominal pipe size of two inches or greater except those two inch systems which have been designed and stamped by a licensed engineer;
 - (h) The installation of any multi-purpose sprinkler system under standards adopted by the department.
- (2) If a jurisdiction providing plumbing code plan review services requires a plumbing code plan review as authorized by section (1) of this rule, the jurisdiction may require the submission of complete specifications, piping layout and fixture location drawings of the proposed system or alteration before issuing a permit. Plans and specifications must indicate the nature and extent of the work proposed and show in detail that the work will conform to provisions of the Plumbing Specialty Code.
 - (3) A jurisdiction requiring plumbing code plan review may not require plan review on more than one building or structure under construction or reconstruction at the same jobsite, as long as:
 - (a) The plumbing systems of the buildings or structures are materially alike; and
 - (b) A person obtains plumbing permits for the buildings or structures within a reasonable time.
 - (4) Any required plumbing code plan review service may be waived by a jurisdiction if the nature of the work applied for is such that reviewing of plans is not necessary to determine compliance with the Plumbing Specialty Code.
 - (5) When the plumbing plan review is completed by a qualified plumbing plan reviewer and a plumbing permit issued, the plans must be endorsed in writing and stamped "Approved." The approved plans cannot be changed without authorization from the jurisdiction providing plumbing code plan review services.
 - (6) Issuance of a permit or approval of plans will not prevent the jurisdiction providing plumbing code plan review services from
 - (a) requiring the correction of errors in plans and specifications; or
 - (b) preventing construction operations when in violation of the Plumbing Specialty Code or of any other ordinance; or
 - (c) revoking any certificate of approval when issued in error.
 - (7) Nothing in this rule prevents a jurisdiction from providing plan review services for utility systems situated outside the building exterior of a particular jobsite.

- (8) Nothing in this rule prevents a jurisdiction from requiring information on grease processing equipment systems.
- (9) Where applicable, the Department of Consumer and Business Services' fees for plan review on complex structures will be based on the time required to review the plans, but must not exceed 30 percent of the total plumbing permit fee for the building or structure under review. When plans are incomplete or substantially changed to require additional plan review services, the department may charge an additional fee based on the time required for the additional review.
- (10) Nothing in these rules shall prohibit the owner or owner's agent from requesting and receiving a plan review for non-complex structures.

[Publications: Publications referenced are available from the agency.]

Stat. Auth.: ORS 455.483

Stats. Implemented: ORS 455.483

Hist.: DC 39, f. 1-6-75, ef. 2-1-75; DC 13-1981, f. 10-30-81, ef. 11-1-81; Renumbered from 814-021-0115; BCD 6-1998, f. 3-2-98, cert. ef. 4-1-98, Renumbered from 918-760-0020; BCD 21-1998, f. 9-30-98, cert. ef. 10-1-98; BCD 7-2006, f. 6-7-06, cert. ef. 10-1-06

103.2.3 Information on Plans and Specifications.

Plans and specifications shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Plans and specifications shall be of sufficient clarity to indicate the location, nature, and extent of the work proposed and show in detail that it is in accordance with the provisions of this code and relevant laws, ordinances, rules, and regulations.

103.2.3.1 Manufacturer's Installation Instructions. Manufacturer's installation instructions, as required by this code, shall be available on the job site at the time of inspection.

103.2.4 Retention of Plans. One set of approved plans, specifications, and computations shall be retained by the building official until final approval of the work covered therein. This set of approved plans, specifications, and computations shall be retained by the building official for a period of not less than that dictated by OAR 166-150-0020 where a county has jurisdiction; OAR 166-200-0025 where a city has jurisdiction; and OAR Chapter 166, division 300 for the jurisdictions where the State of Oregon has jurisdiction. One set of approved plans and specifications 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.

103.3 Permit Issuance.

103.3.1 Issuance. The application, plans, and specifications and other data filed by an applicant for a permit shall be reviewed by the building official. 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 building official 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 103.4 have been paid, the building official shall issue a permit therefore to the applicant.

When the building official issues the permit where plans are required, the building official shall endorse in writing or stamp the plans and specifications "APPROVED." Such approved plans and specifications shall not be changed, modified, or altered without authorization from the building official, and the work shall be done in accordance with approved plans.

Plans and specifications shall be approved in the timelines specified in ORS 455.467.

ORS 455.467 is not part of this code but is reproduced here for the reader's convenience:

455.467 Timelines for approval or disapproval of certain specialty code building plans; exceptions; phased permit systems; failure to adhere to timelines.

- (1) Except as provided in subsection (2) of this section, for specialty code plan reviews of simple low-rise residential dwellings, the Department of Consumer and Business Services or a municipality that administers a building inspection program under ORS 455.148 or 455.150 shall approve or disapprove the specialty code building plan:
 - (a) For a jurisdiction with a population that is less than 300,000, within 10 business days of receiving a complete application, or shall implement the process described in ORS 455.465.
 - (b) For a jurisdiction with a population that is 300,000 or more, within 15 business days of receiving a complete application, or shall implement the process described in ORS 455.465.
- (2) The 10-day and 15-day requirements in subsection (1) of this section do not apply if:
 - (a) The plan requires approval by federal, state or local agencies outside the jurisdiction of the issuing agency;
 - (b) The plan is for a complex structure that requires additional review as determined by the department or municipality; or
 - (c) Based on conditions that exist in the affected municipality, the Director of the Department of Consumer and Business Services authorizes a different plan review schedule as described in a building inspection program submitted under ORS 455.148 or 455.150. [1999 c.1045 §21; 2001 c.384 §1; 2001 c.573 §13; 2003 c.675 §28]

The building official shall be permitted to issue a permit for the construction of a part of a plumbing system before the entire plans and specifications for the whole system have been submitted or approved, provided adequate information and detailed statements have been filed in accordance with the pertinent requirements of this code. The holder of such permit shall be permit-

ted to proceed at the holder’s risk without assurance that the permit for the entire building, structure, or plumbing system will be granted.

ORS 455.467 is not part of this code but is reproduced here for the reader’s convenience:

455.467

- (3) For specialty code plan reviews of commercial structures, a municipality shall include in its building inspection program submitted under ORS 455.148 or 455.150 a process for plan review services. The municipality shall include in its program detailed reasons supporting the proposed plan review process. The plan review services provided by the municipality shall:
 - (a) Allow an applicant to defer the submittal of plans for one or more construction phases for a commercial construction project in accordance with the state building code; and
 - (b) Allow an applicant to receive permits for each of the phases of a commercial construction project as described in the state building code when the plan review for that phase is approved.
- (4) For a phased commercial construction project as described in subsection (3) of this section, the municipality shall inform the applicant of the detailed plans necessary for each phase of the project and the estimated time for initial and phased review of the building plans for conformance with the state building code.
- (5) An applicant submitting plans under subsection (3) of this section is responsible for ensuring that the project meets all specialty code requirements and that the project does not proceed beyond the level of approval authorized by the building official.
- (6) A municipality that repeatedly fails to meet the plan review period described in this section or otherwise authorized in its building inspection program submitted under ORS 455.148 or 455.150 shall be considered to be engaging in a pattern of conduct of failing to provide timely plan reviews under ORS 455.160. [1999 c.1045 §21; 2001 c.384 §1; 2001 c.573 §13; 2003 c.675 §28]

103.3.2 Validity of Permit. The issuance of a permit or approval of plans and specifications shall not be construed to be a permit for, or an approval of, any violation of any 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 building official 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.

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

Any 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 for good and satisfactory reasons. The building official shall be permitted to extend the time for action by the permittee for a period not exceeding 180 days upon written request by the permittee showing that circumstances beyond the control of the permittee have prevented action from being taken. No permit shall be extended more than once. In order to renew action on a permit after expiration, the permittee shall pay a new full permit fee.

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

103.4 Fees.

Note: Unless amended by the municipality under authority of ORS 455.020 and 455.210, Section 103.4 applies.

103.4.1 Permit Fees. Fees shall be assessed in accordance with the provisions of this section and as set forth in the fee schedule of the municipality under the authority of ORS 455.210, or as set forth in OAR 918-780-0080 where the State of Oregon has jurisdiction.

103.4.2 Plan Review Fees. Where a plan or other data is required to be submitted under OAR 918-780-0040, a plan review fee shall be paid at the time of submitting plans and specifications for review.

The plan review fees for plumbing work shall be a percentage of the total plumbing permit as set forth in Section 103.4.2.

The plan review fees specified in this subsection are separate fees from the permit fees specified in this section and are in addition to the permit fees.

Where plans are incomplete or changed so as to require additional review, a fee shall be charged at the rate adopted by the municipality under the authority of ORS 455.210, or as set forth in OAR 918-780-0040 where the State of Oregon has jurisdiction.

103.4.3 Expiration of Plan Review. 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 building official. The building official shall be permitted to exceed the time for action by the applicant for a period not to exceed 180 days upon request by the applicant showing that circumstances beyond the control of the applicant have prevented action from being taken. No application shall be extended more than once. In order to renew action on an application after expiration, the applicant shall resubmit plans and pay a new plan review fee.

ORS 455.210 is not part of this code but is reproduced here for the reader’s convenience:

455.210.

- (1) Fees shall be prescribed as required by ORS 455.020 for plan review and permits issued by the Department of Consumer and Business Services for the construction, reconstruction, alteration and repair of prefabricated structures and of buildings and other structures and the installation of mechanical heating and ventilating devices and equipment. The fees may not exceed 130 percent of the fee schedule printed in the “Uniform Building Code,” 1979 Edition, and in the “Uniform Mechanical Code,” 1979 Edition, both published by the International Conference of building officials. Fees are not effective until approved by the Oregon Department of Administrative Services.
- (2) (a) A municipality may adopt by ordinance or regulation such fees as may be necessary and reasonable to provide for the administration and enforcement of any specialty code or codes for which the municipality has assumed responsibility under ORS 455.148 or 455.150. A municipality shall give the director notice of the proposed adoption of a new or increased fee under this subsection. The municipality shall give the notice to the director at the time the municipality provides the opportunity for public comment under ORS 294.160 regarding the fee or, if the proposed fee is contained in an estimate of municipal budget resources, at the time notice of the last budget meeting is published under ORS 294.426. [Subsections (1) to (5) formerly 456.760; subsection (6) enacted as 1987 c.604 §6; 1997 c.856 §1; 1999 c.432 §1; 1999 c.1045 §24; 1999 c.1082 §9; 2001 c.573 §9; 2001 c.673 §1; 2005 c.193 §1; 2005 c.833 §3; 2007 c.69 §5; 2011 c.473 §29]

103.4.4 Investigation Fees: Work Without a Permit. Any person who commences any work on a plumbing system before obtaining the necessary permits shall be subject to an investigative fee. The amount of the investigative fee shall be the average or actual additional cost of ensuring that the work is in conformance with the Oregon Plumbing Specialty Code and shall be in addition to the required permit fees. Fees shall be charged according to the rates established by the municipality, or as established by the state where the State of Oregon has jurisdiction.

An investigative fee does not apply to emergency installations provided the permit application is submitted within the next five business days.

ORS 455.058 is not part of this code but is reproduced here for the reader’s convenience:

455.058 Investigation fee for work commenced without permit; rules.

- (1) Except as provided in subsection (2) of this section, the Department of Consumer and Business Services, or a municipality administering and enforcing a building inspection program, may assess an investigation fee against a person that is required to obtain a permit for work on the electrical, gas, mechanical, elevator, boiler, plumbing or other systems of a building or structure if the work is commenced before the permit required for the work is obtained. The amount of the investigation fee shall be the average or actual additional cost of ensuring that a building, structure or system is in conformance with state building code requirements that results from the person not obtaining a required permit before work for which the permit is required commences.
- (2) This section does not apply to:
 - (a) An emergency repair required for health, safety, the prevention of property damage or the prevention of financial harm if the required building permit for the repair is obtained no later than five business days after commencement of the repair; or
 - (b) Any project for which construction, alteration, repair, maintenance or installation in a building or structure prior to obtaining a permit is expressly authorized by law.
- (3) The department may adopt rules and establish policies and procedures for use by the department or municipalities in assessing an investigation fee under this section. [2013 c.324 §2]

103.4.5 Fee Refunds. The building official shall be permitted to authorize the refunding of any fee paid hereunder that was erroneously paid or collected.

103.4.5.1 Percentage. The building official shall be permitted to authorize the refunding of not more than a percentage of any fee paid when no work has been done under a permit issued in accordance with this code.

103.4.5.2 In Writing. The building official shall not authorize the refunding of any fee paid except upon written application filed by the original permittee not to exceed 180 days after the date of fee payment.

103.5 Inspections.

103.5.1 General. Plumbing systems for which a permit is required by this code shall be inspected by the building official.

No portion of any plumbing system shall be concealed until inspected and approved. Neither the building official nor the municipality shall be liable for expense entailed in the removal or replacement of material required to permit inspection. Where the installation of a plumbing system is complete, an additional and final inspection shall be made. Plumbing systems regulated by this code shall not be connected to the water, or the sewer system until authorized by the building official.

103.5.1.1 Water Supply System. No water supply system or portion thereof shall be covered or concealed until it first has been tested, inspected, and approved.

103.5.1.2 New Plumbing Work. New plumbing work and such portions of existing systems as affected by new work, or changes, shall be inspected by the building official to ensure compliance with the requirements of this code and to ensure that the installation and construction of the plumbing system is in accordance with approved plans.

A rough-in inspection prior to placement of any concrete, cover, or backfill, or prior to placement of sub-flooring if frame construction must be requested by the permittee.

A cover inspection when all rough-in plumbing is in place prior to being covered.

A final inspection of plumbing fixtures and connections just prior to the building or remodeled area being occupied.

Exception: Rough-in inspections prior to placement of sub-flooring for frame construction may be waived by the building official, if adequate accessibility is available and prior approval is granted.

103.5.1.3 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.

103.5.1.4 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 building official.

103.5.2 Operation of Plumbing Equipment. 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 building official 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.

103.5.3 Testing of Systems. Plumbing systems shall be tested and approved in accordance with this code or the building official.

103.5.3.1 Test. Tests shall be conducted in the presence of the building official.

103.5.3.2 Test Waived. 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.

103.5.3.3 Exceptions. In cases where it would be impractical to provide the required water or air tests, or for minor installations and repairs, the building official 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.

103.5.3.4 Tightness. Joints and connections in the plumbing system shall be gastight and watertight for the pressures required by test.

103.5.4 Inspection Requests. It shall be the duty of the person doing the work authorized by a permit to notify the building official that such work is ready for inspection. The building official shall be permitted to require that a request for inspection be filed not less than 24 hours before such inspection is desired. Such request shall be in writing or by telephone, at the option of the building official.

It shall be the duty of the person requesting inspections in accordance with this code to provide access to and means for proper inspection of such work.

103.5.4.1 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.

103.5.5 Other Inspections. In addition to the inspections required by this code, the building official shall be permitted to require other inspections of any plumbing work to ascertain compliance with the provisions of this code and other laws that are enforced by the building official.

103.5.5.1 Defective Systems. An air test shall be used in testing the sanitary condition of the drainage or plumbing system of any building premises where there is reason to believe that it has become defective. In buildings or premises condemned by other municipal authority than the building official 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.

103.5.5.2 Moved Structures. Parts of the plumbing systems of a building or part thereof that is moved from one foundation to another, or from one location to another, shall be completely tested as prescribed elsewhere in this section for new work, except that walls or floors need not be removed during such test where other equivalent means of inspection acceptable to the building official are provided.

103.5.6 Reinspections. A reinspection fee shall be permitted to be assessed for each inspection or reinspection where such portion of work for which inspection is

called is not complete or where required corrections have not been made.

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

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

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 those adopted by the municipality.

In instances where reinspection fees have been assessed, no additional inspection of the work will be performed until the required fees have been paid. Fees shall be charged according to the rates established by the municipality, or as established by the state where the State of Oregon has jurisdiction.

103.5.6.1 Corrections. Notices of correction or violation shall be written by the building official 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 30 days of receipt thereof, shall be considered a violation of this code and shall be subject to the penalties set forth elsewhere in this code for violations.

103.5.6.2 Retesting. Where the building official finds that the work will not pass the test, necessary corrections shall be made, and the work shall then be resubmitted for test or inspection.

103.5.6.3 Approval. Upon the satisfactory completion and final test of the plumbing system, a certificate of approval shall be issued by the building official to the permittee on demand.

103.6 Connection Approval.

103.6.1 Other Connections. No person shall make connection from any water-supply line nor shall connect to any sewer system regulated by this code and for which a permit is required until approved by the building official.

103.6.2 Temporary Connections. The building official shall be permitted to authorize temporary connection of the plumbing equipment for the purpose of testing the equipment.

103.7 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.

103.7.1 Wherever in this code reference is made to an appendix, the provisions in the appendix shall not apply unless specifically adopted.

103.8 Appeals.

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

103.8.2 Limitations on Authority. An application for appeal shall be based upon a claim that the true intent of this code or rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. An appeals board, when appointed, shall have no authority to waive requirements of this code.

103.8.3 Qualifications. An appeals board, when appointed, shall consist of members who are qualified by experience and training to pass on matters pertaining to plumbing.

103.8.4 Appeal of Decision of Building Official. ORS 455.475 provides an alternative appeals process to that set forth by a municipality.

ORS 455.475 is not part of this code but is reproduced here for the reader's convenience:

455.475 Appeal of decision of building official.

- (1) An applicant for a building permit may appeal a decision made by a building official under authority established pursuant to ORS 455.148, 455.150 or 455.467. The following apply to an appeal under this subsection:
 - (a) An appeal regarding the interpretation or application of a particular specialty code provision shall be made first to the appropriate specialty code chief inspector of the Department of Consumer and Business Services. The decision of the department chief inspector may be appealed to the appropriate advisory board. The decision of the advisory board may only be appealed to the Director of the Department of Consumer and Business Services if codes in addition to the applicable specialty code are at issue.
 - (b) If the appropriate advisory board determines that a decision by the department chief inspector is a major code interpretation, then the inspector shall distribute the decision in writing to all applicable specialty code public and private inspection authorities in the state. The decision shall be distributed within 60 days after the board's determination, and there shall be no charge for the distribution of the decision. As used in this paragraph, a "major code interpretation" means a code interpretation decision that affects or may affect more than one job site or more than one inspection jurisdiction.
- (2) Except as provided in subsection (1) of this section, an applicant for a building permit may appeal the decision of a building official on any matter relating to the administration and

enforcement of this chapter to the department. The appeal must be in writing. A decision by the department on an appeal filed under this subsection is subject to judicial review as provided in ORS 183.484.

- (3) If an appeal is made under this section, an inspection authority shall extend the plan review deadline by the number of days it takes for a final decision to be issued for the appeal. [1999 c.1045 §23; 2001 c.573 §15; 2013 c.528 §13]

Note: Forms for filing an appeal under ORS 455.475 are available online at: www.bcd.oregon.gov.

ORS 445.690 allows an appeal of a municipal appeals board decision to the State Plumbing Board. Appeals to the State Plumbing Board are limited to those that are technical and scientific in nature.

ORS 455.690 is not part of this code but is reproduced here for the reader's convenience:

455.690 Appeal to advisory boards. Any person aggrieved by the final decision of a municipal appeals board or a subordinate officer of the Department of Consumer and Business Services as to the application of any provision of a specialty code may, within 30 days after the date of the decision, appeal to the appropriate advisory board. The appellant shall submit a fee of \$20, payable to the department, with the request for appeal. The final decision of the involved municipality or state officer shall be subject to review and final determination by the appropriate advisory board as to technical and scientific determinations related to the application of the specialty code involved. [Formerly 456.850; 1993 c.744 §98]

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.

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. “Readily accessible” means direct access without the necessity of removing any 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 any pipe or faucet conveying potable water to the flood-level rim of any tank, vat, or fixture.

Anchors. See Supports.

Approved. Acceptable to the building official.

Approved Testing Agency. An organization primarily established for purposes of testing to approved standards and approved by the State Plumbing Board.

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 other requirements that are not part of this code. The Authority Having Jurisdiction shall be a federal, state, or municipal authority. In the absence of a statutory authority, the Authority Having Jurisdiction may be some other responsible party. This definition shall include the Authority Having Jurisdiction’s duly authorized representative.

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-Siphonage, Backpressure Backflow.

Backflow Connection. An arrangement whereby backflow can occur.

Backflow Preventer. A device or means 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 Group. A group of plumbing fixtures consisting of a water closet, one, two, or three lavatories, and any combination of a bathtub, a combination bath/shower, or a shower and may include a urinal or bidet and emergency floor drain(s).

Bathroom, Half. A room equipped with only a water closet and lavatory.

Battery of Fixtures. A group of two or more similar, adjacent fixtures that discharge into a common horizontal waste or soil branch.

Board. For the purposes of this code, “Board” shall mean the State Plumbing Board as defined in ORS 447.010.

ORS 447.010(1) is not a part of this code but is reproduced here for the reader’s convenience:

(1) “Board” means the State Plumbing Board established under ORS 693.115.

[Subsection (3) enacted as 1955 c.548 §2; 1957 c.300 §1; 1961 c.401 §1; 1973 c.734 §1; 1973 c.835 §221; 1981 c.438 §28; 1987 c.414 §26; 1993 c.520 §1; 1993 c.744 §65; 1999 c.723 §1; 2001 c.683 §25]

Boiler Blowoff. An outlet on a boiler to permit emptying or discharge of sediment.

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.

DEFINITIONS

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 5 feet (1524 mm) outside the building wall.

Building Drain (Sanitary). A building drain that conveys sewage only.

Building Official. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative of the building official.

Building Drain (Storm). A building drain that conveys storm water or other drainage, but no sewage.

Building Sewer. See OAR 918-690-0410 and ORS 701.348.

OAR 918-690-0410(2) and ORS 701.348 are not a part of this code but is reproduced here for the reader's convenience:

OAR 918-690-0410(2)

(2) "Building sewer" is defined in ORS 701.348;

Stat. Auth.: ORS 447.020

Stats. Implemented: ORS 447.020

Hist: BCD 6-1998, f. 3-2-98, cert. ef. 4-1-98; BCD 2-2011, f. 2-15-11, cert. ef. 4-1-11

ORS 701.348(4)

(4) As used in this section, "building sewer" means that part of the system of drainage piping that conveys sewage into a septic tank, cesspool or other treatment unit that begins five feet outside the building or structure within which the sewage originates.

[Formerly 701.138; 2013 c.1 §90]

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 other 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 carrying potable water from the water meter or other source of water supply to a building or other point of use or distribution on the lot. Building supply shall also mean water service.

205.0

– C –

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.

Clarifier. See Interceptor.

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.

Clinic Sink. A sink designed primarily to receive wastes from bedpans and having a flush rim, an integral trap with a visible trap seal, and the same flushing and cleansing characteristics as a water closet.

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 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 by means of 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).

Common. That part of a plumbing system that is so designed and installed as to serve more than one appliance, fixture, building, or system.

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 m³/kW) of the aggregate input rating of all fuel-burning appliances installed in that space.

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

Continuous Vent. A vertical vent that is a continuation of the drain to which it connects.

Continuous Waste. A drain connecting the compartments of a set of fixtures to a trap or connecting other permitted fixtures to a common trap.

CPVC. Chlorinated Poly (Vinyl Chloride).

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 –

Design Flood Elevation. The elevation of the “design flood,” including wave height, relative to the datum specified by the Flood Plain Administrator.

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

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

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 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.

Durham System. A 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 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 is applicable also to air gap.)

Essentially Nontoxic Transfer Fluid. Essentially nontoxic at practically nontoxic, Toxicity Rating Class 1 (reference “Clinical Toxicology of Commercial Products” by Gosselin, Smith, Hodge, & Braddock).

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

208.0 – F –

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 drain pipe.

Fixture Supply. A water supply pipe 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 air that exceeds 25 percent of its lower flammability limit (LFL).

Flood Hazard Area. The area designated as a flood hazard by the Flood Plain Administrator.

Flood Hazard Area Subject to High Velocity Wave Action. Area within the flood hazard area that is subject to high velocity wave action as determined by the Flood Plain Administrator.

Flood Level. See Flooded.

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

Flooded. A fixture is flooded where the liquid therein rises to the flood-level rim.

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 the purpose of 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 effluent by separation, mass and volume reduction.

Food Service Establishment. A facility that engages in activities of preparing or serving food or beverage for consumption by person(s) either on or off the premises, including but not limited to restaurants, cafes, commercial kitchens, caterers, hotels and motels, schools, hospitals, prisons, correctional facilities, nursing homes, care institutions, and any other facility preparing and serving food for consumption.

209.0 – G –

Gang or Group Shower. Two or more showers in a common area.

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 professional engineer.] Gravity grease interceptors are generally installed outside.

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 non-petroleum fats, oils and grease (FOG) from the interceptor, the control of which are either automatic or manually initiated.

210.0 – H –

Hangers. See Supports.

High Hazard. See Contamination.

Horizontal Branch. A drain pipe extending laterally from a 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 to 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, and/or barriers in combination or separately, and one of the following:

- A – External flow control, with air intake (vent), directly connected.
- B – External flow control, without air intake (vent), directly connected.
- C – Without external flow control, directly connected.
- D – Without external flow control, indirectly connected.

These interceptors comply with the requirements of Table 10-2. Hydromechanical grease interceptors are generally installed inside.

211.0 – I –

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

Interceptor (Clarifier). A device designed and installed so as to separate and retain deleterious, hazardous, or undesirable matter from normal wastes and permit normal sewage or liquid wastes to discharge into the disposal terminal by gravity.

Invert. The lowest portion of the inside of a horizontal pipe.

212.0 – J –

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

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

213.0 – K –

No definitions.

214.0 – L –

Labeled. Equipment or materials bearing a label of a listing agency (accredited conformity assessment body). See Listed (third-party certified).

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.

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 specified manner.

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

Lot. A single or individual parcel or area of land legally recorded or validated by other means acceptable to the municipality 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.

215.0 – M –

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.

May. A permissive term.

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.

216.0 – N –

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.

218.0 – P –

PB. Polybutylene.

PE. Polyethylene.

PE-AL-PE. Polyethylene-aluminum-polyethylene.

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

PEX. Cross-linked polyethylene.

PEX-AL-PEX. Cross-linked polyethylene–aluminum–cross-linked polyethylene.

Pipe. A cylindrical conduit or conductor conforming to the particular 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 pre-fabricated 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

DEFINITIONS

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 System. Includes all potable water, 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 water heaters and vents for same.

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

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

PP. Polypropylene.

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

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

Static Pressure. The pressure existing without any flow.

Pressure-Balancing Valve. A mixing valve that senses incoming hot and cold water pressures and compensates for fluctuations in either to stabilize outlet temperature.

Private or Private Use. Applies to plumbing fixtures in residences and apartments, to private bathrooms in hotels and hospitals, 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 by other regulating agencies.

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 other point of disposal.

Public or Public Use. Applies to plumbing fixtures that are not defined as private or private use.

Public Sewer. A common sewer directly controlled by public authority.

PVC. Poly(vinyl chloride).

PVDF. Polyvinylidene Fluoride.

219.0

– Q –

No definitions.

220.0

– R –

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.

Regulating Equipment. Includes valves and controls used in a plumbing system that are 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 to the furthest outlet on 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.

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, vent piping, and the necessary fixture supports.

221.0

– S –

Sand Interceptor. See Interceptor.

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.

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.

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, clinic 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 a soil or waste stack 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.

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.

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.

222.0 – T –

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.

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. That portion 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 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 –

Unconfined Space. A room or space having a volume equal to not less than 50 cubic feet per 1000 Btu/h (4.83 m³/kW) of the aggregate input rating of all fuel-burning appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the unconfined space.

Unsanitary. See Insanitary.

224.0 – V –

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

Vacuum Breaker. See Backflow Preventer.

Vacuum Relief Valve. A device that prevents excessive vacuum in a pressure vessel.

Vent. A pipe provided to ventilate a plumbing system, to prevent trap siphonage and back-pressure, or to equalize the air pressure within the drainage system.

Vent Pipe. See 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. 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 back-pressure.

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.

DEFINITIONS

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 so as to change its chemical content or remove suspended solids by filtration.

Water-Distributing 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. Device designed to provide protection against hydraulic shock in the building water supply system.

Water Main (Street Main). A water supply pipe for public or community use.

Water Supply System. The building supply pipe, the water distributing 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.

Wet Room. A barrier free floor with a shower and drainage fixture(s).

Welded Joint or Seam. Any joint or seam obtained by the joining of metal parts in the plastic molten state.

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 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 a soil or waste stack to a vent stack for the purpose of preventing pressure changes in the stacks.

228.0 – Z –

No definitions.

CHAPTER 3

GENERAL REGULATIONS

301.0 Materials – Standards and Alternates.

301.1 Minimum Standards.

301.1.1 Approvals. Pipe, pipe fittings, traps, fixtures, material, and devices used in a plumbing system shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) and shall comply 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 building official for approval.

301.1.2 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 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. 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 building official. Such marking shall be done by the manufacturer. Field markings shall not be acceptable.

301.1.3 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, there may be only a portion of the listed standard that is applicable. Design and materials for special conditions or materials not provided for herein shall be permitted to be used only by special permission of the State Plumbing Board after the State Plumbing Board has been satisfied as to their adequacy. A list of accepted plumbing materials standards is included in Table 14-1 for the convenience of the users of this code. They are not considered as a part of this code unless formally adopted as such by the State Plumbing Board.

301.1.4 Existing Buildings. In existing buildings or premises in which plumbing installations are to be altered, repaired, or renovated, the building official 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.

301.2 Alternate Materials and Methods of Construction Equivalency. Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or

superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this code. Technical documentation shall be submitted to the building official to demonstrate equivalency. The building official 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 building official shall have no effect beyond the jurisdictional boundaries of said building official. Any alternate material or method of construction so approved shall not be considered as conforming to the requirements and/or intent of this code for any purpose other than that granted by the building official when the submitted data does not prove equivalency.

301.2.1 Testing. The building official shall have the authority to require tests, as proof of equivalency.

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

301.2.1.2 Request by Building Official. The building official shall have the authority to require tests to be made or repeated if, at any time, there is reason to believe that any material or device no longer conforms to the requirements on which its approval was based.

301.3 Flood Hazard Resistance.

301.3.1 General. Plumbing systems shall be located above the design flood elevation as determined by the local governing authority.

Exception: Plumbing systems are permitted to be located below the design flood elevation 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 the design flood elevation.

301.3.2 Flood Hazard Areas Subject to High-Velocity Wave Action. Plumbing systems in buildings located in flood hazard areas subject to high-velocity wave action shall meet the requirements of Section 301.3.1, and plumbing systems, pipes, and fixtures shall not be mounted on or penetrate through walls that are intended to breakaway under flood loads as required by the Building Code.

301.4 Alternative Engineered Design.

301.4.1 Design Criteria. An alternative engineered design shall conform to 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.

301.4.2 Permit Application. The registered professional engineer 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.

301.4.3 Technical Data. The registered professional engineer shall submit sufficient technical data to substantiate the proposed alternative engineered design and to prove that the performance meets the intent of this code.

301.4.4 Design Documents. The registered professional engineer shall provide two complete sets of signed and sealed design documents for the alternative engineered design for submittal to the building official. 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.

301.4.5 Design Approval. Any approval of an alternative engineered design shall be at the discretion of the building official. The exercise of this discretionary approval by the building official shall have no effect beyond the jurisdictional boundaries of said building official. An alternative engineered design so approved shall not be considered as conforming to the requirements and/or intent of this code for any purpose other than that granted by the building official.

301.4.6 Design Review. The building official shall have the authority to require testing of the alternative engineered design in accordance to Section 301.2.1, including the authority to require an independent review of the design documents by a registered professional engineer selected by the building official and at the expense of the applicant.

301.4.7 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.

302.0 Iron Pipe Size (IPS) Pipe. Iron, steel, brass, and copper pipe shall be standard-weight iron pipe size (IPS) pipe.

303.0 Disposal of Liquid Waste. It shall be unlawful for any person to cause, suffer, or permit the disposal of sewage, human excrement, or other liquid wastes, in any 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. 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 Sewers Required. Every building in which plumbing fixtures are installed shall have a connection to a public or private sewer except as provided in Section 305.1.

305.1 When a public sewer is not available for use, drainage piping from buildings and premises shall be connected to an approved private sewage disposal system.

305.2 In cities and/or counties where the installation of building sewers is under the jurisdiction of a department other than the building official, the provisions of this code relating to building sewers need not apply.

306.0 Damage to Drainage System or Public Sewer.

It shall be unlawful for any person to deposit, by any means whatsoever, into any plumbing fixture, floor drain, interceptor, sump, receptor, or device, which is connected to any 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 would, or could, cause damage to the drainage system or public sewer.

306.1 Roofs, inner courts, vent shafts, light wells, or similar areas having rainwater drain, shall discharge to the outside of the building or to the gutter and shall not be connected to the sanitary drainage system unless first approved by the building official.

307.0 Industrial 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 building official or the Authority Having Jurisdiction.

307.1 Safe Discharge. Sewage or other waste from a plumbing system that may be deleterious to surface or subsurface waters shall not be discharged into the ground or into any waterway unless it has first been rendered safe by some acceptable form of treatment as required by the building official or the Authority Having Jurisdiction.

308.0 Location. 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 any lot other than the lot that is the site of the building, structure, or premises served by such facilities.

308.1 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.

309.0 Improper Location. Piping, fixtures, 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.

310.0 Workmanship. Design, construction, and workmanship shall be in conformity with accepted engineering practices and shall be of such character as to secure the results sought to be obtained by this code.

310.1 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 any paint, wax, tar, solvent cement, other leak-sealing or repair agent.

310.2 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.

310.3 Installation Practices. Plumbing systems shall be installed in a manner conforming to this code, applicable standards, and the manufacturer's installation instructions. In instances where the code, applicable standards, or the manufacturer's instructions conflict, the more stringent provisions shall prevail.

311.0 Prohibited Fittings and Practices. 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.

311.1 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.

311.2 Waste Connection. No waste connection shall be made to a closet bend or stub of a water closet or similar fixture.

311.3 Use of Vent and Waste Pipes. Except as hereinafter provided in Section 908.0, Section 909.0, and Section 910.0, no vent pipe shall be used as a soil or waste pipe, nor shall any soil or waste pipe be used as a vent. Also, single-stack drainage and venting systems with unvented branch lines are prohibited.

311.4 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 per Section 301.1 of this code. The enlargement of a 3 inch (76 mm) closet bend or stub to 4 inches (102 mm) shall not be considered an obstruction.

311.5 Dissimilar Metals. Except for necessary valves, where inter-membering or mixing of dissimilar metals occurs, the point of connection shall be confined to exposed or accessible locations.

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

311.7 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.

312.0 Independent Systems. The drainage system of each new building and of new work installed in any existing building shall be separate and independent from that of any other building, and, when 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 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.

313.0 Protection of Piping, Materials, and Structures. 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 appropriately sealed.

313.1 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.

313.2 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 5 feet (1524 mm) of any building or structure, or less than 1 foot (305 mm) below the surface of the ground.

313.3 Corrosion, Erosion, and Mechanical Damage. Piping subject to corrosion, erosion, or mechanical damage shall be protected in an approved manner.

313.4 Protectively Coated Pipe. Protectively coated pipe shall be inspected and tested, and any visible void, damage, or imperfection to the pipe coating shall be repaired to comply with Section 313.0.

313.5 Freezing Protection. No water, soil, or waste pipe shall be installed or permitted outside of a building or in an exterior wall unless, where necessary, adequate provision is made to protect such pipe from freezing.

313.6 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, applicable standards referenced in Table 14-1 and Chapter 15, "Firestop Protection."

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313.7 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. Counterflashing shall not restrict the required internal cross-sectional area of the vent.

313.8 Steel Nail Plates. Plastic and copper 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 1½ inches (38 mm) beyond the outside diameter of the pipe or tubing.

313.9 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.

313.9.1 Building Loads. Piping through concrete or masonry walls shall not be subject to any load from building construction.

313.9.2 Exterior Walls. In exterior walls, annular space between sleeves and pipes shall be sealed and made watertight, as approved by the building official. A penetration through fire-resistive construction shall be in accordance with Section 313.6.

313.9.3 Firewalls. A pipe sleeve through a firewall shall have the space around the pipe completely sealed with an approved fire-resistive material in accordance with other codes.

313.10 Structural Member. 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.

313.11 Rodentproofing. Strainer plates on drain inlets shall be designed and installed so that no opening is exceeding ½ inch (12.7 mm) in the least dimension.

313.11.1 Meter Boxes. Meter boxes shall be constructed in such a manner that rats cannot enter a building by following the service pipes from the box into the building.

313.11.2 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.

313.11.3 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.

314.0 Hangers and Supports. Suspended piping shall be supported at intervals not to exceed those shown in Table 3-2.

Exception: Piping supported per the manufacturer’s installation instructions.

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

314.2 Underground Piping. 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 per Section 301.0 of this code.

314.3 Strength. Hangers and anchors shall be of sufficient strength to support the weight of the pipe and its contents. Piping shall be isolated from incompatible materials.

314.4 Piping, Fixtures, Appliances, and Appurtenances. Piping, fixtures, appliances, and appurtenances shall be adequately supported in accordance with this code, the manufacturer’s installation instructions, and as required by the building official.

314.5 Hanger Rod Sizes. Hanger rod sizes shall be no smaller than those shown in Table 3-1.

**TABLE 3-1
HANGER ROD SIZES**

PIPE AND TUBE SIZE	ROD SIZE
Inches	Inches
½ – 4	¾
5 – 8	½
10 – 12	⅝

For SI units: 1 inch = 25.4 mm

315.0 Trenching, Excavation, and Backfill. Trenches deeper than the footing of any building or structure and paralleling the same shall be not less than 45 degrees (0.79 rad) therefrom, or as approved per Section 301.0 of this code.

315.1 Tunneling and Driving. Tunneling and driving shall be permitted to be done in yards, courts, or driveways of any 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). When pipes are driven, the drive pipe shall be not less than one size larger than the pipe to be laid.

315.2 Open Trenches. Excavations required to be made for the installation of a building drainage system or any 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.

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

316.0 Joints and Connections.

316.1 Types of Joints.

316.1.1 Threaded Joints. Threads on iron pipe size (IPS) pipe and fittings shall be standard taper pipe threads in accordance with standards listed in Table 14-1. Threads on tubing shall be approved types. Threads on plastic pipe shall be factory cut or molded. Threaded plastic pipe shall be Schedule 80 minimum wall thickness. Tubing threads shall conform to fine tubing thread standards. When a pipe joint material is used, it shall be applied only on male threads, and such materials shall be approved types, insoluble in water and nontoxic. Cleanout plugs and caps shall be lubricated with water-insoluble, nonhardening material or tape. Thread tape or thread lubricants and sealants specifically intended for use with plastics shall be used on plastic threads. Conventional pipe thread compounds, putty, linseed-oil-based products, and unknown lubricants and sealants shall not be used on plastic threads.

316.1.2 Wiped Joints. Joints in lead pipe or fittings or between lead pipe or fittings and brass or copper pipe, ferrules, solder nipples, or traps shall be full-wiped joints. Wiped joints shall have an exposed surface on each side of a joint not less than $\frac{3}{4}$ inch (19.1 mm) and not less than as thick as the material being joined. Wall or floor flange lead-wiped joints shall be made by using a lead ring or flange placed behind the joint at the wall or floor. Joints between lead pipe and cast-iron, steel, or wrought iron shall be made by means of a caulking ferrule or soldering nipple.

316.1.3 Soldered Joints. Joints in copper tubing shall be made by the appropriate use of approved copper or copper alloy fittings. Surfaces to be joined by soldering shall be cleaned bright by manual or mechanical means. The joints shall be properly fluxed with an approved-type flux and made up with approved solder. Solder and fluxes shall be manufactured to approved standards. Solders and fluxes with a lead content that exceeds .02 percent shall be prohibited in piping systems used to convey potable water.

316.1.4 Flared Joints. Flared joints for soft copper tubing shall be made with fittings meeting approved standards. The tubing shall be reamed to the full inside diameter, resized to round, and expanded with a proper flaring tool.

316.1.5 Flexible Compression Factory-Fabricated Joints. Where pipe is joined by means of flexible compression joints, such joints shall conform to approved standards and shall not be considered as slip joints.

316.1.6 Solvent Cement Plastic Pipe Joints. Plastic pipe and fittings designed to be joined by solvent cementing shall comply with applicable standards referenced in Table 14-1.

ABS pipe and fittings shall be cleaned and then joined with solvent cement(s).

CPVC pipe and fittings shall be cleaned and then joined with listed primer(s) and solvent cement(s).

Exception: Listed solvent cements that do not require the use of primer shall be permitted for use with CPVC pipe and fittings, manufactured in accordance with ASTM D2846, $\frac{1}{2}$ inch (15 mm) through 2 inches (50 mm) in diameter.

PVC pipe and fittings shall be cleaned and joined with primer(s) and solvent cement(s).

A solvent cement transition joint between ABS and PVC building drain and building sewer shall be made using a listed transition solvent cement.

316.1.7 Brazing and Welding. Brazing and welding shall conform to the applicable standard(s) in Table 14-1. Only brazing alloys having a liquid temperature above 1000°F (538°C) shall be used. Brazing on medical gas systems shall be performed by certified installers meeting the requirements of ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications, or AWS B2.2.

316.1.8 Pressure-Lock-Type Connection. This is a mechanical connection that depends on an internal retention device to prevent pipe or tubing separation. Connection is made by inserting the pipe or tubing into the fitting to a prescribed depth.

316.1.9 Pressed Fitting. This is a mechanical connection for joining copper tubing that uses a crimping tool to affix the O-ring seal copper or copper alloy fitting to the tubing. The tubing shall be inserted into the fitting, and the crimp shall be made using the tool recommended by the manufacturer.

316.1.10 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.

316.1.11 Heat Fusion Weld Joints. This type of joint is used in some thermoplastic systems to connect 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.

316.2 Special Joints.

316.2.1 Copper Tubing to Screw Pipe Joints. Joints from copper tubing to threaded pipe shall be made by the use of brass adapter fittings. The joint between the copper tubing and the fitting shall be a soldered brazed flared, or pressed joint and the connection between the threaded pipe and the fitting shall be made with a standard pipe size screw joint. Solder shall conform to the requirements of Section 316.1.3. Brazed joints shall conform to the requirements of Section 316.1.7. Flared joints shall conform to the requirements of Section 316.1.4. Pressed joints shall conform to the requirements of Section 316.1.9.

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316.2.2 Unions. Approved unions shall be permitted to be used in drainage piping when accessibly located in the trap seal or between a fixture and its trap in the vent system, except underground or in wet vents, at any point in the water supply system.

316.2.3 Plastic Pipe to Other Materials. When connecting plastic pipe to other types of piping, only approved types of fittings and adapters designed for the specific transition intended shall be used.

316.3 Flanged Fixture Connections. Fixture connections between drainage pipes and water closets, floor outlet service sinks and urinals shall be made by means of approved brass, 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.

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

316.3.2 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.

316.4 Prohibited Joints and Connections.

316.4.1 Drainage System. A fitting or connection that has an enlargement, chamber, or recess with a ledge, shoulder, or reduction of pipe area that offers an obstruction to flow through the drain shall be prohibited.

316.4.2 Obstruction. No fitting or connection that offers abnormal obstruction to flow shall be used. The enlargement of a 3 inch (76 mm) closet bend or stub to 4 inches (102 mm) shall not be considered an obstruction.

317.0 Increases and Reducers. Where different sizes of pipes and fittings are to be connected, the proper size increasers or reducers or reducing fittings shall be used between the two sizes. Brass or cast-iron body cleanouts shall not be used as a reducer or adapter from cast-iron drainage pipe to iron pipe size (IPS) pipe.

318.0 Food-Handling Establishments. Food or drink shall not be stored, prepared, or displayed beneath soil or drain pipes, 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 drain pipes be located over such areas, the installation shall be made with the least possible number of joints and shall be installed so as to connect to the nearest adequately sized vertical stack with the provisions as follows:

318.1 Openings through floors over such areas shall be sealed watertight to the floor construction.

318.2 Floor and shower drains installed above such areas shall be equipped with integral seepage pans.

318.3 Soil or drain pipes shall be of an approved material as listed in Table 14-1 and Section 701.0. Materials shall conform to established standards. Cleanouts shall be extended through the floor construction above.

318.4 Piping subject to operation at temperatures that will form condensation on the exterior of the pipe shall be thermally insulated.

318.5 Where pipes are installed in ceilings above such areas, the ceiling shall be of the removable type, or shall be provided with access panels in order to form a ready access for inspection of piping.

319.0 Test Gauges. Tests in accordance with this code, which are performed utilizing dial gauges, shall be limited to gauges having the following pressure graduations or incrementations.

319.1 Pressure Tests (10 psi or less). Required pressure tests of 10 pounds-force per square inch (psi) (69 kPa) or less shall be performed with gauges of 0.10 psi (0.69 kPa) incrementation or less.

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

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

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

**TABLE 3-2
HANGERS AND SUPPORTS**

MATERIALS	TYPES OF JOINTS	HORIZONTAL	VERTICAL
Cast	Lead and Oakum	5 feet, except 10 feet where 10 foot lengths are installed ^{1, 2, 3}	Base and each floor, not to exceed 15 feet
	Compression Gasket	Every other joint, unless over 4 feet then support each joint ^{1, 2, 3}	Base and each floor, not to exceed 15 feet
Cast-Iron Hubless	Shielded Coupling	Every other joint, unless over 4 feet then support each joint ^{1, 2, 3, 4}	Base and each floor, not to exceed 15 feet
Copper Tube and Pipe	Soldered or Brazed	1½ inches and smaller, 6 feet; 2 inches and larger, 10 feet	Each floor, not to exceed 10 feet ⁵
Steel and Brass Pipe for Water or DWV	Threaded or Welded	¾ inch and smaller, 10 feet; 1 inch and larger, 12 feet	Every other floor, not to exceed 25 feet ⁵
Steel, Brass, and Tinned Copper Pipe for Gas	Threaded or Welded	½ inch, 6 feet; ¾ inch and 1 inch, 8 feet; 1¼ inches and larger, 10 feet	½ inch, 6 feet; ¾ inch and 1 inch, 8 feet; 1¼ inches every floor level
Schedule 40 PVC and ABS DWV	Solvent Cemented	All sizes, 4 feet; allow for expansion every 30 feet ^{3, 6}	Base and each floor; provide mid-story guides; provide for expansion every 30 feet ⁶
CPVC	Solvent Cemented	1 inch and smaller, 3 feet; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides ⁶
Lead	Wiped or Burned	Continuous Support	Not to exceed 4 feet
Copper	Mechanical	In accordance with standards acceptable to the building official	
Steel and Brass	Mechanical	In accordance with standards acceptable to the building official	
PEX	Cold Expansion, Insert and Compression	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
PEX-AL-PEX	Metal Insert and Metal Compression	½ inch } ¾ inch } 1 inch } All sizes 98 inches	Base and each floor; provide mid-story guides
PE-AL-PE	Metal Insert and Metal Compression	½ inch } ¾ inch } 1 inch } All sizes 98 inches	Base and each floor; provide mid-story guides
Polypropylene (PP)	Fusion weld (socket, butt, saddle, electrofusion), threaded (metal threads only), or mechanical	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides

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

Notes:

- ¹ Support adjacent to joint, not to exceed 18 inches (457 mm).
- ² Brace not to exceed 40 foot (12 192 mm) intervals to prevent horizontal movement.
- ³ Support at each horizontal branch connection.
- ⁴ Hangers shall not be placed on the coupling.
- ⁵ Vertical water lines shall be permitted to be supported in accordance with recognized engineering principles with regard to expansion and contraction, where first approved by the building official.
- ⁶ See the appropriate IAPMO Installation Standard for expansion and other special requirements.

CHAPTER 4

PLUMBING FIXTURES AND FIXTURE FITTINGS

401.0 Materials – General Requirements.

401.1 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. Except as permitted elsewhere in this code, fixtures shall conform in quality and design to nationally recognized applicable standards included in Table 14-1.

401.2 Lead. Sheet lead shall be not less than the following:

For safe pans not less than 4 pounds per square foot (lb/ft²) (19 kg/m²) or 1/16 of an inch (1.6 mm) thick. (See Table 14-1)

401.3 Plumbing fixture fittings covered under the scope of NSF 61 shall comply with the requirements of NSF 61.

402.0 Water-Conserving Fixtures and Fittings. Flush volumes for low-consumption and water-saver water closets and urinals shall be in accordance with applicable standards referenced in Table 14-1.

402.1 Water Closets. Water closets, either flush tank, flushometer tank, or flushometer valve operated, shall have an average consumption of a maximum of 1.6 gallons (6.0 Lpf) of water per flush.

402.2 Urinals. Urinals shall have an average water consumption of a maximum of 1 gallon (3.8 Lpf) of water per flush.

402.2.1 Nonwater Urinals. Nonwater urinals shall be listed and comply with the applicable standards referenced in Table 14-1. Nonwater urinals shall have a barrier liquid sealant to maintain a trap seal. Nonwater urinals shall permit the uninhibited flow of waste through the urinal to the sanitary drainage system. Where nonwater urinals are installed they shall have a water distribution line rough-in to the urinal location to allow for the installation of an approved backflow prevention device in the event of a retrofit.

402.3 Metered Faucets. Self-closing or self-closing metering faucets shall be installed on lavatories intended to serve the transient public in service stations, train stations, airports, and convention halls. Metered faucets shall deliver a maximum of 0.25 gallons (1.0 L) of water per use. Employee restrooms not generally used by the public shall be exempt from the requirement of self-closing lavatory faucets.

402.4 Emergency Safety Showers. Emergency safety showers shall not be limited in their water supply flow rates.

402.5 Installation. Water-conserving fixtures shall be installed in strict accordance with the manufacturer's instructions to maintain their rated performance.

402.6 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 ASME A112.18.1/CSA B125.1 and shall be equipped with an integral automatic shutoff.

403.0 Overflows. When any fixture is provided with an overflow, the waste shall be so arranged that the standing water in the fixture cannot rise in the overflow when the stopper is closed or remain in the overflow when the fixture is empty. The overflow pipe from a fixture shall be connected on 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.

404.0 Strainers and Connections.

404.1 Strainers. Plumbing fixtures, other than water closets and urinals, shall be equipped with approved strainers having an approved waterway area. Strainers serving shower drains shall have a waterway equivalent to the area of the tailpiece.

404.2 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.

404.3 Continuous Wastes. Continuous wastes and fixture tailpieces shall be constructed from the materials specified in Section 701.0 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). Each such tailpiece, continuous waste, or waste and overflow shall be not less than 1½ inches (40 mm) O.D. for sinks, dishwashers, laundry tubs, bathtubs, urinals, and similar fixtures, and not less than 1¼ inches (32 mm) for lavatories, drinking fountains, and similar small fixtures.

404.4 Approved wye or other directional-type branch fittings shall be installed in continuous wastes connecting or receiving the discharge from food waste disposal units, dishwashers, clothes washers, or other force discharge fixtures or appliances. No dishwasher drain shall be connected to a sink tailpiece, continuous waste, or trap on the discharge side of a food waste disposal unit.

405.0 Prohibited Fixtures. Water closets having an invisible seal or an unventilated space or having walls which are not thoroughly washed at each discharge shall be prohibited. Any water closet that might permit siphonage of the contents of the bowl back into the tank shall be prohibited. Drinking fountains shall not be installed in public toilet rooms.

405.1 Prohibited Urinals. Trough urinals and urinals with an invisible seal shall be prohibited.

405.2 Miscellaneous Fixtures. Fixed wooden, or tile wash trays or sinks for domestic use shall not be installed in any 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 any 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 and/or waste connections shall be submitted for approval to the building official 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 (0.0625 inches) (1.6 mm). Sheet-metal plumbing fixtures shall be adequately designed, constructed, and braced in an approved manner to satisfactorily 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 meet the applicable nationally recognized standards and shall be used in accordance with their listing.

407.0 Installation.

407.1 Cleaning. Plumbing fixtures shall be installed in a manner to afford easy access for repairs and cleaning. Where practical, pipes from fixtures shall be run to the nearest wall.

407.2 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.

407.3 Securing Fixtures. Floor-outlet or floor-mounted fixtures shall be rigidly secured to the drainage connection and to the floor, when so designed, by screws or bolts of copper, brass, or other equally corrosion-resistant material.

407.4 Wall-Hung Fixtures. Wall-hung fixtures shall be rigidly supported by metal supporting members so that no strain is transmitted to the connections. Flush tanks and similar appurtenances shall be secured by approved non-corrosive screws or bolts.

407.5 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 any side wall or obstruction nor closer than 30 inches

(762 mm) center to center to any similar fixture. The clear space in front of any water closet 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 any side wall or partition nor closer than 24 inches (610 mm) center to center. The clear space in front of water closets and bidets in residential structures shall not be less than 21 inches (533.4mm).

Exception: The installation of paper dispensers or accessibility grab bars shall not be considered obstructions.

407.6 Installations for Persons with Disabilities. Where facilities for persons with disabilities are required in applicable building regulations, the facilities shall be installed in accordance with those regulations.

407.7 Supply Fittings. The supply lines and fittings for every plumbing fixture shall be so installed as to prevent backflow as required in Chapter 6.

408.0 Water Closets. 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. Water closets shall be equipped with seats as required below.

408.1 Water Closet Seats. Water closet seats shall be of smooth, non-absorbent material. Seats for public use shall conform to the applicable standard referenced in Table I4-1.

408.1.1 Type. Water closet seats, for public use, shall be of the elongated type and either of the open front type or have an automatic seat cover dispenser.

408.1.2 Size. Water closet seats shall be properly sized for the water closet bowl type.

408.2 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 to the floor by corrosion-resistant screws or bolts. The closet flange shall be 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 floor flanges shall not be used.

408.3 Closet Rings (Closet Flanges).

408.3.1 Closet rings (closet flanges) for water closets or similar fixtures shall be of an approved type and shall be bronze, 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, when installed, shall, together with the soil pipe, present a 1½ inch (38 mm) wide flange or face to receive the fixture gasket or closet seal.

408.3.2 Caulked-on closet rings (closet flanges) shall be not less than ¼ inch (6.4 mm) thick and not less than 2 inches (51 mm) in overall depth.

408.3.3 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.

408.3.4 Closet rings (closet flanges) shall be adequately designed and secured to support fixtures connected thereto.

408.3.5 Closet screws, bolts, washers, and similar fasteners shall be of brass, copper, or other listed, equally corrosion-resistant materials. Screws and bolts shall be of adequate size and number to properly support the fixture installed.

409.0 Urinals. A water supply to a urinal shall be protected by an approved-type vacuum breaker or other approved back-flow prevention device as described in Section 603.4.

410.0 Flushing Devices for Water Closets and Urinals.

410.1 Flushing Devices Required. Each water closet, urinal, clinic 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 meet anti-siphon requirements required in Chapter 6.

Exception: Nonwater urinals as required in section 402.2.1.

410.2 Automatic Flushing Tanks. Tanks flushing more than 1 urinal shall be automatic in operation and of sufficient capacity to provide the necessary volume to flush and properly cleanse urinals simultaneously. Automatically controlled flushometer valves shall be permitted to be substituted for flush tanks.

410.3 Flushometer Valves. 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 properly operate them. When 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.

410.4 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 completely shut off the water

flow to the tank when the tank is filled to operational capacity. Provision shall be made to automatically supply water to the fixture so as to refill the trap seal after each flushing. The water supply to flush tanks equipped for automatic flushing shall be controlled by a suitable timing device.

410.5 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 when installed per manufacturer's instructions.

411.0 Floor Drains and Shower Stalls. 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, floor receptors, and shower drains shall be of an approved type, suitably flanged to provide a watertight joint in the floor.

411.1 Location of Floor Drains. Floor drains shall be installed in the following areas:

411.1.1 Toilet rooms containing two or more water closets or a combination of one water closet and one urinal, except in a dwelling unit. Floor mounted urinals may be used as a floor drain to meet the requirements of this section when there are two or more such urinals.

411.1.2 Commercial kitchens and in accordance with Section 704.3.

411.1.3 Laundry rooms in commercial buildings and common laundry facilities in multi-family dwelling buildings.

411.2 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 if required under Section 801.2.2 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, when supplied, are 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.

411.3 Floor Slope. Floors shall be sloped to floor drains.

411.4 Shower receptors are plumbing fixtures and shall conform to the general requirements contained in Table 14-1. Each such shower receptor shall be constructed of vitrified china or earthenware, ceramic tile, porcelain-enameled metal, or of such other material acceptable to the building official. No shower receptor shall be installed unless it conforms to acceptable standards as referenced in Table 14-1 or until a specification or a prototype or both of such receptor has first been submitted to and approval obtained from the building official.

411.5 Each shower receptor shall be an approved type and be so constructed as to have a finished dam, curb, or threshold that is not less than 1 inch (25.4 mm) lower than the sides and back of such receptor. In no case shall any dam or threshold be less than 2 inches (51 mm) or exceeding 9 inches (229 mm) in depth when 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 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 toward the drain not less than ¼ inch per foot (20.8 mm/m), nor more than ½ inch per foot (41.8 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.

Exception: Showers that are designed to comply with the accessibility standards listed in Table 14-1.

411.6 Shower Compartments. Shower compartments, regardless of shape, shall have a minimum finished interior of 1024 square inches (0.66.06 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 at 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, shower head, 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 comply 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.
- (3) Wet Rooms. The area of the floor serving each shower fixture(s) shall be no less than 4 feet by 4 feet (1219 mm by 1219 mm) and be sloped no less than one quarter inch per foot to the drainage fixture. The floor area serving the shower shall be protected with an approved membrane system as described in Section 411.7 “Non metallic shower sub pans”, or as approved by the building official.

411.7 Lining for Showers and Receptors. When the construction of on-site built-up shower receptors are permitted by the building official, receptors built directly on the ground 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 in 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 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 approved backing so as not to occupy the space required for the wall covering and shall not be nailed or perforated at any point that is less than 1 inch (25.4 mm) above the finished dam or threshold. An approved-type subdrain shall be installed with every 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.

Shower lining materials shall comply with to approved standards acceptable to the building official and the State Plumbing Board.

Note: Lead and copper subpans or linings shall be insulated from conducting substances other than their connecting drain by 15 pound (6.8 kg) asphalt felt or its equivalent, and no lead pan or liner shall be constructed of material weighing less

than 4 lb/ft² (19 kg/m²). Copper pans or liners shall be not less than No. 24 B & S Gauge (0.02 inches) (0.51 mm). Joints in lead pans or liners shall be burned. Joints in copper pans or liners shall be soldered or brazed. Plastic pans shall not be coated with asphalt-based materials.

411.7.1 Tests for Shower Receptors. Shower receptors shall be tested for watertightness by filling with water to the level of the rough threshold. 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.

411.8 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 nor more than 16 feet (4877 mm) apart.

411.9 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 and the bather can adjust the valves prior to stepping into the shower spray.

411.10 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.

412.0 Fixtures and Fixture Fittings for Persons with Disabilities. Plumbing fixtures and fixture fittings for persons with disabilities shall comply with to the appropriate standards referenced in Table 14-1 of this code.

412.1 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) by a device that is in accordance with ASSE 1070 or CSA B125.3. The water heater thermostat shall not be considered a control for meeting this provision.

413.0 Dishwashing Machines.

413.1 Application. Domestic or commercial dishwashing machines shall comply with the applicable standards referenced in Table 14-1.

413.2 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 603.2.2, Section 603.2.5, or Section 603.2.6.

413.3 Drainage Connection. Domestic dishwashing machines shall discharge indirectly through an air gap fitting in accordance with Section 807.4 into a waste receptor, a wye branch fitting on the tailpiece of a kitchen sink, or dishwasher connection of a food waste grinder. Commercial dishwashing machines shall discharge indirectly through an air gap or direct connection in accordance with Section 704.3 with floor drain protection.

414.0 Bathtubs and Whirlpool Bathtubs. Unless otherwise listed, bathtubs and whirlpool bathtubs shall comply with the following requirements:

414.1 A removable panel shall be provided to access and remove the pump. Whirlpool pump access located in the crawl space shall be located no more than 20 feet (6096 mm) from an access door, trap door, or crawl hole.

414.2 The circulation pump shall be located above the crown weir of the trap.

414.3 The pump and the circulation piping shall be self-draining to minimize water retention in accordance with standards referenced in Table 14-1.

414.4 Suction fittings on whirlpool bathtubs shall comply with the listed standards.

414.5 Limitation of Hot Water 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) by a device that is in accordance with ASSE 1070 or CSA B125.3. Water heater thermostats shall not be considered a control for meeting this provision.

415.0 Installation of Fixture Fittings. Where two separate handles control the hot and cold water, the left-hand control of the faucet when facing the fixture fitting outlet shall provide the means to alter the hot water temperature from the fixture fitting.

Single-handle mixing valves shall have the flow of hot water correspond to the markings on the fitting.

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. Flow rate, discharge pattern, and temperature of flushing fluids shall be provided in accordance with ISEA Z358.1 based on the hazardous material.

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 Bidets.

417.1 Application. Bidets shall comply with the standards listed in Table 14-1.

417.2 Backflow Protection. The water supply to the bidet shall be protected according to Chapter 6, which allows for an air gap or vacuum breaker.

417.3 Limitation of Water Temperature in Bidets. The maximum hot water temperature discharging from a bidet shall be limited to 110°F (43°C) by a device that is in accordance with ASSE 1070 or CSA B125.3. Water heater thermostat shall not be considered a control for meeting this provision.

418.0 Future Fixtures. Where provisions are made for the future installation of fixtures, those provided for shall be considered in determining the required sizes of drain pipes. 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.

419.0 Shower and Tub-Shower Combination Control Valves. Showers and tub-shower combinations in buildings 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. These valves shall conform to ASME A112.18.1/CSA B125.1. Gang showers, where supplied with a single temperature-controlled water supply pipe, shall be controlled by a mixing valve that is in accordance with ASSE 1069. Handle position stops shall be provided on such valves and shall be adjusted per the manufacturer's instructions to deliver a maximum mixed water setting of 120°F (49°C). Water heater thermostats shall not be considered a suitable control for meeting this provision.

CHAPTER 5

WATER HEATERS

Part I

501.0 General.

501.1 Applicability. The regulations of this chapter shall govern the construction, location, and installation of fuel-burning instantaneous and other water heaters heating potable water. The minimum capacity for water heaters shall be in accordance with the first hour rating listed in Table 5-1. Design, construction, and workmanship shall be in accordance with accepted engineering practices, manufacturer's installation instructions, and applicable standards and shall be of such character as to secure the results sought to be obtained by this code. No water heater shall be hereinafter installed that does not comply with the type and model of each size thereof approved by the State Plumbing Board. A list of accepted gas appliance standards are included in Table 14-1.

502.0 Definitions.

502.1 Direct-Vent Water Heaters. Water heaters that are constructed and installed so that air for combustion is derived directly from the outside atmosphere and all flue gases are discharged to the outside atmosphere. [NFPA 54:3.3.6.3]

502.2 Hot Water Supply Boiler. A storage type potable water heating unit exceeding any of the parameters of Section 502.3. A Hot Water Supply Boiler is under the jurisdiction of the Oregon Boiler and Pressure Vessel Specialty Code.

→ **502.3** Storage type water heaters regulated by this code are appliances which heat potable water and are equipped with approved safety devices and operate at or below the following:

- (1) Volume of 120 gallons (454 L);
- (2) Water temperature of 210°F (99°C);
- (3) One hundred fifty pounds-force per square inch (psi) (1034 kPa) operating pressure; and
- (4) Two hundred thousand British Thermal Units (BTU) (58.6 kW•h) input.

→ **Exception:** Potable water heaters designed to create hot water instantaneously on demand without the use of a storage tank.

502.4 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.

502.5 Water Heater. An appliance for supplying hot water for domestic or commercial purposes. [NFPA 54:3.3.55.7]

502.6 Instantaneous-Tankless Water Heater. Potable water heating units, sometimes with a small buffer tank, designed to create hot water instantaneously on demand without the use of a storage tank, regardless of size or BTU input, and shall be listed per Table 14-1.

503.0 Permits.

503.1 General. It shall be unlawful for any person to install, remove, or replace or cause to be installed, removed, or replaced a water heater without first obtaining a permit from the building official to do so.

504.0 Inspection.

504.1 Final Water Heater Inspection. This inspection shall be made after work authorized by the permit has been installed. The building official 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 building official.

505.0 Water Heater Requirements.

505.1 Location. Water heater installations in bedrooms and bathrooms shall be in accordance with one of the following [NFPA 54:10.28.1]:

- (1) Fuel-burning water heaters may 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 505.1.1. The door assembly shall be installed with a threshold and bottom door seal and shall meet the requirements of Section 505.1.2. Combustion air for such installations shall be obtained from the outdoors. The closet shall be for the exclusive use of the water heater.

TABLE 5-1
FIRST HOUR RATING¹

Number of Bathrooms	1 to 1.5			2 to 2.5				3 to 3.5			
	1	2	3	2	3	4	5	3	4	5	6
First Hour Rating, ² Gallons	42	54	54	54	67	67	80	67	80	80	80

For SI units: 1 gallon = 3.785 L

Notes:

¹ The first hour rating is found on the "Energy Guide" label.

² Solar water heaters shall be sized to meet the appropriate first hour rating as shown in the table.

WATER HEATERS

(2) Water heater shall be of the direct vent type. [NFPA 54:10.28.1(2)]

505.1.1 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. [NFPA 80:6.1.4.2]

505.1.2 Gasketing. Gasketing on gasketed doors or frames shall be furnished in accordance with the published listings of the door, frame, or gasketing material manufacturer. [NFPA 80:6.4.8]

|| **Exception:** Where acceptable to the building official, gasketing of non-combustible or limited-combustible material (see NFPA 220) shall be permitted to be applied to the frame, provided closing and latching of the door are not inhibited.

505.2 Vent. Water heaters of other than the direct-vent type shall be located as close as practical to the chimney or gas vent. [NFPA 54:9.28.1.2]

505.3 Clearance.

505.3.1 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 instructions. [NFPA 54:10.28.2.1]

505.3.2 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 54:10.28.2.2]

505.4 Pressure-Limiting Devices. A water heater installation shall be provided with overpressure protection by means of an approved, listed device installed in accordance with the terms of its listing and the manufacturer's installation instructions. [NFPA 54:10.28.3]

505.5 Temperature-Limiting Devices. A water heater installation or a hot water storage vessel installation shall be provided with over temperature protection by means of an approved, listed device installed in accordance with the terms of its listing and the manufacturer's installation instructions. [NFPA 54:10.28.4]

505.6 Temperature, Pressure, and Vacuum Relief Devices. The installation of temperature, pressure, and vacuum relief devices or combinations thereof, 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 54:10.28.5]

506.0 Oil-Burning and Other Water Heaters. Water heaters deriving heat from fuels or types of energy other than gas shall be constructed and installed in accordance with approved standards. Vents or chimneys for such appliances

shall be 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 building official and || local and state fire-prevention agencies.

506.1 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 constructed, listed, and installed in accordance with nationally recognized applicable standards for such devices and a combination temperature and pressure-relief valve.

506.2 Indirect-Fired Water Heaters. Indirect-fired water heaters shall comply with the applicable sections of the ASME Boiler and Pressure Vessel Code, or to one of the other applicable standards shown in Table 14-1. 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. ←

506.2.1 Single-Wall Heat Exchanger. Indirect-fired water heater that incorporate a single-wall heat exchanger shall meet the following requirements:

- (1) Connected to a low-pressure hot water boiler limited to a maximum of 30 pounds-force per square inch gauge (psig) (207 kPa) by an approved safety or relief valve.
- (2) Heater transfer medium is either potable water or contains fluids having a toxicity rating or Class of 1.
- (3) Bear a label with the word "Caution," followed by the following statements:
 - (a) The heat-transfer medium shall be water or other nontoxic fluid having a toxic rating or Class of 1 as listed in Clinical Toxicology of Commercial Products, 5th edition.
 - (b) The pressure of the heat-transfer medium shall be limited to a maximum of 30 psig (207 kPa) by an approved safety or relief valve.

Note: The word "Caution" and the statements in letters having 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.

Exception: Solar water heaters with single-walled heat exchangers using non-toxic heat transfer fluids may have relief valves set at not more than One hundred fifty pounds-force per square inch (psi) (1034 kPa) .

507.0 Other Water Heater Installation Requirements.

The building official 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. ←

507.1 Seismic Provisions. In seismic design categories C, D, E, and F, 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.

507.2 Ground Support. A water heater supported from the ground shall rest on level concrete or other approved base extending not less than 3 inches (76 mm) above the adjoining ground level.

Exception: Water heaters in residential structures in seismic design category C are not required to be strapped or anchored to resist horizontal displacement due to earthquake motion.

507.3 Drainage Pan. Where a water heater is located in an attic, or any wood framed assembly, 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.

Exceptions:

- (1) Replacement of an existing water heater shall not require a water heater pan or drain unless one already exists.
- (2) Instantaneous water heaters.

507.4 Flammable Vapors. Gas 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. Water heaters installed in accordance with Section 507.5, Section 507.6, or Section 507.7 shall be considered to be in accordance with the intent of this provision. [NFPA 54:9.1.9]

507.5 Installation in Residential Garages.

- (1) Fuel gas water heaters 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 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]
- (2) Such appliances shall be located or protected so it is not subject to physical damage by a moving vehicle in compliance with the Oregon Mechanical Specialty Code, Section M1307.3.1.
- (3) Where such 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]
- (4) Electric water heaters installed in garages may be installed at floor level.

507.6 Installation in Commercial Garages.

507.6.1 Parking Structures. Fuel gas water heaters installed in enclosed, basement, and underground parking structures shall be installed in accordance with the Oregon Mechanical Specialty Code, Section C305.5.

507.6.2 Repair Garages. Fuel gas water heaters installed in repair garages shall be installed in accordance with the provisions of the Oregon Mechanical Specialty Code, Section C305.5.

507.7 Installation in Aircraft Hangars. Heaters in aircraft hangars shall be installed in accordance with NFPA 409. [NFPA 54:9.1.12]

507.8 Fuel Gas Water Heaters Physical Protection. Where it is necessary to locate gas utilization appliances close to a passageway traveled by vehicles. Protection shall be provided in accordance with the Oregon Mechanical Specialty Code, Section C305.

507.9 Combination of Appliances. A combination of fuel gas water heaters, attachments, or devices used together in any manner shall be in accordance with the standards that apply to the individual appliance. [NFPA 54:9.1.21]

507.10 Installation Instructions. The installing agency shall comply with the appliance manufacturer's recommendations in completing an installation. The installing agency shall leave the manufacturer's installation, operating, and maintenance instructions in a location on the premises where they will be readily available for reference and guidance for the building official, service personnel, and the owner or operator. [NFPA 54:9.1.22]

508.0 Access to Appliances on Roofs. Water heaters located on roofs or other elevated locations shall be accessible. [NFPA 54:9.4.3.1]

508.1 Access. Buildings exceeding 15 feet (4572 mm) in height shall have an inside means of access to the roof, unless other means acceptable to the building official are used. [NFPA 54:9.4.3.2]

508.2 Access Type. The inside means of access shall be a permanent, or fold-away inside stairway or ladder, terminating in an enclosure, scuttle, or trap door. Such scuttles or trap doors shall be not less than 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.

Not less than 6 feet (1829 mm) of clearance shall be between the access opening and the edge of the roof or similar hazard, or rigidly fixed rails or guards not less than 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 not less than 42 inches (1067 mm) in height. [NFPA 54:9.4.3.3]

508.3 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.

508.4.1 Attic Access. An attic 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]

508.4.2 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]

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508.4.3 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]

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

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

CHAPTER 6

WATER SUPPLY AND DISTRIBUTION

601.0 Water Required. Except where not deemed necessary for safety or sanitation by the building official, 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, urinals, and trap primers in designated non-residential buildings shall be provided with reclaimed water as defined, regulated and adopted in Chapter 16 of this code.

601.1 Identification of a Potable and Nonpotable Water System. In buildings where potable water and non-potable water systems are installed, each system shall be clearly identified in accordance with Section 601.1.1 through Section 601.1.4.

601.1.1 Potable Water. Green background with white lettering.

601.1.2 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 in Section 1617.0, nonpotable water systems shall have a yellow background with black uppercase lettering, with the words “CAUTION: NON-POTABLE WATER, DO NOT DRINK.” Each non-potable 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 conform to Table 6-1.

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.

601.1.2.1 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 yellow letters (Pantone 108 or equivalent).
- (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: ON-SITE TREATED NON-POTABLE WATER, DO NOT DRINK” in yellow letters (Pantone 108 or equivalent).

- (4) Rainwater catchment systems shall be marked in accordance with this section with the words: “CAUTION: NONPOTABLE RAINWATER WATER, DO NOT DRINK” in yellow letters (Pantone 108 or equivalent).

601.1.3 Fixtures. Where vacuum breakers or backflow preventers are installed with fixtures listed in Table 14-1, identification of the discharge side shall be permitted to be omitted.

601.1.4 Outlets. Each outlet on the nonpotable water line that is used for special purposes shall be posted with black uppercase lettering as follows: “CAUTION: NON-POTABLE WATER, DO NOT DRINK.”

601.2 Faucets and diverters shall be connected to the water distribution system so that hot water corresponds to the left side of the fittings.

TABLE 6-1
MINIMUM LENGTH OF COLOR FIELD AND SIZE OF LETTERS

OUTSIDE DIAMETER OF PIPE OR COVERING (inches)	MINIMUM LENGTH OF COLOR FIELD (inches)	MINIMUM SIZE OF LETTERS (inches)
½ to 1¼	8	½
1½ to 2	8	¾
2½ to 6	12	1¼
8 to 10	24	2½
Over 10	32	3½

For SI units: 1 inch = 25.4 mm

602.0 Unlawful Connections. 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 any tank, receptor, equipment, or plumbing fixture by reason of backsiphonage, 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.

602.1 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 water service system, and pipes, conduits, or fixtures containing or carrying water from any other source or containing or carrying water that has been used for a 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.

602.2 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.

602.3 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 building official, Oregon Health Authority and other municipal authority.

603.0 Cross-Connection Control. 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.

603.1 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 building official, Building Codes Division, State Plumbing Board. Devices or assemblies shall be tested in accordance with recognized standards or other standards acceptable to the building official, Building Codes Division, State Plumbing Board. Backflow prevention devices and assemblies shall comply with Table 6-2, except for specific applications and provisions as stated in Section 603.4 through Section 603.4.21.

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.

603.2 Backflow Prevention Devices, Assemblies, and Methods.

603.2.1 Air gap. The minimum air gap to afford backflow protection shall be in accordance with Table 6-3.

603.2.2 Atmospheric Vacuum Breaker (AVB). An atmospheric vacuum breaker consists of a body, a checking member, and an atmospheric port.

603.2.3 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.

603.2.4 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.

603.2.5 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.

603.2.6 Pressure Vacuum Breaker Spill-Resistant-Type Backflow Prevention Assembly (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 shut-off valves and test cocks.

603.2.7 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 General Requirements. Assemblies shall comply with listed standards and be acceptable to the State Plumbing Board, with jurisdiction over the selection and installation of backflow prevention assemblies.

603.3.1 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 building official.

603.3.2 Testing. The premise owner or responsible person shall have the backflow prevention assembly tested at the time of installation.

603.3.3 Access and Clearance. Access and clearance shall be provided for the required testing, maintenance, and repair. Access and clearance shall require a minimum of 1 foot (305 mm) between the lowest portion of the assembly and grade, floor, or platform. Installations elevated exceeding 5 feet (1524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

603.3.4 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.

**TABLE 6-2
BACKFLOW PREVENTION DEVICES, ASSEMBLIES, AND METHODS**

DEVICE, ASSEMBLY, OR METHOD ¹	APPLICABLE STANDARDS	DEGREE OF HAZARD				INSTALLATION ^{2,3}
		POLLUTION (LOW HAZARD)		CONTAMINATION (HIGH HAZARD)		
		BACK-SIPHONAGE	BACK-PRESSURE	BACK-SIPHONAGE	BACK-PRESSURE	
Air gap	ASME A112.1.2	X	—	X	—	See Table 6-3 in this chapter.
Air gap fittings for use with plumbing fixtures, appliances and appurtenances	ASME A112.1.3	X	—	X	—	Air gap fitting is a device with an internal air gap and typical installation includes plumbing fixtures, appliances and appurtenances. The critical level shall not be installed below the flood level rim.
Atmospheric vacuum breaker (consists of a body, checking member and atmospheric port)	ASSE 1001 or CSA B64.1.1	X	—	X	—	Upright position. No valve downstream. Minimum of 6 inches or listed distance above all downstream piping and flood-level rim of receptor. ^{4,5}
Antisiphon fill valve (ball-cocks) for gravity water closet flush tanks and urinal tanks	ASSE 1002 or CSA B125.3	X	—	X	—	Installation on gravity water closet flush tank and urinal tanks with the fill valve installed with the critical level not less than 1 inch above the opening of the overflow pipe. ^{4,5}
Vacuum breaker wall hydrants, hose bibbs, frost resistant, automatic draining type	ASSE 1019 or CSA B64.2.1.1	X	—	X	—	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). ^{4,5}
Backflow preventer for Carbonated Beverage Dispensers (two independent check valves with a vent to the atmosphere)	ASSE 1022	X	—	—	—	Installation includes carbonated beverage machines or dispensers. These devices operate under intermittent or continuous pressure conditions.
Spill-Resistant Pressure Vacuum Breaker (single check valve with air inlet vent and means of field testing)	ASSE 1056	X	—	X	—	Upright position. Minimum of 12 inches or listed distance above all downstream piping and flood-level rim of receptor. ⁵
Double Check Valve Backflow Prevention Assembly (two independent check valves and means of field testing)	ASSE 1015; AWWA C510; CSA B64.5 or CSA B64.5.1	X	X	—	—	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 bottom for maintenance. May need platform/ladder for test and repair. Does not discharge water.
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 of field testing)	ASSE 1048	X	X	—	—	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 bottom for maintenance. May need platform/ladder for test and repair. Does not discharge water. Installation includes a fire protection system and is designed to operate under continuous pressure conditions.

**TABLE 6-2
BACKFLOW PREVENTION DEVICES, ASSEMBLIES, AND METHODS (continued)**

DEVICE, ASSEMBLY, OR METHOD ¹	APPLICABLE STANDARDS	DEGREE OF HAZARD				INSTALLATION ^{2,3}
		POLLUTION (LOW HAZARD)		CONTAMINATION (HIGH HAZARD)		
		BACK-SIPHONAGE	BACK-PRESSURE	BACK-SIPHONAGE	BACK-PRESSURE	
Pressure Vacuum Breaker Backflow Prevention Assembly (loaded air inlet valve, internally loaded check valve and means of field testing)	ASSE 1020 or CSA B64.1.2	X	—	X	—	Upright position. May have valves downstream. Minimum of 12 inches above all downstream piping and flood-level rim of receptor. May discharge water.
Reduced Pressure Principle Backflow Prevention Assembly (two independently acting loaded check valves, a differential pressure relief valve and means of field testing)	ASSE 1013; AWWA C511; CSA B64.4 or CSA B64.4.1	X	X	X	X	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 bottom for maintenance. May need platform/ladder for test and repair. May discharge water.
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 of field testing)	ASSE 1047	X	X	X	X	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 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.

For SI units: 1 inch = 25.4 mm

Notes:

- ¹ See description of devices and assemblies in this chapter.
- ² Installation in pit or vault requires previous approval by the building official.
- ³ Refer to 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 603.4.14.

603.3.5 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.

603.3.6 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.

603.3.7 Freeze Protection. In cold climate areas, backflow assemblies and devices shall be protected from

freezing with an outdoor enclosure or by a method acceptable to the building official. ||

603.3.8 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.

603.3.9 Design and Installation of Plumbing Fixtures. Plumbing fixtures shall be installed such that fixture fittings shall be in accordance with the backflow prevention requirements of ASME A112.18.1/CSA B125.1. These requirements shall not be compromised by the designated fixture fitting mounting surface.

**TABLE 6-3
MINIMUM AIR GAPS FOR WATER DISTRIBUTION⁴**

FIXTURES	WHERE NOT AFFECTED BY SIDEWALLS ¹ (inches)	WHERE AFFECTED BY SIDEWALLS ² (inches)
Effective openings ³ not greater than ½ of an inch in diameter	1	1½
Effective openings ³ not greater than ¾ of an inch in diameter	1½	2¼
Effective openings ³ not greater than 1 inch in diameter	2	3
Effective openings ³ greater than 1 inch in diameter	Two times diameter of effective opening	Three times diameter of effective opening

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 Foot-note 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).

603.4 Specific Requirements.

603.4.1 Atmospheric Vacuum Breaker. Water closet and urinal flushometer valves shall be 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.

603.4.2 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.

603.4.3 Backflow Prevention. Water closet flushometer tanks shall be protected against backflow by an approved backflow prevention assembly, device, or method.

603.4.4 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 506.2.1. 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.

603.4.5 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 contamination or pollution, installed in accordance with the requirements for that type of device or assembly as set forth in this chapter.

603.4.6 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 (PVB)
- (3) Spill-resistant pressure vacuum breaker (SVB)
- (4) Reduced-pressure backflow preventer (RP)
- (5) Double check valve backflow preventer

603.4.6.1 Systems with Pumps. Where sprinkler and irrigation systems have pumps, connections for pumping equipment, or auxiliary air tanks, or are otherwise capable of creating back-pressure, the potable water supply shall be protected by the following type of device where the backflow device is located upstream from the source of back-pressure:

- (1) Reduced-pressure backflow preventer (RP)

603.4.6.2 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 (PVB)
- (3) Spill-resistant pressure vacuum breaker (SVB)
- (4) Reduced-pressure backflow preventer (RP)
- (5) Double check valve backflow preventer

603.4.6.3 Systems with Chemical Injectors.

Where systems include a chemical injector or provisions for chemical injection, the potable water supply shall be protected by the following:

- (1) Reduced-pressure backflow preventer (RP)

603.4.7 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. External vertical yard hydrants shall be of the self-draining sanitary type or be provided with a dual check backflow preventer meeting the ASSE 1024 standard.

603.4.8 Water-Cooled Equipment. Water-cooled compressors, degreasers, or any 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.

603.4.9 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.

603.4.10 Steam or Hot Water Boilers. Potable water makeup connections to steam or hot water boilers shall be provided with a listed backflow protection assembly.

603.4.11 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

building official. 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."

603.4.12 Beverage Dispensers. Potable water supply to carbonators shall be protected by an air gap or a vented backflow preventer for carbonated beverage dispensers installed within the carbonated beverage dispenser. The carbonated beverage dispenser shall bear the label of an approved testing agency, certifying and attesting that such equipment has been tested and inspected and meets the requirements of the approved applicable standard. Carbonated beverage dispensers without an approved internal air gap or vented backflow preventer for carbonated beverage dispensers and carbonated beverage dispensing systems shall have the water supply protected with a vented backflow preventer for carbonated beverage dispensers in accordance with ASSE 1022. For carbonated beverage dispensers, piping material installed downstream of the backflow preventer shall not be affected by carbon dioxide gas.

603.4.13 Water Treatment Units. Reverse osmosis drinking water treatment units shall comply with the requirements of the applicable standards referenced in Table 14-1. Waste or discharge from reverse osmosis or other types of water treatment units shall enter the drainage system through an air gap.

603.4.14 Prohibited Location. Backflow preventers shall not be located in any area containing fumes that are toxic, poisonous, or corrosive.

603.4.15 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.

603.4.16 Protection from Fire Systems. Except as provided under Section 603.4.15.1 and Section 603.4.15.2, 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 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 assembly (DC)
- (2) Double check detector assembly
- (3) Reduced pressure backflow preventer (RP)
- (4) Reduced pressure detector 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 Table 14-1.

603.4.16.1 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 non-potable water source that could be 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 backflow preventer (RP)
- (2) Reduced pressure detector 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.

603.4.16.2 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 backflow preventer (RP)
- (2) Reduced pressure detector assembly

603.4.16.3 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.

603.4.16.4 Residential Sprinkler Systems. Where residential sprinkler systems are installed using the potable water system, they shall be installed in accordance with the standards listed in Table 14-1.

603.4.17 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.

603.4.18 Special Equipment. Portable cleaning equipment, dental vacuum pumps, and chemical dispensers 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.

603.4.19 Potable Water Outlets and Valves. Combination stop-and-waste valves or cocks shall not be installed underground.

603.4.20 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 back-siphonage by a reduced-pressure principle backflow preventer.

603.4.20.1 Dialysis Water Systems. The individual connections of the dialysis related equipment to the dialysis pure water system shall not require additional backflow protection.

603.4.21 Plumbing Fixture Fittings. Plumbing fixture fittings with integral backflow protection shall comply with ASME A112.18.1/CSA B 125.1.

603.4.22 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.

604.0 Materials.

604.1 Pipe, Tube, and Fittings. Pipe, tube, and fittings carrying water used in potable water systems intended to supply drinking water shall be in accordance with the requirements of NSF 61 as found in Table 14-1.

Materials used in the water supply system, except valves and similar devices, shall be of a like material, except where otherwise approved by the State Plumbing Board or the building official.

Materials for building water piping and building supply piping shall comply with the applicable standards referenced in Table 6-4.

604.2 Copper Tube. Copper tube for water piping shall have a weight of not less than Type L.

Exception: Type M copper tubing shall be permitted to be used for water piping when piping is above ground in, or on, a building or underground outside of structures.

604.3 Hard-Drawn Copper Tubing. Hard-drawn copper tubing for water supply and distribution in addition to the required incised marking, shall be marked in accordance with ASTM B88 as referenced in Table 14-1. The colors shall be: Type K, green; Type L, blue; and Type M, red.

604.4 Flexible Copper Connectors. Listed flexible copper water connectors shall be installed in readily accessible locations, unless otherwise listed.

604.5 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.

604.6 Malleable Iron Fittings. Malleable iron water fittings shall be galvanized.

604.7 Previously Used Piping and Tubing. Piping and tubing that has previously been used for purpose other than for potable water systems shall not be used.

604.8 Plastic Materials. Approved plastic materials shall be permitted to be used in water service piping, provided that where metal water service piping is used for electrical grounding purposes, replacement piping therefore shall be of like materials.

Exception: Where a grounding system acceptable to the building official is installed, inspected, and approved, metallic pipe shall be permitted to be replaced with nonmetallic pipe. Plastic materials for water service piping outside underground shall

**TABLE 6-4
MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS**

MATERIAL	BUILDING SUPPLY PIPE AND FITTINGS	WATER DISTRIBUTION PIPE AND FITTINGS	REFERENCED STANDARD(S) PIPE	REFERENCED STANDARD(S) FITTINGS
Asbestos-Cement	X ¹	—	ASTM C 296	—
Brass	X	X	ASTM B 43, ASTM B 135	—
Copper	X	X	ASTM B 42, ASTM B 75, ASTM B 88, ASTM B 251, ASTM B 302, ASTM B 447	ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.26
CPVC	X	X	ASTM D 2846, ASTM F 441, ASTM F 442	ASTM D 2846, ASTM F 437, ASTM F 438, ASTM F 439, ASTM F 1970
Ductile-Iron	X	X	AWWA C151	ASME B16.4, AWWA C110, AWWA C153
Galvanized Steel	X	X	ASTM A 53	—
Malleable Iron	X	X	—	ASME B16.3
PE	X ¹	—	ASTM D 2239, ASTM D 2737, ASTM D 3035, AWWA C901, CSA B137.1	ASTM D 2609, ASTM D 2683, ASTM D 3261, ASTM F 1055, CSA B137.1
PE-AL-PE	X	X	ASTM F 1282, CSA B137.9	ASTM F 1282, ASTM F 1974, CSA B137.9
PE-RT	X	X	ASTM F 2769	ASTM F 1807, ASTM F 2098, ASTM F 2159; ASTM F 2735, ASTM F 2769
PEX	X	X	ASTM F 876, ASTM F 877, CSA B137.5, AWWA C904*	ASSE 1061, ASTM F 877, ASTM F 1807, ASTM F 1960, ASTM F 1961, ASTM F 2080, ASTM F 2159, ASTM F 2735, CSA B137.5
PEX-AL-PEX	X	X	ASTM F 1281, CSA B137.10, ASTM F 2262	ASTM F 1281, ASTM F 1974, ASTM F 2434, CSA B137.10
PP	X	X	ASTM F 2389, CSA B137.11	ASTM F 2389, CSA B137.11
PVC	X ¹	—	ASTM D 1785, ASTM D 2241, AWWA C900	ASTM D 2464, ASTM D 2466, ASTM D 2467, ASTM F 1970
Stainless Steel	X	X	ASTM A 269, ASTM A 312	—

* For building supply or cold-water applications.

have a 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 18 AWG and the insulation type shall be suitable for direct burial.

604.9 Solder. Solder shall conform to the requirements of Section 316.1.3.

604.10 Lead Content. Water pipe and fittings with a lead content which exceeds .25 percent shall be prohibited in piping systems used to convey potable water.

604.11 PEX. Cross-linked polyethylene (PEX) tubing conforming to ASTM F877 shall be marked with the appropriate

standard designation(s) for the fittings specified for use with the tubing. Such marking shall not be required for PEX tubing conforming to only ASTM F876. PEX tubing shall be installed in compliance with the provisions of this section.

604.11.1 PEX Fittings. Fittings used with PEX tubing shall be manufactured to and marked in accordance with the standards for the fittings referenced in Table 14-1.

604.11.2 Water Heater Connections. PEX tubing shall not be installed within the first 18 inches (457 mm) of piping connected to a water heater.

604.12 Flexible Corrugated Connectors. Flexible corrugated connectors of copper or stainless steel shall be limited to the following connector lengths:

Water Heater Connectors – 24 inches (610 mm)

Fixture Connectors – 30 inches (762 mm)

Washing Machine Connectors – 72 inches (1829 mm)

Dishwasher and Icemaker Connectors – 120 inches (3048 mm)

604.13 PEX-AL-PEX and PE-AL-PE. Crosslinked polyethylene-aluminum-crosslinked polyethylene (PEX-AL-PEX) and polyethylene-aluminum-polyethylene (PE-AL-PE) composite pipe shall be marked with the applicable standard referenced in Table 14-1 for which the piping has been listed or approved. PEX-AL-PEX and PE-AL-PE piping shall be installed in compliance with the provisions of this section.

604.13.1 PEX-AL-PEX and PE-AL-PE. Fittings used with PEX-AL-PEX and PE-AL-PE piping shall be manufactured to and marked in accordance with the standard for the fittings referenced in Table 14-1.

604.13.2 Water Heater Connections. PEX-AL-PEX or PE-AL-PE tubing shall not be installed within the first 18 inches 457 mm of piping connected to a water heater.

604.14 Water Heater Connectors. Flexible metallic water heater connectors or reinforced flexible water heater connectors connecting water heating to the piping system shall be in accordance with the applicable standards referenced in Table 14-1.

605.0 Valves.

605.1 General. Valves up to and including 2 inches (50 mm) in size shall be brass or other approved material. Sizes exceeding 2 inches (50 mm) shall be permitted to have cast-iron or brass bodies. Each gate or ball valve shall be a fullway type with working parts of non-corrosive material. Valves carrying water used in potable water systems intended to supply drinking water shall be in accordance with the requirements of NSF 61 as referenced in Table 14-1.

605.2 Fullway Valve. A fullway valve controlling outlets shall be installed on the discharge side of each water meter and on each unmetered water supply. Water piping supplying more than one building on any one premises 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 on 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.

605.3 Multidwelling Units. In multidwelling units, one or more shutoff valves shall be provided in each dwelling unit so that the water supply to any 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.

605.4 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.

605.5 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.

605.6 Accessible. Required shutoff or control valves shall be accessible.

605.7 Multiple Fixtures. A single control valve shall be installed on a water supply line ahead of any automatic metering valve that supplies a battery of fixtures.

606.0 Joints and Connections.

606.1 Types of Joints.

606.1.1 Flared Joints. Flared joints for soft copper water tubing shall be made with fittings that are in accordance with the applicable standards. The tubing shall be reamed to the full bore, resized to round, and expanded with a proper flaring tool.

606.1.2 Mechanical Joints. Mechanical joints for cast-iron water pipe shall comply with nationally recognized standards.

606.1.3 Mechanically Formed Tee Fittings. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height not less than three times the thickness of the branch tube wall.

The branch tube shall be notched to conform to the inner curve of the run tube and shall have two dimple depth stops to ensure that penetration of the branch tube into the collar is of a depth for brazing and that the branch tube does not obstruct the flow in the main line tube. Dimple depth stops shall be in line with the run of the tube. The second dimple shall be $\frac{1}{4}$ of an inch (6.4 mm) above the first and shall serve as a visual point of inspection.

Joints shall be brazed in accordance with Section 316.1.7. Soldered joints shall not be allowed.

606.2 Use of Joints.

606.2.1 Copper Water Tube. Joints in copper tubing shall be made by the appropriate use of approved fittings properly soldered or brazed together as provided in Section 316.1.3 or Section 316.1.7 or by means of approved flared or compression fittings in Section 606.1.1 or Section 316.1.5. Solder and soldering flux shall comply with the requirements of Section 316.1.3. Mechanically formed tee fittings shall be made by brazing only and shall comply with the requirements of Section 316.1.7 and Section 606.1.3.

606.2.2 Plastic Fittings. Female PVC screwed fittings for water piping shall be used with plastic male fittings and plastic male threads only.

606.2.3 Slip Joints. In water piping, slip joints shall be permitted to be used only on the exposed fixture supply.

607.0 Gravity Supply Tanks. Gravity tanks for potable water shall be tightly covered, and have not less than a 16 square inch (0.01 m²) overflow screened with copper screen having not less than 14 nor exceeding 18 openings per linear inch (25.4 mm).

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 fifteen 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. Such regulator(s) shall control the pressure to water outlets in the building unless otherwise approved by the building official. Each such regulator and strainer shall be accessibly located aboveground or in a vault equipped with adequate means to provide drainage and 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 6-6. 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 shall be properly sized and installed in accordance with the manufacturer's installation instructions and listing. Systems designed by registered engineers 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, Combination Pressure, and Temperature Relief. 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 shall be provided with an approved, listed, and adequately sized expansion tank or other approved device having a similar function to control thermal expansion. 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. No shutoff valve shall be installed between the expansion tank and the system.

Exception: Non-storage instantaneous water heaters without a recirculation system.

A water system containing storage water heating equipment shall be provided with an approved, listed, adequately sized combination pressure and temperature 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.

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 or in the drain line.

608.5 Drains. Relief valves shall be provided with a full sized drain, not smaller than the relief valve outlet, of galvanized steel or hard-drawn copper, CPVC piping and fittings and shall extend from the valve to a discharge location which will avoid the hazard to persons or damage to property. Discharge locations outside of the building shall be not less than 6 inches (152 mm) aboveground or the flood level of the area receiving the discharge, and shall not terminate between 2 feet (610 mm) and 16 feet (4877 mm) aboveground or above any other area where persons may normally be present. No valve shall be installed on the discharge side of any relief valve. The termination end of the drain pipe shall not be threaded and no part of such drain pipe shall be trapped.

Other approved locations shall include:

- (1) To a water heater drip pan of approved design, provided the pan is drained with pipe and fittings of the same size and material as required for the relief valve or with PVC Schedule 40 pipe and fittings.
- (2) To an approved, properly installed clothes washer stand-pipe receptor, laundry tray, floor drain, floor sink, hub drain, area drain or catch basin.
- (3) On grade concrete garage floors at not less than 6 inches (30 mm) nor more than 12 inches (152 mm) above the floor.
- (4) Other locations meeting the requirements of this section or as approved by the building official.

Note: There shall be no requirement to provide the pan or fixtures described in (1) or (2) above only for the purpose of receiving discharge from a relief valve.

Relief valve drains shall not terminate in a building's crawl space.

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 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 Section 314.0. 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 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. Water service 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:

609.2.1 The bottom of the water pipe, at all points, shall be not less than 12 inches (305 mm) above the top of the sewer or drain line.

609.2.2 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 drain pipe.

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:

609.3.1 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.

609.3.2 Copper 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, it shall be tested and proved tight under a water pressure not less than the working pressure under which it is to be used. The water used for tests shall be obtained from a potable source of supply. A 50 psi (345 kPa) air pressure shall be permitted to be substituted for the water test. In either method of test, the piping shall withstand the test without leaking for a period of not less than 15 minutes.

609.5 Unions. Unions shall be installed in the water supply piping not more than 12 inches (305 mm) of regulating equipment, water heating, conditioning tanks, and similar equipment that requires service by removal or replacement in a manner that will facilitate its ready removal.

609.6 Location. Except as provided in Section 609.7, no building supply shall be located in a lot other than the lot that is the site of the building or structure served by such building supply.

609.7 Abutting Lot. Nothing contained in this code shall be construed to prohibit the use of an abutting lot to:

609.7.1 Provide access to connect a building supply to an available public water service where proper cause and legal easement not in violation of other requirements have been first established to the satisfaction of the building official. ||

609.7.2 Provide additional space for a building supply where proper cause, transfer of ownership, or change of boundary not in violation of other requirements have been first established to the satisfaction of the building official. The instrument recording such action shall constitute an agreement with the building official, 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 an agreement shall be recorded in the office of the County Recorder as a 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 building official. ||

609.8 Low-Pressure Cutoff Required on Booster Pumps for Water Distribution Systems. Where a booster pump (excluding a fire pump) is connected to a water service 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.

609.9 Disinfection of Potable Water System. New or repaired potable water systems shall be disinfected prior to use where required by the building official/Oregon Health Authority. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by it, the following: ||

609.9.1 The pipe system shall be flushed with clean, potable water until only potable water appears at the points of outlet.

609.9.2 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.

609.9.3 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.

609.9.4 The procedure shall be repeated if it is shown by bacteriological examination made by an approved agency that contamination persists in the system.

609.10 Water Hammer. Building water supply systems where flushometers or quick-acting valves are installed shall be provided with water hammer arrester(s) to absorb high pressures resulting from the quick closing of these valves. Water hammer arrestors shall be approved mechanical devices in accordance with the applicable standard(s) referenced in Table 14-1 and shall be installed as close as possible to quick-acting valves.

Exception: Residential structures within the scope of the Oregon Residential Structures Specialty Code.

609.10.1 Mechanical Devices. Where listed mechanical devices are used, the manufacturer's specifications as to location and method of installation shall be followed.

610.0 Size of Potable Water Piping. 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.

610.1 Pressure Loss. Where a water filter, water softener, backflow prevention device 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 any such 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 building official or the State Plumbing Board 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.

610.2 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 6-5. Equivalent fixture values shown in Table 6-5 include both hot and cold water demand.

610.3 Parallel Distribution Systems. Systems within the range of Table 6-6 shall be permitted to be sized from that table or by the method set forth in Section 610.4.

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.

610.4 Sizing per Appendices A and L. Except as provided in Section 610.3, 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 L.

610.5 Friction and Pressure Loss. Except where the type of pipe used and the water characteristics are such that no decrease in capacity due to 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 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 610.1.

610.6 Conditions for Using Table 6-5. On a proposed water piping installation sized using Table 6-6, the following conditions shall be determined:

- (1) Total number of fixture units as determined from Table 6-5, Equivalent Fixture Units, for the fixtures to be installed.
- (2) Developed length of supply pipe from meter to 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 other 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.

610.7 Size of Meter and Building Supply Pipe Using Table 6-6. The size of the meter and the building supply pipe shall be determined as follows:

- (1) Determine the available pressure at the water meter or other source of supply.
- (2) Subtract ½ 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 6-6.
- (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.

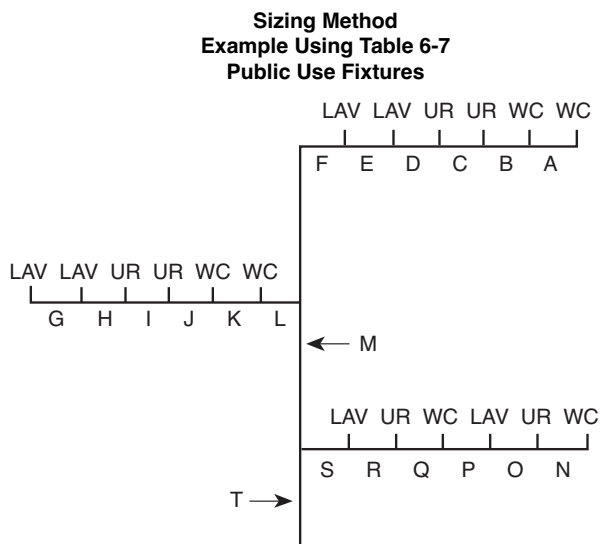
No building supply pipe shall be less than 3/4 of an inch (20 mm) in diameter.

610.8 Size of Branches. Where Table 6-6 is used, the minimum size of each branch shall be determined by the number of fixture units to be served by that branch, the total developed length of the system, and the meter and street service size in accordance with Section 610.7. No branch piping is required to be larger in size than that required by Table 6-6 for the building supply pipe.

610.9 Sizing for Flushometer Valves. Where using Table 6-6 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 6-7. Piping supplying a flushometer valve shall be not less in size than the valve inlet.

Where using Table 6-7 to size water piping, care shall be exercised to assign flushometer fixture units based on the number and category of fixtures served.

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.



- A: 1 WC = 40 F.U.
- B: 2 WC = 70 F.U.
- C: 2 WC (70) + 1 UR (20) = 90 F.U.
- D: 2 WC (70) + 2 UR (35) = 105 F.U.
- E: 2 WC (70) + 2 UR (35) + 1 LAV (1) = 106 F.U.
- F: 2 WC (70) + 2 UR (35) + 2 LAV (2) = 107 F.U.
- G: 1 LAV = 1 F.U.
- H: 2 LAV = 2 F.U.

- I: 2 LAV (2) + 1 UR (20) = 22 F.U.
- J: 2 LAV (2) + 2 UR (35) = 37 F.U.
- K: 2 LAV (2) + 2 UR (35) + 1 WC (40) = 77 F.U.
- L: 2 LAV (2) + 2 UR (35) + 2 WC (70) = 107 F.U.
- M: 4 WC (105) + 4 UR (53) + 4 LAV (4) = 162 F.U.
- N: 1 WC = 40 F.U.
- O: 1 WC (40) + 1 UR (20) = 60 F.U.
- P: 1 WC (40) + 1 UR (20) + 1 LAV (1) = 61 F.U.
- Q: 2 WC (70) + 1 UR (20) + 1 LAV (1) = 91 F.U.
- R: 2 WC (70) + 2 UR (35) + 1 LAV (1) = 106 F.U.
- S: 2 WC (70) + 2 UR (35) + 2 LAV (2) = 107 F.U.
- T: 6 WC (125) + 6 UR (63) + 6 LAV (6) = 194 F.U.

610.10 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.

610.11 Sizing for Velocity. Water piping systems shall not exceed the maximum velocities listed in this section or Appendix A.

610.11.1 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 .

610.11.2 Tubing Systems Using Copper Alloy Fittings. Maximum velocities through copper alloy fittings in tubing other than copper 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 Exceptions. The provisions of this section relative to 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 building official. ||
- (2) Alteration of or minor additions to existing installations, provided the building official finds that there will be an adequate supply of water to operate all 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 building official, an adequate supply of water is provided to operate fixtures and equipment. ||
- (6) Nonpotable waterlines as defined in Sections 601.1.2 and 601.1.4.
- (7) 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 is 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.

WATER SUPPLY AND DISTRIBUTION

**TABLE 6-5
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES³**

APPLIANCES, APPURTENANCES OR FIXTURES ²	MINIMUM FIXTURE BRANCH PIPE SIZE ^{1,4} (inches)	PRIVATE	PUBLIC	ASSEMBLY ⁶
Bathtub or Combination Bath/Shower (fill)	½	4.0	4.0	—
¾ inch Bathtub Fill Valve	¾	10.0	10.0	—
Bidet	½	1.0	—	—
Clothes Washer	½	4.0	4.0	—
Dental Unit, cuspidor	½	—	1.0	—
Dishwasher, domestic	½	1.5	1.5	—
Drinking Fountain or Water Cooler	½	0.5	0.5	0.75
Hose Bibb	½	2.5	2.5	—
Hose Bibb, each additional ⁸	½	1.0	1.0	—
Lavatory	½	1.0	1.0	1.0
Lawn Sprinkler, each head ⁵	—	1.0	1.0	—
Mobile Home, each (minimum)	—	12.0	—	—
Sinks	—	—	—	—
Bar	½	1.0	2.0	—
Clinic Faucet	½	—	3.0	—
Clinic Flushometer Valve with or without faucet	1	—	8.0	—
Kitchen, domestic with or without dishwasher	½	1.5	1.5	—
Laundry	½	1.5	1.5	—
Service or Mop Basin	½	1.5	3.0	—
Washup, each set of faucets	½	—	2.0	—
Shower, per head	½	2.0	2.0	—
Urinal, 1.0 GPF Flushometer Valve	¾	See Footnote ⁷		—
Urinal, greater than 1.0 GPF Flushometer Valve	¾	See Footnote ⁷		—
Urinal, flush tank	½	2.0	2.0	3.0
Wash Fountain, circular spray	¾	—	4.0	—
Water Closet, 1.6 GPF Gravity Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	1	See Footnote ⁷		—
Water Closet, greater than 1.6 GPF Gravity Tank	½	3.0	5.5	7.0
Water Closet, greater than 1.6 GPF Flushometer Valve	1	See Footnote ⁷		—

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].
- ⁷ Where sizing flushometer systems, see Section 610.9.
- 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.

**TABLE 6-6
FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES**

METER AND STREET SERVICE (inches)	BUILDING SUPPLY AND BRANCHES (inches)	MAXIMUM ALLOWABLE LENGTH (feet)													
		40	60	80	100	150	200	250	300	400	500	600	700	800	900
PRESSURE RANGE – 30 to 45 psi¹															
3/4	1/2 ²	6	5	4	3	2	1	1	1	0	0	0	0	0	0
3/4	3/4	16	16	14	12	9	6	5	5	4	4	3	2	2	1
3/4	1	29	25	23	21	17	15	13	12	10	8	6	6	6	6
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6
3/4	1 1/4	36	33	31	28	24	23	21	19	17	16	13	12	12	11
1	1 1/4	54	47	42	38	32	28	25	23	19	17	14	12	12	11
1 1/2	1 1/4	78	68	57	48	38	32	28	25	21	18	15	12	12	11
1	1 1/2	85	84	79	65	56	48	43	38	32	28	26	22	21	20
1 1/2	1 1/2	150	124	105	91	70	57	49	45	36	31	26	23	21	20
2	1 1/2	151	129	129	110	80	64	53	46	38	32	27	23	21	20
1	2	85	85	85	85	85	85	82	80	66	61	57	52	49	46
1 1/2	2	220	205	190	176	155	138	127	120	104	85	70	61	57	54
2	2	370	327	292	265	217	185	164	147	124	96	70	61	57	54
2	2 1/2	445	418	390	370	330	300	280	265	240	220	198	175	158	143
PRESSURE RANGE – 46 to 60 psi¹															
3/4	1/2 ²	7	7	6	5	4	3	2	2	1	1	1	0	0	0
3/4	3/4	20	20	19	17	14	11	9	8	6	5	4	4	3	3
3/4	1	39	39	36	33	28	23	21	19	17	14	12	10	9	8
1	1	39	39	39	36	30	25	23	20	18	15	12	10	9	8
3/4	1 1/4	39	39	39	39	39	39	34	32	27	25	22	19	19	17
1	1 1/4	78	78	76	67	52	44	39	36	30	27	24	20	19	17
1 1/2	1 1/4	78	78	78	78	66	52	44	39	33	29	24	20	19	17
1	1 1/2	85	85	85	85	85	85	80	67	55	49	41	37	34	32
1 1/2	1 1/2	151	151	151	151	128	105	90	78	62	52	42	38	35	32
2	1 1/2	151	151	151	151	150	117	98	84	67	55	42	38	35	32
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	83
1 1/2	2	370	370	340	318	272	240	220	198	170	150	135	123	110	102
2	2	370	370	370	370	368	318	280	250	205	165	142	123	110	102
2	2 1/2	654	640	610	580	535	500	470	440	400	365	335	315	285	267
PRESSURE RANGE – Over 60 psi¹															
3/4	1/2 ²	7	7	7	6	5	4	3	3	2	1	1	1	1	0
3/4	3/4	20	20	20	20	17	13	11	10	8	7	6	6	5	4
3/4	1	39	39	39	39	35	30	27	24	21	17	14	13	12	11
1	1	39	39	39	39	38	32	29	26	22	18	14	13	12	11
3/4	1 1/4	39	39	39	39	39	39	39	39	34	28	26	25	23	22
1	1 1/4	78	78	78	78	74	62	53	47	39	31	26	25	23	22
1 1/2	1 1/4	78	78	78	78	78	74	65	54	43	34	26	25	23	22
1	1 1/2	85	85	85	85	85	85	85	85	81	64	51	48	46	43
1 1/2	1 1/2	151	151	151	151	151	151	130	113	88	73	51	51	46	43
2	1 1/2	151	151	151	151	151	151	142	122	98	82	64	51	46	43
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	85
1 1/2	2	370	370	370	370	360	335	305	282	244	212	187	172	153	141
2	2	370	370	370	370	370	370	370	340	288	245	204	172	153	141
2	2 1/2	654	654	654	654	654	650	610	570	510	460	430	404	380	356

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 3/4 of an inch (20 mm) nominal size.

**TABLE 6-7
FLUSHOMETER FIXTURE UNITS FOR WATER
SIZING USING TABLE 6-5**

FIXTURE CATEGORY: WATER CLOSET WITH FLUSHOMETER VALVES		
NUMBER OF FLUSHOMETER VALVES	INDIVIDUAL FIXTURE UNITS ASSIGNED IN DECREASING VALUE	FIXTURE UNITS ASSIGNED FOR WATER CLOSETS AND SIMILAR 10-UNIT FIXTURES IN ACCUMULATIVE VALUES
1	40	40
2	30	70
3	20	90
4	15	105
5 or more	10 each	115 plus 10 for each additional fixture in excess of 5
FIXTURE CATEGORY: URINALS WITH FLUSHOMETER VALVES		
NUMBER OF FLUSHOMETER VALVES	INDIVIDUAL FIXTURE UNITS ASSIGNED IN DECREASING VALUE	FIXTURE UNITS ASSIGNED FOR URINALS AND SIMILAR 5-UNIT FIXTURES IN ACCUMULATIVE VALUES
1	20	20
2	15	35
3	10	45
4	8	53
5 or more	5 each	58 plus 5 for each additional fixture in excess of 5

**TABLE 6-8
SIZING OF RESIDENTIAL WATER SOFTENERS⁴**

REQUIRED SIZE OF SOFTENER CONNECTION (inches)	NUMBER OF BATHROOM GROUPS SERVED ¹
3/4	up to 2 ²
1	up to 4 ³

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 L, Alternate Plumbing Systems, for alternate methods of sizing water supply systems.

611.0 Drinking Water Treatment Units.

611.1 Compliance with Standard. Drinking water treatment units shall comply with the requirements of the appropriate standard referenced in Table 14-1.

611.2 Air gap Discharge. Discharge from drinking water treatment units shall enter the drainage system through an air gap or an air gap device that is in accordance with the requirements of the appropriate standards referenced in Table 14-1.

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. The tubing shall comply

with the requirements of the appropriate standards referenced in Table 14-1.

611.4 Sizing of Residential Softeners. Residential-use water softeners shall be in accordance with Table 6-8.

CHAPTER 7

SANITARY DRAINAGE

Part I – Drainage Systems.

701.0 Materials.

701.1 Drainage Piping. Materials for drainage piping shall be in accordance with one of the referenced standards in Table 7-1 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) above ground.
- (2) ABS and PVC DWV piping installations shall be installed in accordance with applicable standards referenced in Table 14-1 and Chapter 15 “Firestop Protection.” Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a flame-spread index of a maximum of 25 and a smoke-developed index of a maximum 50, where tested in accordance with ASTM E84 and UL 723.
- (3) No vitrified clay pipe or fittings shall be used above-ground or where pressurized by a pump or ejector. They shall be kept not less than 12 inches (305 mm) below-ground.
- (4) Copper tube for drainage and vent piping shall have a weight of not less than that of copper 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 shall be listed and tested to comply with standards referenced in Table 14-1.

701.2 Drainage Fittings. Materials for drainage fittings shall be in accordance with the applicable standards referenced in Table 7-1 of the same diameter as the piping served, and such fittings shall be compatible with the type of pipe used.

701.2.1 Screwed Pipes. Fittings on screwed pipe shall be of the recessed drainage type. Burred ends shall be reamed to the full bore of the pipe.

701.2.2 Threads. The threads of drainage fittings shall be tapped so as to allow ¼ inch per foot (20.8 mm/m) grade.

701.2.3 Type. Fittings used for drainage shall be of the drainage type, have a smooth interior water-way, and be constructed so as to allow ¼ inch per foot (20.8 mm/m) grade.

701.3 Lead. See Table 14-1. Sheet lead shall be not less than the following:

- (1) For safe pans – not less than 4 pounds per square foot lb/ft² (19 kg/m²) or ¼ 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 (1.1989 mm) thick.
- (3) Lead bends and lead traps shall be not less than ⅛ of an inch (3.2 mm) wall thickness.

701.4 Caulking Ferrules. Caulking ferrules shall be manufactured from bronze or copper and shall be in accordance with Table 7-2 (a).

701.5 Soldering Bushings. Soldering bushings shall be of bronze or copper in accordance with Table 7-2(b).

**TABLE 7-2(a)
CAULKING FERRULES**

PIPE SIZE (inches)	INSIDE DIAMETER (inches)	LENGTH (inches)	MINIMUM WEIGHT EACH	
			pounds	ounces
2	2¼	4½	1	0
3	3¼	4½	1	12
4	4¼	4½	2	8

For SI units: 1 inch = 25 mm, 1 pound = 0.453 kg, 1 ounce = 0.02834 kg

**TABLE 7-2(b)
SOLDERING BUSHINGS**

PIPE SIZE (inches)	MINIMUM WEIGHT EACH		PIPE SIZE (inches)	MINIMUM WEIGHT EACH	
	pounds	ounces		pounds	ounces
1¼	0	6	2½	1	6
1½	0	8	3	2	0
2	0	14	4	3	8

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 7-3 shall be based on the size of the trap required, and the unit equivalent of fixtures and devices not shown in Table 7-3 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 7-4(a).

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 7-4(b).

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) (0.06 L/s) of flow.

**TABLE 7-1
MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS**

MATERIAL	UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS	ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS	BUILDING SEWER PIPE AND FITTINGS	REFERENCED STANDARD(S) PIPE	REFERENCED STANDARD(S) FITTINGS
ABS (Schedule 40)	X	X	X	ASTM D 1527, ASTM D 2661, ASTM D 2680 ¹ , ASTM F 628	ASTM D 2661, ASTM D 2680 ¹
Asbestos-Cement	—	—	X	ASTM C 14 ¹ , ASTM C 428 ¹	—
Brass	—	X	—	ASTM B 43	—
Cast-Iron	X	X	X	ASTM A 74, ASTM A 888, CISPI 301	ASME B16.12, ASTM A 74, ASTM A 888, CISPI 301
Co-Extruded ABS (Schedule 40)	X	X	X	ASTM F 1488	ASTM D 2661, ASTM D 2680 ¹
Co-Extruded PVC (Schedule 40)	X	X	X	ASTM F 891, ASTM F 1488	ASTM D 2665, ASTM F 794 ¹ , ASTM F 1866
Copper (Type DWV)	X	X	X	ASTM B 75, ASTM B 251, ASTM B 302, ASTM B 306	ASME B16.23, ASME B16.29
Galvanized Malleable Iron	—	X	—	—	ASME B16.3
Galvanized Steel	—	X	—	ASTM A 53	—
Polyethylene	—	—	X	ASTM F 714	ASTM D 2683, ASTM D 3261, ASTM F 1055, ASTM F 2206
PVC (Schedule 40)	X	X	X	ASTM D 1785, ASTM D 2665, ASTM F 794 ¹	ASTM D 2665, ASTM F 794 ¹ , ASTM F 1866
Stainless Steel 304	—	X	—	ASME A112.3.1	ASME A112.3.1
Stainless Steel 316L	X	X	X	ASME A112.3.1	ASME A112.3.1
Vitrified Clay (Extra strength)	—	—	X	ASTM C 700	ASTM C 700

¹ For Building Sewer applications.

**TABLE 7-3
DRAINAGE FIXTURE UNIT VALUES (DFU)**

PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	MINIMUM SIZE TRAP AND TRAP ARM ⁷ (inches)	PRIVATE	PUBLIC	ASSEMBLY ⁸
Bathtub or Combination Bath/Shower	1½	2.0	2.0	—
Bidet	1¼	1.0	—	—
Bidet	1½	2.0	—	—
Clothes Washer, domestic, standpipe ⁵	2	3.0	3.0	3.0
Dental Unit, cuspidor	1¼	—	1.0	1.0
Dishwasher, domestic, with independent drain ²	1½	2.0	2.0	2.0
Drinking Fountain or Water Cooler	1¼	0.5	0.5	1.0
Food Waste Grinder, commercial	2	—	3.0	3.0
Floor Drain, emergency	2	—	0.0	0.0
Floor Drain (for additional sizes see Section 702.0)	2	2.0	2.0	2.0
Shower, single-head trap	2	2.0	2.0	2.0
Multi-head, each additional	2	1.0	1.0	1.0
Lavatory, single	1¼	1.0	1.0	1.0
Lavatory, in sets of two or three	1½	2.0	2.0	2.0
Washfountain	1½	—	2.0	2.0
Washfountain	2	—	3.0	3.0
Mobile Home, trap	3	12.0	—	—
Receptor, indirect waste ^{1,3}	1½	See footnote ^{1,3}		
Receptor, indirect waste ^{1,4}	2	See footnote ^{1,4}		
Receptor, indirect waste ¹	3	See footnote ¹		
Sinks	—	—	—	—
Bar	1½	1.0	—	—
Bar ²	1½	—	2.0	2.0
Clinical	3	—	6.0	6.0
Commercial with food waste ²	1½	—	3.0	3.0
Special Purpose ²	1½	2.0	3.0	3.0
Special Purpose	2	3.0	4.0	4.0
Special Purpose	3	—	6.0	6.0
Kitchen, domestic ² (with or without food waste grinder, dishwasher, or both)	1½	2.0	2.0	—
Laundry ² (with or without discharge from a clothes washer)	1½	2.0	2.0	2.0
Service or Mop Basin	2	—	3.0	3.0
Service or Mop Basin	3	—	3.0	3.0
Service, flushing rim	3	—	6.0	6.0
Wash, each set of faucets	—	—	2.0	2.0
Urinal, integral trap 1.0 GPF ²	2	2.0	2.0	5.0
Urinal, integral trap greater than 1.0 GPF	2	2.0	2.0	6.0
Urinal, exposed trap ²	1½	2.0	2.0	5.0
Water Closet, 1.6 GPF Gravity Tank ⁶	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Tank ⁶	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Valve ⁶	3	3.0	4.0	6.0
Water Closet, greater than 1.6 GPF Gravity Tank ⁶	3	4.0	6.0	8.0
Water Closet, greater than 1.6 GPF Flushometer Valve ⁶	3	4.0	6.0	8.0

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 therein to, in accordance with Table 7-4.

² Provide a 2 inch (51 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.

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.

**TABLE 7-4(a)
MAXIMUM DRAINAGE FIXTURE UNITS FOR A
TRAP AND TRAP ARM***

SIZE OF TRAP AND TRAP ARM (inches)	DRAINAGE FIXTURE UNIT VALUES (DFU)
1/4	1 unit
1/2	3 units
2	4 units
3	6 units
4	8 units

For SI Units: 1 inch = 25 mm

* **Exception:** On self-service laundries.

**TABLE 7-4(b)
DISCHARGE CAPACITY IN GALLONS PER MINUTE FOR
INTERMITTENT FLOW ONLY***

GPM	FIXTURE UNITS
Up to 7½	Equals 1 Fixture Unit
Greater than 7½ to 15	Equals 2 Fixture Units
Greater than 15 to 30	Equals 4 Fixture Units
Greater than 30 to 50	Equals 6 Fixture Units

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

* Discharge capacity exceeding 50 gallons per minute (3.15 L/sec.) shall be determined by the building official.

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 7-5 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 L. For alternate method of sizing drainage piping, see Appendix L.

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 or sanitary cross having inlet openings at the same level. Sanitary cross connections shall be sized as required in Section 706.2.

704.3 Commercial Dishwashing Machines and Sinks. Pot sinks, scullery sinks, dishwashing sinks, silver-

ware sinks, and other similar fixtures shall be connected directly to the drainage system. A floor drain shall be provided adjacent to the fixture, and the fixture shall be connected on the sewer side of the floor drain trap, provided that no other drainage line is 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.

Exception: The above listed fixtures may be drained indirectly if provided with an approved air gap no less than 1 inch (25.4 mm) without the necessity of the adjacent floor drain.

705.0 Joints and Connections.

705.1 Types of Joints.

705.1.1 Caulked Joints. Caulked joints for cast-iron bell-and-spigot soil pipe and other similar 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). The lead shall be caulked thoroughly at the inside and outside edges of the joint. After caulking, the finished joint shall not exceed 1/8 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. Caulked joints in cast-iron bell-and-spigot water piping shall be made with nontoxic materials.

705.1.2 Cement Mortar Joints. Except for repairs and connections to existing lines constructed with such joints, cement mortar joints shall be prohibited on building sewers.

705.1.3 Burned Lead Joints. Burned (welded) lead joints shall be lapped, and the lead shall be fused together to form a uniform weld not less than as thick as the lead being joined.

705.1.4 Asbestos Cement Sewer Pipe Joints. Joints in asbestos cement pipe shall be a sleeve coupling of the same composition as the pipe or of other approved materials, and sealed with rubber rings or joined by an approved-type compression coupling. Joints between asbestos cement pipe and other approved pipe shall be made by means of an approved adapter coupling.

705.1.5 Packing Additives Prohibited. The addition of leak-sealing additives to joint packing shall be prohibited.

705.1.6 Molded Rubber Coupling Joints. Where pipe is joined by means of molded rubber coupling joints, such joints shall comply with approved standards and shall not be considered as slip joints. When required, appropriate rubber bushings shall be used to allow for any difference in piping material diameters.

705.1.7 Elastomeric Gasketed and Rubber-Ring Joints. Elastomeric gasketed and rubber-ring joints shall comply with the applicable standards referenced in Table 14-1.

705.1.8 Shielded Coupling Joints. Where piping systems are joined by means of shielded couplings, such couplings shall comply with approved standards and shall not be considered as slip joints.

**TABLE 7-5
MAXIMUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING**

SIZE OF PIPE (inches)	1¼	1½	2	2½	3	4	5	6	8	10	12
Maximum Units Drainage Piping ¹											
Vertical	1	2 ²	16 ³	32 ³	48 ⁴	256	600	1380	3600	5600	8400
Horizontal	1	1	8 ³	14 ³	35 ⁴	216 ⁵	428 ⁵	720 ⁵	2640 ⁵	4680 ⁵	8200 ⁵
Maximum Length Drainage Piping											
Vertical, (feet)	45	65	85	148	212	300	390	510	750	—	—
Horizontal (unlimited)											
Vent Piping Horizontal and Vertical ⁶											
Maximum Units	1	8 ³	24	48	84	256	600	1380	3600	—	—
Maximum Lengths, (feet)	45	60	120	180	212	300	390	510	750		

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

Notes:

- ¹ Excluding trap arm.
- ² Except sinks, urinals, and dishwashers – exceeding 1 fixture unit.
- ³ Except six-unit traps or water closets.
- ⁴ Only four water closets or six-unit traps allowed on a vertical pipe or stack; and not to exceed three water closets or six-unit traps on a horizontal branch or drain.
- ⁵ Based on ¼ inch per foot (20.8 mm/m) slope. For ⅛ 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 7-3 and Table 7-4(b). 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 901.2.

705.1.9 Hubless Cast-Iron Pipe Joints. Joints for hubless cast-iron soil pipe and fittings shall conform to applicable standards referenced in Table 14-1 and shall not be considered as slip joints.

705.2 Use of Joints.

705.2.1 Clay and Sewer Pipe. Joints in vitrified clay pipe or between such pipe and metal pipe shall be made as provided in Section 316.1.5, Section 705.1.6, Section 705.1.7, or Section 705.1.8.

705.2.2 Cast-Iron Pipe. Joints in cast-iron pipe shall be made as provided in Section 316.1.2, Section 316.1.5, Section 705.1.1, Section 705.1.8, or Section 705.1.9.

705.2.3 Screw Pipe to Cast-Iron. Joints between wrought iron, steel, brass, or copper pipe and cast-iron pipe shall be either caulked or threaded joints made as provided in Section 316.1.1 or Section 705.1.1, or shall be made with approved adapter fittings.

705.2.4 Lead to Cast-Iron, Wrought-Iron, or Steel. Joints between lead and cast-iron, wrought-iron, or steel pipe shall be made by means of wiped joints to a caulking ferrule, soldering nipple, or bushing as provided in Section 316.1.2.

705.3 Special Joints.

705.3.1 Slip Joints. In fixture drains and traps, slip joints of approved materials shall be permitted to be used in accordance with their approvals.

705.3.2 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.

705.3.3 Ground Joint, Flared, or Ferrule Connections. Brass or copper 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.

706.0 Changes in Direction of Drainage Flow.

706.1 Approved Fittings. Changes in 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

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purpose are 1¼ inches, 1½ inches, 2 inches, 2½ inches, 3 inches, 3½ inches, 4 inches, 4½ inches, 5 inches, 6 inches etc.) (50, 65, 80, 90, 100, 115, 125, 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 only when 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 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 7-6, 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.

**TABLE 7-6
CLEANOUTS**

SIZE OF PIPE (inches)	SIZE OF CLEANOUT (inches)	THREADS (per inches)
1½	1½	11½
2	1½	11½
2½	2½	8
3	2½	8
4 & larger	3½	8

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.

707.3 Gas and Watertight. Cleanouts shall be designed to be gas- and watertight.

707.4 Location. Each horizontal drainage pipe shall be provided with a cleanout or removable fixture trap 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 of direction exceeding 135 degrees (2.36 rad). Removable fixture traps drain size shall meet Section 707.10.

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 any 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 and its horizontal branches, 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.

707.5 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 12 inches (305 mm) in front of the cleanout. Cleanouts in piping exceeding 2 inches (50 mm) shall have a clearance of not less than 18 inches (457 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 20 feet (6096 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 7-6.

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 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 of an 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 ⅛ inch per foot (10.4 mm/m) or 1 percent, where first approved by the building official.

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. Where a fixture is installed on a floor level that is lower than the next upstream manhole cover of the public or private sewer, serving such drainage piping, shall be protected from backflow of sewage by installing an approved type of 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 label, sign or markings, 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 gallons per minute (75.7 L/m).
- (2) In single dwelling units, the ejector or pump shall be capable of passing a 1½ 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 other mechanical device shall 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 brass bodies.

710.5 Size of Building Drains and Sewers. Building drains or building sewers receiving discharge from a pump or ejector shall be adequately sized to prevent overloading. Two fixture units shall be allowed for each gallon per minute (0.06 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 have bodies of cast-iron, plastic, brass, or other approved materials; shall have noncorrosive bearings, seats, and self-aligning discs; and shall be constructed so as 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, where in a “public use” occupancy, shall be provided with dual pumps or ejectors arranged to function alternately in normal use and independently in case of overload or mechanical failure. 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 with a minimum of 24” clearance above the lid 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 7-5 for the number and type of fixtures discharging into the sump, nor less than 1½ inches (40 mm) in diameter. Where the foregoing 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 therewith 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 1¼ inches (32 mm) in diameter. A check valve and fullway-type shutoff valve shall be located within the discharge line.

710.13 Macerating Toilet Systems. Listed macerating toilet systems shall be permitted as an alternate to a sewage pump system where approved by the building official.

710.13.1 Sumps. The sump shall be water- and gas-tight.

710.13.2 Discharge Piping. The discharge piping shall be sized in accordance with manufacturer's instructions and shall be not less than ¾ inches (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 per 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.

710.14 Elevator Pit Drains. Permanent means of drainage shall be provided for each elevator car. Gravity drains, when installed, shall be provided with an approved type backwater valve to prevent drain line backup and the trap seal shall be protected with an automatic trap seal primer. Sumps and pumps may be installed when provided with the following:

- (1) A check valve to prevent water, gases, and odors from entering the pit.
- (2) A secured and level cover over the sump.
- (3) An automatic activation switch.
- (4) A minimum of a 50 gpm pump per each elevator car shall be installed.
- (5) A minimum of a 2 inch discharge pipe.
- (6) Sump size as recommended by the pump manufacturer.
- (7) The outlet pipe of the pump shall be directly or indirectly connected to the sanitary drainage system.

- (8) Single pumps shall be permitted.
- (9) A minimum of a 4 inch receiving gravity drain at ¼ inch per foot slope shall serve the branch connected through the trap.
- (10) Dual pumps and oil water separator are not required.

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:

- (1) Single-family residences.
- (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. The building official 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 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 (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 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 (3048 mm) head of water. 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 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 balance a column of mercury 10 inches (34 kPa) in height. The pressure shall be held without introduction of additional air for a period of not less than 15 minutes.

712.4 Where circumstances exist that make air and water tests described in Section 712.2 and Section 712.3 impractical, see Section 103.5.6.2.

Part II – Building Sewers.

713.0 Sewer Required.

713.1 Where Required. A building in which plumbing fixtures are installed and every premises having drainage piping thereon shall have a connection to a public or private sewer, except as provided in Section 101.4.1.2, 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.

713.3 Public Sewer. Within the limits prescribed by Section 713.3 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 abuts 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.

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 building official, 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 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, 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 building official.

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 Grinder. The building official shall review before approval, the installation of a commercial food waste grinder 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 building official 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. Replacement of existing building sewer and building storm sewers using trenchless methodology and materials shall be installed in accordance with IAPMO IS-26 and ASTM F 1216.

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 7-8. No building sewer shall be smaller than the building drain.

For alternate methods of sizing building sewers, see Appendix L.

**TABLE 7-8
MAXIMUM/MINIMUM FIXTURE UNIT LOADING
ON BUILDING SEWER PIPING***

SIZE OF PIPE (inches)	SLOPE, (inches per foot)		
	1/16	1/8	1/4
6 and smaller	(As specified in Table 7-5/ No minimum loading)		
8	1950/1500	2800/625	3900/275
10	3400/1600	4900/675	6800/300
12	5600/1700	8000/725	11 200/325

For SI units: 1 inch = 25 mm, 1 inch per foot = 83.3 mm/m

* For alternate methods of sizing drainage piping, see Appendix L.

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 building official and where it is impractical, due to the depth of the street sewer or 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), 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).

718.2 Support. Building sewer piping shall be laid on a firm bed throughout its entire length, and a 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 || building official.

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 5 feet (1524 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 cocheres; roofed patios; carports; covered walks; covered driveways; and similar structures or appurtenances.

718.4 All nonmetallic yard building sewer piping shall have an electrically conductive tracer wire 18-gauge, insulated copper or heavier, green in color, or other approved materials installed in the trench for locating the pipe in the future. The tracer wire shall run the full length of the installed pipe, with one end left above the finished grade at the building end of the pipe, or at a cleanout next to the building wall, and shall be clearly marked. The other end of the tracer wire shall be spliced into the serving utilities tracer wire, when present.

719.0 Cleanouts. 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).

719.1 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.

719.2 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.

719.3 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.

719.4 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.

719.5 Manholes. Approved manholes shall be permitted to be installed in lieu of cleanouts, where first approved by the building official. 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.

719.6 Cleanouts for building sewers that pass through a backwater valve shall be clearly identified with a label, sign or markings that are weather resistant on the outside building cleanout stating: "backwater valve downstream."

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 drain pipe.

For the purpose of this section, "within the 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 7-7.

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 building official. ||

**TABLE 7-7
MINIMUM HORIZONTAL DISTANCE REQUIRED FROM BUILDING SEWER (feet)**

Buildings or structures ¹	2
Property line adjoining private property	Clear ²
Water supply wells	50 ³
Streams	50
On-site domestic water service line	1 ⁴
Public water main	10 ^{5, 6}

For SI units: 1 foot = 304.8 mm

Notes:

- ¹ Including porches and steps, whether covered or uncovered; breezeways; roofed portecocheres; roofed patios; carports; covered walks; covered driveways; and similar structures or appurtenances.
- ² See also Section 313.2.
- 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.

- (2) Provide additional space for a building sewer 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 building official. The instrument recording such action shall constitute an agreement with the building official 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 building official.

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 building official.

722.5 Disposal Facilities. Where disposal facilities are abandoned consequent to connecting any premises with the public sewer, the permittee making the connection shall fill abandoned facilities in accordance with the building official 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 with 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. The building sewer shall be watertight.

723.2 Where circumstances exist that make air and water tests described in Section 712.2 and Section 712.3 impractical, see Section 103.5.6.3.

CHAPTER 8

INDIRECT WASTES

801.0 Indirect Wastes.

801.1 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).

801.2 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 brewers, hot-and-cold drink dispensers, and similar equipment.

801.2.1 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 not be 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 $\frac{3}{4}$ of an inch (20 mm).

801.2.2 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 every 90 degree (1.57 rad) turn 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.

801.2.3 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 $\frac{1}{2}$ of an inch (15 mm).

801.3 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 801.2.3) into an

approved receptor that is vented. The developed length from the fixture outlet to the receptor shall not exceed 5 feet (1524 mm).

801.4 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 by means of a water-distribution air gap constructed in accordance with Table 6-3.

801.5 Sterilizers. Lines, devices, or apparatus such as stills, sterilizers, and similar equipment requiring waste connections and used for sterile materials shall be indirectly connected by means of 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.

801.6 Drip or Drainage Outlets. Appliances, devices, or apparatus not regularly classified as plumbing fixtures, but which have 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 801.2.1).

802.0 Approvals. No plumbing fixtures served by indirect waste pipes or receiving discharge therefrom shall be installed until first approved by the building official. ||

803.0 Indirect Waste Piping.

803.1 General. Except as hereinafter provided, the size and construction 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 $\frac{1}{2}$ of an inch (15 mm). Angles and changes of direction in such indirect waste pipes shall be provided with cleanouts so as 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

INDIRECT WASTES

inches (457 mm) above its trap. 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, nor 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 when the clothes washer is installed in the same room.

804.2 Where water service connections are installed for a clothes washer, an approved method of waste disposal shall be provided.

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 foregoing shall not apply to an approved sump pump or to an approved pressure-wasting plumbing fixture or device where the building official 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-Classified Apparatus. 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 into an approved type of open receptor.

807.2 Condensate Waste. 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.

807.3 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 brass.
- (2) Materials approved in Section 701.0 shall be permitted to be used when data is provided that the condensate waste is adequately diluted.

807.4 Domestic Dishwashing Machine. A domestic-type dishwasher having a pump for removing waste water may discharge over the sink or, if the discharge pipe from the pump is extended to the underside of the cabinet top and securely anchored to preclude the danger of sink waste water from flowing back into the dishwasher, it may be connected to a fitting or other inlet between the sink and sink trap. The discharge pipe extending from the dishwasher pump outlet to a connection above and on the inlet side of a sink trap shall be of copper tube or other materials approved for such purposes.

808.0 Cooling Water.

808.1 General. Where permitted by the building official, 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.

810.0 Steam and Hot Water Drainage Condensers and Sumps.

810.1 High Temperature Discharge. No steam pipe shall be directly connected to a plumbing or drainage system, nor shall water having a temperature above 140°F (60°C) be discharged under pressure directly into a part of a drainage system. Pipes from boilers shall discharge by means of indirect waste piping, as determined by the building official 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 3/4 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 baffles 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 8-1. The contents of condensers receiving steam or hot water under pressure shall pass through an open sump before entering the drainage system.

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 thereto where the normal water level of such boiler or boilers is reduced not less than 4 inches (102 mm).

**TABLE 8-1
PIPE CONNECTIONS IN BLOWOFF
CONDENSERS AND SUMPS
(inches)**

BOILER BLOWOFF	WATER OUTLET	VENT
¾*	¾*	2
1	1	2½
1¼	1¼	3
1½	1½	4
2	2	5
2½	2½	6

For SI units: 1 inch = 25.4 mm

* To be used only with boilers of 100 square feet (9.29 m²) of heating surface or less.

810.4 Strainers. An indirect waste interceptor 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 industrial liquid 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 prior to discharge into a drainage system. Detailed plans and specifications of the pretreatment facilities shall be required by the building official.

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 building official. Drainage discharge piping from pretreatment facilities or interceptors shall be in accordance with standard drainage installation procedures.

Copper tube shall not be used for chemical or industrial wastes as defined in this section.

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 Poly(vinyl-

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 ⅛ of an inch (3.2 mm); an approved type of ceramic glazed or unglazed vitrified clay; or other approved corrosion-resistant materials.

811.3 Joining Materials. Joining materials shall be of approved type and quality.

811.4 Access. Where practicable, 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 building official.

811.8 Diluted Chemicals. The provisions in this section relative to materials and methods of construction shall not apply to installations such as photographic or x-ray dark rooms 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 waste pool water to the drainage system, the pump discharge shall be installed as an indirect waste.

CHAPTER 9

VENTS

901.0 General.

901.1 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.

901.2 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 when 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 is such as to make it impossible to do so. Where such conditions exist, said sinks shall discharge by means of 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 7-1, 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 the applicable standards referenced in Table 14-1, and Chapter 15 "Firestop Protection." Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a flame-spread index of a maximum of 25 and a smoke-developed index of not more than 50 where tested in accordance with ASTM E84 and UL 723.

903.2 Use of Copper Tubing.

903.2.1 Underground. Copper tube for underground drainage and vent piping shall have a weight of not less than that of copper drainage tube type DWV.

903.2.2 Aboveground. Copper tube for above ground drainage and vent piping shall have a weight of not less than that of copper drainage tube type DWV.

903.2.3 Prohibited Use. Copper tube shall not be used for chemical or industrial wastes as defined in Section 811.0.

903.2.4 Marking. Hard-drawn copper tubing, in addition to the required incised marking, shall be marked in accordance with either ASTM B306 or ASTM B88 as listed in Table 14-1. The colors shall be: Type K, green; Type L, blue; Type M, red; Type DWV, yellow.

903.3 Changes in Direction. Changes in 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 7-5. 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. 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 7-5. 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 7-5, provided the aggregate cross-sectional area of vents is not less than that of the largest required common building sewer.

904.2 Length. No more than one-third of the total permitted length, in accordance with Table 7-5, of a minimum-sized vent shall be installed in a horizontal position.

Exception: 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 downstream of the trap being served. A sanitary tee fitting may be used on its back for a vertical dry vent connection to a horizontal drain.

VENTS

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 a soil or waste vent of proper size.

905.5 Location of Opening. The vent pipe opening from a soil or waste pipe, except for water closets and similar fixtures, shall not be below the weir of the trap.

905.6 Common Vertical Pipe. Two fixtures shall be permitted to be served by a common vertical pipe when 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 nor less than 1 foot (305 mm) from a vertical surface.

906.2 Clearance. Each vent shall terminate not less than 10 feet (3048 mm) from, or not less than 3 feet (914 mm) above, a 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 fire wall. Flagpoling of vents shall be prohibited except where the roof is used for purposes other than weather protection. Vents within 10 feet (3048 mm) of a part of the roof that is used for such other purposes shall extend not less than 7 feet (2134 mm) above such roof and shall be securely stayed.

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 water-tight by the use of approved flashings or flashing material.

906.6 Lead. See Table 14-1. Sheet lead shall be not less than the following:

- (1) For safe pans – not less than 4 pounds per square foot (lb/ft²) (19 kg/m²) or 1/16 of an inch (1.6 mm) thick.
- (2) For flashings or vent terminals – not less than 3 lb/ft² (15 kg/m²).
- (3) Lead bends and lead traps shall be not less than 1/8 of an inch (3.2 mm) 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 2 inches (50 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 building official. ||

907.0 Vent Stacks and Relief Vents.

907.1 Drainage Stack. Each drainage stack that extends 10 or more stories above the building drain or other horizontal drain, 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, by means of 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 by means of 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 any 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).

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 Bathroom Groups.

Water closets, bathtubs, showers and floor drains within one or two bathroom groups located on the same floor level and for private use shall be permitted to be vented by a wet vent. || The wet vent shall be considered the vent for the fixtures and shall extend from the connection of the dry vent along the direction of the flow in the drain pipe to the most downstream

fixture drain or trap arm connection to the horizontal branch drain. Each wet-vented fixture drain or trap arm shall connect independently to the wet-vented horizontal branch drain. Each individual fixture drain or trap arm shall connect horizontally to the wet-vented horizontal branch drain or shall be provided with a dry vent. The trap to vent distance shall be in accordance with Table 10-1. Only the fixtures within the bathroom groups shall connect to the wet-vented horizontal branch drain. The water closet fixture drain or trap arm connection to the wet vent shall be downstream of the fixture drain or trap arm connections. Additional fixtures shall discharge downstream of the wet vent system and be conventionally vented.

908.2.1 Vent Connection. The dry vent connection to the wet vent shall be an individual vent or common vent for the lavatory, urinal, bidet, shower, or bathtub. Only one wet-vented fixture drain or trap arm shall discharge upstream of the dry-vented fixture drain connection.

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 Tables 7-3 and 7-5 based on the total fixtures units discharging into the wet vent.

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 all parts of 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 under 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. Plans and specifications for each combination waste and vent system shall first be approved by the building official 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 drain pipe served. The vent connection shall be downstream of the uppermost fixture.

910.4 Size. 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 Engineered Vent System.

911.1 General. The design and sizing of a vent system shall be permitted to be determined by accepted engineering practice. The system shall be designed by a registered design professional and approved in accordance with Section 301.4.

911.2 Minimum Requirements. An engineered vent system shall provide protection of the trap seal in accordance with Section 901.2.

CHAPTER 10

TRAPS AND INTERCEPTORS

1001.0 Traps Required. Each plumbing fixture, excepting those having integral traps or as permitted in Section 1001.1, shall be separately trapped by an approved type of water seal trap. Not more than one trap shall be permitted on a trap arm.

1001.1 Where Required. 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.

1001.2 No food waste disposal unit shall be installed with a set of restaurant, commercial, or industrial sinks served by a single trap; each such food waste disposal unit 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 be permitted to also receive the waste from a clothes washer set adjacent thereto. No clothes washer or laundry tub shall be connected to any trap for a kitchen sink.

1001.3 The vertical distance between a fixture outlet and the trap weir shall be as short as practicable, but in no case shall the tailpiece from any fixture exceed 24 inches (610 mm) in length.

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, back-pressure, and air circulation shall be assured throughout the drainage system by means of 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 10-1, but in no case less than two times the diameter of the trap arm.

1002.3 Change of Direction. A trap arm shall be permitted to change direction without the use of a cleanout when such change of direction does not exceed 90 degrees (1.57 rad). Horizontal changes in direction of trap arms shall comply with Section 706.2.

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 a 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-brass tubing trap, not less than 17 B & S Gauge (0.045 inch) (0.114 mm), shall be permitted to be used on fixtures discharging domestic sewage.

Exception: Drawn-brass 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.

TABLE 10-1
HORIZONTAL LENGTHS OF TRAP ARMS
(EXCEPT FOR WATER CLOSETS AND SIMILAR FIXTURES)^{1, 2}

TRAP ARM PIPE DIAMETER (inches)	DISTANCE TRAP TO VENT MINIMUM (inches)	LENGTH MAXIMUM (inches)
1¼	2½	30
1½	3	42
2	4	60
3	6	72
4	8	120
Exceeding 4	2 x Diameter	120

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 of the closet flange to the inner edge of the vent) and its vent shall not exceed 6 feet (1829 mm).

TRAPS AND INTERCEPTORS

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 7-3. 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 Moveable Parts. Bladders, check valves or other 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 building official. 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, floor sinks, funnel drains and similar fixtures 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.

Traps for floor drains, floor sinks, funnel drains, area drains, catch basins and receptors within a building discharging to a vented horizontal soil or waste pipe are exempt from

the provision requiring individual vents for each trap, provided that the trap arm, or distance from the trap to the vented horizontal soil or waste pipe to which it discharges, measuring the developed length, does not exceed the maximum distances as shown in Table 10-1.1, and that the branch waste pipe from the trap connects to a soil or waste pipe which is vented with a pipe having a diameter not less than that which would be required to vent a floor drain, floor sink, funnel drain, area drain, catch basin and receptors, computed on the units allowed in Table 7-3 and Table 7-5. Common vent sizing shall be the sum of fixture units served, but in no case smaller than the minimum vent size required for any fixture served or as determined from Table 7-5 whichever is larger.

Exception: Floor sinks installed to receive the discharge waste from sinks may be individually vented. Trap arms shall not exceed distances as per Table 10-1.1. Priming of traps for above vented floor sinks are not required.

Vents are not required for traps for exterior area drains and catch basins which discharge to a storm water drain system.

Cleanouts required in Section 706.0 do not apply when utilizing Table 10-1.1, except for catch basins.

1007.0 Trap Seal Protection.

1007.1 General. Floor drain or similar traps directly connected to the drainage system shall be provided with an approved automatic means of maintaining their water seals.

1007.2 Each nonpressure-activated primer valve, similar operated device, or toilet flush primer connection shall serve no more than two traps, unless a specific non-pressure activated primer valve, similarly operated device, or toilet flush primer is approved for a limited number of traps by the Administrative Authority. Pressure-activated primer valves shall be limited to the number of traps to be served as approved by the Administrative Authority for that specific valve.

1007.3 Supply piping between the priming device connection and the trap shall be at least 3/8 of an inch (12 mm) I.D. The supply piping to priming devices shall be protected against a form of crossconnection and sized according to the primer device manufacturer's recommendation.

**TABLE 10-1.1
FLOOR DRAINS
MAXIMUM HORIZONTAL DISTANCE TO VENT OR VENTED LINE**

TRAP SIZE I.D. (inches)	WASTE BRANCH SIZE I.D. (inches)	MAXIMUM DIST. (feet)
2	2	6
3	3	10
4	4	14
6	6	20

For SI units: 1 inch = 25.4 mm

Notes:

¹ Vents are not required for traps for exterior area drains and catch basins which discharge to a storm water drain system.

² Cleanouts required in Section 706.0 do not apply when utilizing Table 10-1.1, except for catch basins.

1007.4 Primer valve bodies shall be installed a minimum of 12 inches (305 mm) above the flood level rim of the fixture being served and in an accessible location.

1007.5 Primer headers for three or more traps shall be the "inverted manifold" type (or other approved method) having equal water flow to all outlets, with each outlet provided with a threaded removable plug or cap inspection fitting. Approved flush tanks may be used as an alternate supply source for primer headers.

1007.6 A primer stop, if used, must be an accessible screw-driver stop.

1008.0 Building Traps.

1008.1 General. Building traps shall not be installed except where required by the building official. 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 need 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 Industrial Interceptors (Clarifiers) and Separators.

1009.1 Where Required. Interceptors (clarifiers) (including grease, oil, sand interceptors [clarifiers], etc.) shall be required by the building official 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.

1009.2 Approval. The size, type, and location of each interceptor (clarifier) or separator shall be approved by the building official. 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 in order 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 building official. ||

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 does 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 dimension, 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 Where Required. Waste pretreatment is required in all Food Service Establishments. Waste pretreatment is also required in other establishments as determined by the building official, where grease is introduced into the drainage or sewer system. An approved type of grease interceptor(s) complying with the provisions of this section shall be correctly sized and properly installed. The following plumbing fixtures and drains shall be connected to the grease interceptor(s):

Plumbing fixtures, garbage disposals, dishwashers, floor drains, and cooking equipment, with drain connections in food and/or beverage preparation areas of all Food Service Establishments.

TRAPS AND INTERCEPTORS

If a garbage disposal is installed on a system using a hydromechanical grease interceptor, a solids interceptor shall be installed upstream of the inlet of the grease interceptor.

Where space or existing physical constraints of existing buildings necessitate such installations a combination of hydromechanical, gravity grease interceptors, and professionally engineered systems shall be allowed in order to meet this code and other applicable requirements of the building official. A grease interceptor shall not be required for individual dwelling units or for private living quarters.

Exceptions:

- (1) Ice wells and condensate drains are not required to drain into or through the grease interceptor(s).
- (2) Bathroom plumbing fixtures, including bathroom floor drains, shall not drain into or through the grease interceptor(s).

1014.2 Trapped and Vented. Each fixture discharging into a grease interceptor shall be individually trapped and vented in an approved manner.

1014.3 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 manufacturers' instructions.

1014.3.1 Capacity. The total capacity in gallons (gal) (L) of fixtures discharging into any 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 10-2.

For the purpose of 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 any provision of this section.

Sizing criteria specified in this section are based upon proper maintenance of the grease interceptor(s).

1014.3.2 Vent. A vent shall be installed downstream of hydromechanical grease interceptors in accordance with the requirements of this code.

**TABLE 10-2
TABLE HYDROMECHANICAL GREASE INTERCEPTOR (HGI)
SIZING CHART***

DRAINAGE FIXTURE UNITS (DFUs)	HGI FLOW (gpm)
8	20
10	25
13	35
20	50
35	75
172	100
216	150
342	200
428	250
576	350
720	500

For SI units: 1 gallon = 3.785 L

Notes:

* Based on intermittent potentially full flow in drainage lines

1014.4 Gravity Grease Interceptors. Required gravity grease interceptors shall comply with the provisions of Section 1014.4.1 through Section 1014.4.7.

1014.4.1 General. The provisions of this section shall apply to the design, construction, installation, and testing of commercial kitchen gravity grease interceptors.

1014.4.2 Waste Discharge Requirements. Waste discharge from plumbing fixtures and equipment as required in Section 1014.0, shall be permitted to be drained into the sanitary waste through the interceptor where approved by the building official.

1014.4.2.1 Toilets and Urinals. Bathroom fixtures, toilets, urinals, and other similar fixtures shall not drain through the interceptor.

1014.4.2.2 Inlet Pipe. Waste shall enter the interceptor through the inlet pipe.

1014.4.3 Design. Gravity Interceptors shall be constructed in accordance with the applicable standard in Table 14-1 or the design approved by the building official.

1014.4.4 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 in accordance with IAPMO Z1001, shall not be installed in a building where food is handled. Location of the grease interceptor shall meet the approval of the building official.

1014.4.4.1 Interceptors. Interceptors shall be placed as close as practical to the fixtures they serve.

1014.4.4.2 Business Establishment. Each business establishment for which a gravity grease interceptor is required shall have an interceptor which shall serve only that establishment unless otherwise approved by building official.

1014.4.4.3 Access. Each gravity grease interceptor shall be located so as to be readily accessible to the equipment required for maintenance.

1014.4.5 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 be located at the outlet end of gravity grease interceptors so that effluent quality can be sampled periodically.

1014.4.6 Sizing Criteria. The volume of the interceptor shall be determined by using Table 10-3. If 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 7-5, Drainage Piping, Horizontal.

Sizing criteria specified in this section are based upon proper maintenance of the grease interceptor(s).

1014.4.7 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.

**TABLE 10-3
GRAVITY GREASE INTERCEPTOR SIZING**

DRAINAGE FIXTURE UNITS ^{1, 3} (DFUs)	INTERCEPTOR VOLUME ² (gallons)
8	500
21	750
35	1000
90	1250
172	1500
216	2000
307	2500
342	3000
428	4000
576	5000
720	7500
2112	10 000
2640	15 000

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 7-5; 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.

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.

1015.2 Components, Materials, and Equipment. FOG disposal systems, including all components, materials, and equipment necessary for the proper function of the system, shall be in accordance with Section 301.1.3 or Section 301.2 of this code.

1015.3 Sizing Application and Installation. FOG disposal systems shall be engineered, sized, and installed in accordance with the manufacturer’s installation instructions and as specified in ASME A112.14.6, as listed in Chapter 14, Table 14-1 of this code.

1015.4 Performance. FOG disposal systems shall be tested and certified as listed in Chapter 14, Table 14-1 of this code, and other national consensus standards applicable to FOG disposal systems as discharging a maximum of 5.84 grains per gallon (gr/gal) 100 mg/L) FOG.

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 7-3):

- 3 floor drains @ 2 DFUs each = 6 DFUs
- Mop sink @ 3 DFUs each = 3 DFUs
- Food prep sink @ 3 DFUs each = 3 DFUs
- Total 12 DFUs

Using Table 10-3, the grease interceptor will be sized at 750 gallons (2389 L).

1016.0 Sand Interceptors.

1016.1 Discharge. Where the discharge of a fixture or drain contain 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 Where Required. Sand interceptors are required where the building official 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),

TRAPS AND INTERCEPTORS

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 feet square (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) per minute flow or fraction thereof over 20 gpm gallons (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. 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. The minimum size of a flammable vapor vent shall be not less than 2 inches (51 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. 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. 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 building official. The waste oil from the separator shall flow by gravity or shall be pumped to a higher elevation by an automatic pump. Pumps shall be adequately sized and accessible. Waste oil tanks shall have a 2 inch (50 mm) minimum pump-out connection at grade and a 1½ inch (38 mm) minimum vent to atmosphere at an approved location not less than 10 feet (3048 mm) above grade.

1017.2 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 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.

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: 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. Above 10 vehicles, the building official shall determine the size of the interceptor required. Where vehicles are serviced only 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 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 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 building official.

1101.2 Storm Water Drainage to Sanitary Sewer Prohibited. Storm water shall not be drained into sewers intended for sanitary drainage only.

1101.2.1 Traps Required for Combined Sewers.

Storm water from an exterior area drain, catch basin, or from a roof and discharging to a combined sewer shall be trapped. The trap shall be of approved design and located in the storm drain line between the sanitary sewer connection and the inlet opening into which storm is discharged.

More than one roof drain or other storm receptor drain shall be served by a single trap where the trap is located so as to receive, through its inlet side, drainage from roof drains and receptors.

Storm water drainage traps shall be below the frost line or within the building. An accessibly located cleanout not smaller than the size of the trap, shall be extended to grade from the inlet side of each such trap with approved piping and fittings. Where the cleanout is installed on the exterior of the building, it shall extend at least 6 inches (152 mm) above grade and be within 24 inches (610 mm) of the foundation unless otherwise approved by the building official.

Exception: Where a roof drain is located not less than 10 feet (3048 mm) from, or at least 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, road, ally and street lines excepted, no trap is required.

Traps, trap primers and vents for exterior area drains and catch basins where located less than 10 feet (3048 mm) from a building, shall be the same as for floor drains and catch basins located within a building where such drains are connected to a combined sewer as required by this code.

1101.3 Material Uses. Rainwater piping placed within the interior of a building or run within a vent or shaft shall be of cast-iron, galvanized steel, wrought iron, brass, copper, 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. Fittings shall be the same as that specified for sanitary drainage pipe, except that 90 degree (1.57 rad) sanitary tee

branch fittings shall be used in lieu of combination wye and 1/8 bends. Short-turn 90 degree (1.57 rad) bends shall be substituted for long-turn 90 degree (1.57 rad) bends. Fittings installed in a storm drain between a trap and a connection to a combined sewer shall be the same as those for sanitary drainage work. Inside conductors shall connect to an approved roof or deck, or overflow drain. ABS and PVC DWV piping installations shall be installed in accordance with Chapter 15 "Firestop Protection." Except for individual single-family dwelling units, materials exposed within ducts or plenums shall have a flame-spread index of a maximum of 25 and a smoke-developed index of a maximum of 50, where tested in accordance with ASTM E84 and UL 723.

Exterior storm drainage piping and fittings shall be CPE as listed in Table 14-1.

1101.3.1 The installation of building storm sewers shall be in accordance with the requirements applicable under this code.

1101.3.2 Building storm sewers located 2 feet (610 mm) or more away from a building or property line, except roads, streets or alleys, shall be of cast iron, vitrified clay, concrete, asbestos cement, ABS, PVC, CPE, or other pipe meeting standards approved by the building official.

1101.3.3 Fittings shall be the same as specified for sanitary sewers in Section 715.0 of this code.

Exception: Approved taps shall be installed in accordance with the manufacturer's listing where first approved by the building official.

1101.3.4 Cleanouts shall be required and shall be installed in accordance with Section 707.0 of this code.

1101.3.5 Joints and connections shall be as prescribed in Section 715.2 of this code.

1101.3.6 Pipe or other products or appurtenances incidental to the installation of building storm sewers shall be in accordance with the requirements for approval of Chapter 3 of this code and shall be identified in a manner satisfactory to the building official.

1101.4 Expansion Joints Required. Expansion joints or sleeves shall be provided where warranted by temperature variations or physical conditions.

1101.4.1 Connections. Connections between inside conductors and roof, deck and overflow drains shall be made with approved adapter fittings as required by this code. Such connectors shall be provided with an expansion or approved swing joint. Rain or storm water piping within a building shall be watertight and shall be tested pursuant to Section 1109.0 of this code.

1101.5 Storm and Groundwater Drainage.

1101.5.1 Prohibited Use. No conductor pipe shall be used as a sanitary drain or vent; nor shall any sanitary

drain or vent pipe be used as a conductor. Subsoil drains under and around buildings shall be used to collect and drain groundwater.

1101.5.2 Subsoil, Foundation and Absorption Tile Drains. Groundwater collected or drained from under or around buildings shall be disposed of through approved pipe material, as follows:

(1) **Disposal.** Where practical, such groundwater shall be drained by gravity to a natural surface drainage course or other approved disposal site.

(2) **Sump.** Where groundwater is drained by gravity to a combination sewer or storm sewer system, the groundwater shall be drained into an accessible trapped sump or catch basin.

Exception: Subsoil drain lines covered with an approved filter fabric shall connect to a combination sewer trapped as per Section 1101.2.1. Subsoil drain lines covered with an approved filter material shall directly connect to the storm sewer.

Drainage pipe on the discharge side of such sump, trap or catch basin shall be tested as per Section 1109.0.

(3) **Backwater Valves.** Subsoil, foundation, and absorption drains that are subject to reverse flow shall be equipped with approved, accessible backwater valves as required by the building official.

(4) **Ejectors.** Subsoil drains which cannot remove groundwater by gravity shall have the storm water lifted by means of an approved ejector. The discharge shall be drained into the building storm sewer, or an open drainage course, or other suitable disposal facility at least 10 feet (3048 mm) beyond the exterior of the building.

(5) **Valves and Connections.** The discharge pipe from a pump or ejector used to lift groundwater shall be equipped with a swing check or backwater valve and a gate valve. Where the gravity drainage line to which such discharge line connects is horizontal, the method of connection shall be from the top through wye branch fitting. The gate valve shall be located on the discharge side of the backwater or check valve.

(6) **Venting.** Gastight and watertight receiving tanks or sumps shall be vented by means of an approved pipe not less than 2 inches (51 mm) in size. Such vents shall be properly terminated in accordance with the applicable section of this code.

(7) **Tracer Wire.** Nonmetallic piping for yard, ground or storm water for building sewers shall have an electrically conductive tracer wire (18-gauge, insulated copper, or heavier, green in color or other approved materials) installed in the trench for locating the pipe in the future. The tracer wire shall run the full length of the installed pipe, with one end left above the finished grade at the building end of the pipe, or at a cleanout next to the building wall, and shall be clearly marked. The other end of the tracer wire shall be spliced into the serving utilities tracer wire, when present.

(8) **Materials.** Storm drainage, groundwater drainage, rainwater piping systems, exterior building drains, subsurface, foundation, footing, under-slab and absorption drains shall be of materials approved by and specified in Section 701.0 of this code, except for corrugated metal storm sewers installed as per Oregon IS 29-04.

1101.5.3 Dry Wells; Construction, Use and Limitations.

1101.5.3.1 Construction. Where permitted by the building official, dry well shall be used. The building official shall require soil percolation tests. Where authorized, dry wells shall be of reinforced concrete rings with an inside diameter of not less than 28 inches (700 mm) with a minimum depth of 5 feet (1524 mm), measured from the bottom to the top of the reinforced concrete cover and set on undisturbed soil. Dry wells shall be covered with at least 2 feet (610 mm) of compacted earth where measured from the top of the lid to the finished grade. Where first approved by the building official, dry wells shall be constructed of brick or other approved material in of not less than 4 inches (102 mm) thickness. Brick or block shall be assembled with or without openings, provided the openings on the outside of the dry well are not greater than 3 inches (76 mm). This type of dry well shall have a brick arched top or an arched top of other approved materials.

1101.5.3.2 Location. No dry well shall be located closer than 5 feet (1524 mm) of a property line nor closer than 10 feet (3048 mm) to a building unless approved by the building official. Each drainage connection to a dry well shall be made at the top center of the lid by the use of an approved 90 degree (1.57 rad) waste fitting. Support of piping shall be as required by Chapter 3 of this code. Special permission shall be granted to enter the side of the dry well where grade and structural conditions make top entrance impractical.

1101.5.3.3 Backfill. The particle size of the backfill surrounding a dry well shall be of sufficient size to prevent its incursion into the interior of the dry well. The backfill shall form a continuous layer around the dry well not less than 6 inches (152 mm) in thickness and shall extend to the full height of the dry well.

Exception: Where the dry well is installed in sandy-type soil an approved filter material shall be placed around the exterior of the liner to prevent infiltration of sand. The backfill shall be of native soil properly compacted.

1101.5.3.4 Abandonment. Where required by the building official, every drywell which has been abandoned or has been otherwise discontinued from further use shall be completely filled with earth, sand, gravel, concrete, or other approved material.

1101.6 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.

1101.7 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. Such 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. Areaways in excess of 100 square feet (9.29 m²) shall not drain into subsoil drains. Areaway drains for areaways exceeding 100 square feet (9.29 m²) shall be sized according to Table 11-2.

1101.8 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) 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 1101.7).

1101.9 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.

1101.10 Catch Basin Specifications.

1101.10.1 General. Catch Basins shall be made of approved material and sized to carry the designed capacity. Catch basins shall have an inside dimension of not less than 24 inches (610 mm) and extend not less than 24 inches (610 mm) below the water line. The catch basin can be either square or round and shall be provided with a top turned out flange of not less than 2 inches (50 mm) and the outer edge raised to a height of the top edge of the grate. Catch basins made of cast iron shall have a wall thickness of not less than ¼ of an inch (6.4 mm) with sleeves attached for connecting the storm drain line, or have other attachment means. Cast iron and steel catch basins shall be asphalt coated inside and outside.

Steel-plate catch basins shall not be less than ten gauge, joined with welded seams with sleeves attached for connecting the storm drain line or have other attachment means.

Concrete catch basins shall have a wall thickness of not less than 4 inches (102 mm) and be reinforced with number four steel rod installed at intervals not to exceed 6 inches (152 mm) on center. The inside surface shall have a trowel finish, constructed so as to be water tight. The size shall be the same as for cast-iron and steel catch basins.

1101.10.2 Trap. Catch basins shall be trapped by using an inverted one-quarter bend or welded baffle. Traps so constructed shall provide no less than a 6 inches (152 mm) water seal. Where other than a turned down one-quarter bend is provided, a cleanout shall be required as per Section 719.0 of this code.

1101.10.3 Outlets. Outlets installed in standard 24 inch (610 mm) catch basins shall be at least 3 inches (76 mm) and not larger than 6 inches (152 mm). Where outlets larger than 6 inches (152 mm) are provided, a drawing and specifications shall be submitted to the building official for approval of the alternate sizing. Connections to catch basin outlets shall be made by approved methods.

1101.10.4 Catch Basin Grates. Grates for catch basins shall be made of approved materials and shall be capable of supporting the anticipated load. Grates shall be designed to prevent bicycle and wheelchair tires from entering or becoming entrapped.

1101.10.5 Protection of Piping; Structural Integrity. Where drainage piping to or from a catch basin is subject to heavy vehicular traffic or other excessive loads, such piping shall be structurally designed to withstand all anticipated loads and shall be installed on a firm bed throughout its entire length.

1101.11 Roof Drainage.

1101.11.1 Primary Roof Drainage. Roof areas of a building shall be drained by roof drains or gutters. The location and sizing of drains and gutters shall be coordinated with the structural design and pitch of the roof. Unless otherwise required by the building official, roof drains, gutters, vertical conductors or leaders, and horizontal storm drains for primary drainage shall be sized based on a storm of 60 minutes duration and 100 year return period. Refer to Table D-1 (in Appendix D) for 100 year, 60 minute storms at various locations.

1101.11.2 Secondary drainage. Secondary (emergency) roof drainage shall be provided by one of the methods specified in Section 1101.11.2.1 or Section 1101.11.2.2.

1101.11.2.1 Roof Scuppers or Open Side.

Secondary roof drainage shall be provided by an open-sided roof or scuppers where the roof perimeter construction extends above the roof in such a manner that water will be entrapped. An open-sided roof or scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1101.11.1. Scupper openings shall be not less than of 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 11-1.

1101.11.2.2 Secondary Roof Drain.

Secondary roof drains shall be provided. The secondary roof drains shall be located not less than 2 inches (51 mm) above the roof surface. The maximum height of the roof drains shall be a height to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1101.11.1. The secondary roof drains shall connect to a piping system in accordance with Section 1101.11.2.2(A) or Section 1101.11.2.2(B).

1101.11.2.2(A) Separate Piping System.

The secondary roof drainage system shall be a separate system of piping, independent of the primary roof drainage system. The discharge shall be above grade, in a location observable by the building occupants or maintenance personnel. Secondary roof drain systems shall be sized in accordance with Section 1101.11.1 based on the rainfall rate for which the primary system is sized.

1101.11.2.2(B) Combined System.

The secondary roof drains shall connect to the vertical piping of the primary storm drainage conductor downstream of a horizontal offset below the roof. The primary storm drainage system shall connect to the building storm water that connects to an underground public storm sewer. The combined secondary and primary roof drain systems shall be sized in accordance with Section 1106.0 based on double the rainfall rate for the local area.

1101.12 Cleanouts. Cleanouts for building storm drains shall comply with the requirements of Section 719.0 of this code.

1101.12.1 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.

1101.13 Rainwater Sumps. Rainwater sumps serving “public use” occupancy buildings shall be provided with dual pumps arranged to function alternately in case of overload or mechanical failure.

1102.0 Materials.

1102.1 Conductors. Conductors installed aboveground in buildings shall be in accordance with the applicable standards referenced in Table 7-1 for aboveground drain, waste and vent pipe.

1102.1.1 Inside of Conductors. The inside of conductors installed aboveground 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) above ground]; or Schedule 40 ABS or Schedule 40 PVC plastic pipe.

1102.2 Underground Building Storm Drains. Underground building storm drains shall comply with the applicable standards referenced in Table 7-1 for underground drain, waste and vent pipe.

1102.3 Building Storm Sewers. Building storm sewers shall comply with the applicable standards referenced in Table 7-1 for building sewer pipe.

1102.3.1 Fittings. Fittings for exterior storm drainage and sewer piping shall be as required for drainage piping in Section 706.0. Interior storm drainage fittings may be sanitary tee branch fittings and short-turn 90 degree (1.57 rad) bends.

1103.0 Traps on Storm Drains and Leaders.

1103.1 Where Required. 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 allowed under Section 906.0, Vent Termination.

1103.2 Where Not Required. No trap shall be required for leaders or conductors that are connected to a sewer carrying storm water exclusively.

1103.3 Trap Size. Traps, where installed for individual conductors, shall be the same size as the horizontal drain to which they are connected.

1103.4 Method of Installation of Combined Sewer.

Individual storm-water traps shall be installed on the storm-water 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.

1104.0 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 single wye fittings to the combined building sewer not less than 10 feet (3048 mm) downstream from any soil stack.

1104.1 Improper Use. 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.

1105.0 Roof Drains.

1105.1 Material.

1105.1.1 Lead. Roof drains shall be constructed of materials specified in accordance with Table 14-1.

1105.1.2 Copper. Roof drains shall be of cast-iron, copper or copper alloy, lead, or plastic.

1105.2 Dome or Strainer for General Use. Roof drains and overflow drains, except those draining to hanging gutters, shall be equipped with strainers extending not less than 4 inches (102 mm) above the surface of the roof immediately adjacent to the drain. Strainers shall have a minimum inlet area above the roof level not less than one and one-half times the area of the conductor or leader to which the drain is connected.

1105.3 Strainers for Flat Decks. 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 and shall have an available inlet area of not less than two times the area of the conductor or leader to which the drain is connected.

1105.4 Roof Drain Flashings. 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.

1105.4.1 Lead Flashing. Where lead flashing material is used, it shall be not less than 4 pounds per square foot (lb/ft²) (19 kg/m²).

1105.4.2 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).

1106.0 Size of Leaders, Conductors, and Storm Drains.

1106.1 Vertical Conductors and Leaders. Vertical conductors and leaders shall be sized on the basis of the maximum projected roof area and Table 11-1.

1106.2 Size of Horizontal Storm Drains and Sewers. The size of building storm drains or building storm sewers or any of their horizontal branches shall be based upon the maximum projected roof or paved area to be handled and Table 11-2.

1106.3 Size of Roof Gutters. The size of semi-circular gutters shall be based on the maximum projected roof area and Table 11-3.

1106.4 Side Walls Draining onto a Roof. Where vertical walls project above a roof so as to permit storm water to drain to the roof area below, the adjacent roof area shall be permitted to be computed from Table 11-1 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 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 allowance for the area of the wall above the top of the lowest wall in accordance with (3) and (5) above.
- (7) 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 (1), (3), (5), and (6) above.

1107.0 Values for Continuous Flow.

1107.1 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).

**TABLE 11-3
CONTROLLED-FLOW MAXIMUM ROOF WATER DEPTH**

ROOF RISE* (inches)	MAXIMUM WATER DEPTH AT DRAIN (inches)
Flat	3
2	4
4	5
6	6

For SI units: 1 inch = 25.4 mm

* Vertical measurement from the roof surface at the drain to the highest point of the roof surface served by the drain, ignoring a local depression immediately adjacent to the drain.

1108.0 Controlled-Flow Roof Drainage.

1108.1 Application. In lieu of sizing the storm drainage system in accordance with Section 1106.0, the roof drainage shall be permitted to be sized on the basis of 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 11-4.
- (3) No less than two drains shall be installed in roof areas of 10 000 square feet (929 m²) or less, and no 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 allowed.
- (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 Tables 11-1 and 11-2.
- (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 11-3.
- (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 11-4.

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- (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 11-1.
- (10) Flashings shall extend above the top of the scuppers.
- (11) At any 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 building official for approval.

1108.2 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 1108.0 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 11-1.

**TABLE 11-4
DISTANCE OF SCUPPER BOTTOMS ABOVE ROOF**

ROOF RISE* (inches)	ABOVE ROOF LEVEL AT DRAIN (inches)
Flat	3
2	4
4	5
6	6

For SI units: 1 inch = 25.4 mm

* Vertical measurement from the roof surface at the drain to the highest point of the roof surface served by the drain, ignoring a local depression immediately adjacent to the drain.

1109.0 Testing.

1109.1 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 1109.2.1 or Section 1109.2.2 to disclose leaks and defects.

1109.2 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, and proved tight. The building official 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:

1109.2.1 Water Test. After piping has been installed, the water test shall be applied to the drainage system, either to the entire system or to 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 a 10 foot (3048 mm) head of water. 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.

1109.2.2 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 introduction of additional air for a period of not less than 15 minutes.

1109.2.3 Exceptions. Where circumstances exist that make air and water tests described in Section 1109.2.1 and Section 1109.2.2 impractical, see Section 103.5.3.3.

1110.0 Abandoned Storm Sewers.

Every abandoned storm sewer system or any parts thereof, shall be plugged or capped in an approved manner as determined by the enforcing agency.

**TABLE 11-1
SIZING ROOF DRAINS, LEADERS, AND VERTICAL RAINWATER PIPING^{2, 3}**

SIZE OF DRAIN, LEADER, OR PIPE	FLOW	MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)												
		inches	gpm ¹	1 (in/h)	2 (in/h)	3 (in/h)	4 (in/h)	5 (in/h)	6 (in/h)	7 (in/h)	8 (in/h)	9 (in/h)	10 (in/h)	11 (in/h)
2	30		2880	1440	960	720	575	480	410	360	320	290	260	240
3	92		8800	4400	2930	2200	1760	1470	1260	1100	980	880	800	730
4	192		18 400	9200	6130	4600	3680	3070	2630	2300	2045	1840	1675	1530
5	360		34 600	17 300	11 530	8650	6920	5765	4945	4325	3845	3460	3145	2880
6	563		54 000	27 000	17 995	13 500	10 800	9000	7715	6750	6000	5400	4910	4500
8	1208		116 000	58 000	38 660	29 000	23 200	19 315	16 570	14 500	12 890	11 600	10 545	9600

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 1¾ 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 roundpipe. 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.

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**TABLE 11-2
SIZING OF HORIZONTAL RAINWATER PIPING^{1, 2}**

SIZE OF PIPE	FLOW ($\frac{1}{8}$ inch per foot slope)	MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)					
		1 (in/h)	2 (in/h)	3 (in/h)	4 (in/h)	5 (in/h)	6 (in/h)
inches	gpm						
3	34	3288	1644	1096	822	657	548
4	78	7520	3760	2506	1880	1504	1253
5	139	13 360	6680	4453	3340	2672	2227
6	222	21 400	10 700	7133	5350	4280	3566
8	478	46 000	23 000	15 330	11 500	9200	7670
10	860	82 800	41 400	27 600	20 700	16 580	13 800
12	1384	133 200	66 600	44 400	33 300	26 650	22 200
15	2473	238 000	119 000	79 333	59 500	47 600	39 650

SIZE OF PIPE	FLOW ($\frac{1}{4}$ inch per foot slope)	MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)					
		1 (in/h)	2 (in/h)	3 (in/h)	4 (in/h)	5 (in/h)	6 (in/h)
inches	gpm						
3	48	4640	2320	1546	1160	928	773
4	110	10 600	5300	3533	2650	2120	1766
5	196	18 880	9440	6293	4720	3776	3146
6	314	30 200	15 100	10 066	7550	6040	5033
8	677	65 200	32 600	21 733	16 300	13 040	10 866
10	1214	116 800	58 400	38 950	29 200	23 350	19 450
12	1953	188 000	94 000	62 600	47 000	37 600	31 350
15	3491	336 000	168 000	112 000	84 000	67 250	56 000

SIZE OF PIPE	FLOW ($\frac{1}{2}$ inch per foot slope)	MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)					
		1 (in/h)	2 (in/h)	3 (in/h)	4 (in/h)	5 (in/h)	6 (in/h)
inches	gpm						
3	68	6576	3288	2192	1644	1310	1096
4	156	15 040	7520	5010	3760	3010	2500
5	278	26 720	13 360	8900	6680	5320	4450
6	445	42 800	21 400	14 267	10 700	8580	7140
8	956	92 000	46 000	30 650	23 000	18 400	15 320
10	1721	165 600	82 800	55 200	41 400	33 150	27 600
12	2768	266 400	133 200	88 800	66 600	53 200	44 400
15	4946	476 000	238 000	158 700	119 000	95 200	79 300

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 m²

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.

CHAPTER 13

HEALTH CARE FACILITIES AND MEDICAL GAS AND VACUUM SYSTEMS

Part I – Special Requirements for Health Care Facilities.

1301.0 Application.

1301.1 Where Required. Construction and equipment requirements shall be applied to new construction and new equipment, except as modified in individual chapters. The altered, renovated, or modernized portion of an existing system or individual component shall be required to meet the installation and equipment requirements stated in this code. Where the alteration, renovation, or modernization adversely impacts existing performance requirements of a system or component, additional upgrading shall be required. [NFPA 99:1.3.2 – 1.3.2.2]

1301.2 Health Care Facilities. This chapter applies to the special fixtures and systems in health care facilities and to the special plumbing requirements for such facilities. Other plumbing in such facilities shall comply with other applicable sections of this code.

1301.3 Breathing Air Replenishment (BAR) System. This chapter shall not apply to breathing air replenishment (BAR) systems.

1302.0 Medical Gas and Vacuum Piping Systems – Installation Requirements.

1302.1 General. The installation of medical gas and vacuum piping systems shall be in accordance with the requirements of this chapter, the appropriate standards, or both adopted in this code by the State Plumbing Board. For additional standards, see Table 14-1.

1302.2 Manufacturer's Instructions. The installation of individual components shall be made in accordance with the manufacturer's installation instructions. Such 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]

1303.0 Protrusions from Walls.

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 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]

1304.0 Psychiatric Patient Rooms.

1304.1 General. Piping and drain traps in psychiatric patient rooms shall be concealed. Fixtures and fittings shall be resistant to vandalism.

1305.0 Locations for Ice Storage.

1305.1 General. Ice makers or ice storage containers shall be located in nursing stations or similarly supervised areas to minimize potential contamination.

1306.0 Sterilizers.

1306.1 General. The requirements of this section apply to sterilizers and bedpan steamers. Such equipment shall be installed in accordance with this code and the manufacturer's installation instructions.

1306.2 Indirect Waste Connections. Waste drainage from sterilizers and bedpan steamers shall be connected to the sanitary drainage system through an air gap in accordance with this chapter and Chapter 8. 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.

1307.0 Vapor Vents and Stacks for Sterilizers.

1307.1 General. Where a sterilizer 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 vapor vents shall be installed in accordance with the manufacturer's instructions and shall not be connected to any drainage system vent.

1308.0 Aspirators.

1308.1 General. Provisions for aspirators or other water-supplied suction devices shall be installed only with the specific approval of the building official. 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 Chapter 8. The potable water supply to an aspirator shall be protected by a vacuum breaker or equivalent backflow protection device in accordance with Section 603.0.

Part II – Medical Gas and Vacuum Systems.

1309.0 Application.

1309.1 General. The provisions herein shall apply to the installation and testing of medical gas and vacuum piping in hospitals, clinics, and other health care facilities.

1309.2 Purpose. The purpose of this chapter is to provide requirements for the installation, testing, and verification of medical gas and medical vacuum systems, from the central supply system to the station outlets or inlets.

1309.3 Terms. Where the terms “medical gas” or “vacuum” occur, the provisions shall apply to piped systems for oxygen, nitrous oxide, medical air, carbon dioxide, helium, nitrogen, instrument air, and mixtures thereof. Where the name of a specific gas or vacuum service occurs, the provision shall apply only to that gas. [NFPA 99:5.1.1.2, 5.1.1.3]

1309.4 Portable Compressed Gas Systems. This chapter does not apply to portable compressed gas systems.

1309.5 Where Not Applicable. This chapter does not apply to:

- (1) Cylinder and container management, storage, and reserve requirements.
- (2) Gas central supply and bulk supply systems, except as addressed in this chapter.
- (3) Electrical connections and requirements.
- (4) Motor requirements and controls.
- (5) Systems having nonstandard operating pressures, except as addressed in this chapter.
- (6) Waste anesthetic gas disposal (WAGD) systems.
- (7) Surface-mounted medical gas rail systems

1309.6 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 medical vacuum systems not addressed in this chapter or medical gas and medical vacuum systems beyond the scope of this chapter refer to NFPA 99.

1309.7 Existing Systems. An existing system that is not in strict compliance with the provisions of the Code shall be permitted to be continued in use as long as the building official has determined that such use does not constitute a distinct hazard to life. [NFPA 99:5.1.1.4]

1310.0 Definitions.

1310.1 Building Supply. The pipe from the source of supply to a building or structure.

1310.2 Critical Care Room. These rooms are typically where patients are intended to be subjected to invasive procedures and connected to line-operated, patient care-related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms, and other similar rooms. [NFPA 99:3.3.138.2]

1310.3 General Care Room. Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [NFPA 99:3.3.138.3]

1310.4 Manifold. A device for connecting outlets of one or more gas cylinders to the central piping system for that specific gas. [NFPA 99:3.3.101]

1310.5 Medical Air. For purposes of this standard, medical air is air supplied from cylinders, bulk containers, medical air compressors, or has been reconstituted from oxygen USP and oil-free, dry nitrogen NF. Medical air shall be required to have the following characteristics [NFPA 99:3.3.104]:

- (1) Be supplied from cylinders, bulk containers, medical air compressor sources, or be reconstituted from oxygen USP and oil-free dry nitrogen NF.
- (2) Meet the requirements of medical air USP.
- (3) Have no detectable liquid hydrocarbons.
- (4) Have less than 25 parts per million (ppm) gaseous hydrocarbons.
- (5) Have equal to or less than 1.8 E-10 pounds per cubic inch (lb/in³) (5 mg/m³) permanent particulates sized one micron or larger in the air at normal atmospheric pressure. [NFPA 99:5.1.3.5.1]

1310.6 Medical Gas. A patient medical gas or medical support gas. [NFPA 99:5.1.3.5.1] (see also NFPA 99 Section 3.3.142, patient medical gas and NFPA 99 Section 3.3.109, medical support gas)

1310.7 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]

1310.8 Medical Vacuum System. See 1310.19, Vacuum System – Category 1.

1310.9 Nitrogen, NF (Oil-Free, Dry) (Nitrogen for Brazing and Testing). Nitrogen complying, at a minimum, with oil-free, dry nitrogen NF. [NFPA 99:3.3.118.1]

1310.10 Patient Care Room. A room of a health care facility wherein patients are intended to be examined or treated. [NFPA 99:3.3.138]

1310.11 Purge, Flow. The removal of oxygen from a system by oil-free dry nitrogen during brazing.

1310.12 Purge, System. The removal of nitrogen from a system with the medical gas required for that system.

1310.13 SCFM. Standard cubic feet per minute. [NFPA 99:3.3.161]

1310.14 Special Hazard Area. An area such as a kitchen or electrical switch-gear room.

1310.15 Station Inlet. An inlet point in a medical-surgical piped vacuum distribution system at which the user makes connections and disconnections. [NFPA 99:3.3.169]

1310.16 Station Outlet. An inlet point in a piped medical/surgical vacuum distribution system at which the user makes connections and disconnections. [NFPA 99:3.3.170]

1310.17 Use Point. A room or area of a room where medical gases are dispensed to a single patient for medical purposes. A use point is permitted to be comprised of a number of station outlets of different gases. [NFPA 99:3.3.179]

1310.18 User Outlet. See Station Outlet.

|| 1310.19 Vacuum System – Category 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. [NFPA 99:3.3.111]

1310.20 Valve, Isolation. A valve that isolates one piece of equipment from another.

1310.21 Valve, Riser. A valve at the base of a vertical riser that isolates that riser.

1310.22 Valve, Service. A valve serving horizontal piping extending from a riser to a station outlet or inlet.

1310.23 Valve, Source. A single valve at the source that controls a number of units that make up the source.

1310.24 Valve, Zone. A valve that controls the gas or vacuum to a particular area.

1310.25 Waste Anesthetic Gas Disposal. The process of capturing and carrying away gases vented from the patient breathing circuit during the normal operation of gas anesthesia or analgesia equipment. [NFPA 99:3.3.183]

|| 1310.26 Piped Vacuum System – Category 3. A vacuum distribution system that can be either a wet or dry system designed to remove liquids, air-gas, or solids from the treatment area.

|| 1310.27 Compressed Air System – Category 3. A system of component parts that delivers compressed air to power devices.

|| 1310.28 – Category 1. Facility systems in which failure of such equipment or system is likely to cause injury or death of patients or caregivers shall be designed to meet system Category 1 requirements. [NFPA 99:4.1.1]

1310.29 – Category 2. Facility systems in which failure of such equipment is likely to cause minor injury to patients or caregivers shall be designed to meet system Category 2 requirements. [NFPA 99:4.1.2]

1310.30 – Category 3. Facility systems in which failure of such equipment is not likely to cause injury to patients or caregivers, but can cause patient discomfort, shall be designed to meet system Category 3 requirements. [NFPA 99:4.1.3]

1310.31 – Category 4. Facility systems in which failure of such equipment would have no impact on patient care shall be designed to meet system Category 4 requirements as defined in this code. [NFPA 99:4.1.4]

1311.0 General Requirements.

1311.1 Oxygen Compatibility. 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 CGA 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]

1311.1.1 Components. Components include but are not limited to containers, valves, valve seats, lubricants, fittings, gaskets, and interconnecting equipment including hose. Easily ignitable materials should be avoided.

Compatibility involves both combustibility and ease of ignition. Materials that burn in air will burn violently in pure oxygen at normal pressure and explosively in pressurized oxygen. Also, many materials that do not burn in air will do so in pure oxygen, particularly under pressure. Metals for containers and piping have to be carefully selected, depending on service conditions. The various steels are acceptable for many applications, but some service conditions are capable of calling for other materials (usually copper or its alloys) because of their greater resistance to ignition and lower rate of combustion. Similarly, materials that can be ignited in air have lower ignition energies in oxygen. Many such materials are capable of being ignited by friction at a valve seat, stem packing or by adiabatic compression produced where oxygen at high pressure is rapidly introduced into a system initially at low pressure.

1311.1.2 Materials. Materials used in central supply systems shall meet the following requirement [NFPA 99:5.1.3.4.4]:

In those portions of systems intended to handle oxygen or nitrous oxide at gauge pressures of less than 350 || pounds-force per square inches (psi) (2068 kPa), material construction shall be compatible with oxygen under the temperatures and pressures to which the components are capable of being exposed in the containment and use of oxygen, nitrous oxide, mixtures of these gases, or mixtures containing more than 23.5 percent oxygen. [NFPA 99:5.1.3.4.4(2)]

1311.1.3 Delivery. Each length of tube shall be delivered plugged or capped by the manufacturer and kept sealed until prepared for installation. Fittings, valves, and other components shall be delivered sealed, labeled, and kept sealed until prepared for installation. [NFPA 99:5.1.10.1.2, 5.1.10.1.3]

1311.2 Supply Source. Medical gas and medical vacuum systems shall be supplied from a source consisting of not less than two units – primary and secondary, e.g., a manifold consisting of two cylinder banks with not less than two cylinders in each bank, not less than two air compressors, or not less than two vacuum pumps. However, two supply pipelines are not required.

1312.0 Plan Review.

1312.1 Plans and Specifications. Before a medical gas or medical vacuum system is installed or altered in a hospital, medical facility, or clinic, duplicate plans and specifications shall be filed with the building official. Approval of the plans shall be obtained prior to issuance of a permit by the building official. ||

1312.2 Requirements. Plans and specifications shall show the following, in detail:

- (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, origin of gases, and user outlets/inlets. The demand and loading of a piping, existing or future, shall also be indicated.
- (3) Complete specification of materials.

1312.3 Extent of Work. Plans and specifications submitted to the building official shall clearly indicate the nature and extent of the work proposed and shall show in detail that such work will conform to the provisions of this code.

1312.4 Record. A record of as-built plans and valve identification records shall remain on the site at all times.

1313.0 System Performance.

1313.1 Required Operating Pressures. Medical gas and medical vacuum systems shall be capable of delivering service in the pressure ranges listed in Table 13-1.

1313.2 Minimum Flow Rates. Medical gas and medical vacuum systems shall be capable of supplying the flow rates listed in Table 13-2.

1313.3 Minimum Station Outlets/Inlets. Station outlets and inlets for medical gas and medical vacuum systems shall be provided as listed in Table 13-3.

1314.0 Required Pipe Sizing.

1314.1 Maximum Demand. Where the maximum demand for each medical gas or vacuum system and the maximum length of piping between the source equipment and the most distant station outlet/inlet do not exceed the values in Table 13-6, the size of pipe of each section of the system shall be determined using Tables 13-4 and 13-6. The size for systems beyond the range of Table 13-6 shall be determined by using the methods in accordance with Section 1314.3 of this chapter.

1314.2 Sizing Procedures. To determine the size of each section of pipe in a system within the range of Table 13-6, proceed as follows:

- (1) Measure the length of the pipe from the source equipment location to the most remote station inlet/outlet on the system.
- (2) In Table 13-6, select the column showing that distance, or the next longer distance where the table does not give the exact length.
- (3) Starting at the most remote outlet/inlet, find in the vertical column just selected the medical gas or vacuum demand for that inlet/outlet. Where the exact figure of demand is not shown, choose the next larger figure below in the column.
- (4) Opposite this demand figure, in the first column at the left in Table 13-6, will be found the correct size of pipe.
- (5) Using this same vertical column, proceed in a similar manner for each section of pipe serving this inlet/outlet. For each section of pipe, determine the total gas or vacuum demand supplied by the section, using Table 13-4.

**TABLE 13-1
STANDARD DESIGNATION COLORS AND OPERATING PRESSURES FOR GAS AND VACUUM SYSTEMS
[NFPA 99: TABLE 5.1.11]**

GAS SERVICE	ABBREVIATED NAME	COLORS (BACKGROUND/TEXT)	STANDARD GAUGE PRESSURE
Medical air	Med Air	Yellow/black	50–55 psi
Carbon dioxide	CO ₂	Gray/black or gray/white	50–55 psi
Helium	He	Brown/white	50–55 psi
Nitrogen	N ₂	Black/white	160–185 psi
Nitrous oxide	N ₂ O	Blue/white	50–55 psi
Oxygen	O ₂	Green/white or white/green	50–55 psi
Oxygen/carbon dioxide mixture	O ₂ /CO ₂ n% (n is % of CO ₂)	Green/white	50–55 psi
Medical–surgical vacuum	Med Vac	White/black	15 inch to 30 inch HgV
Waste anesthetic gas disposal	WAGD	Violet/white	Varies with system type
Other mixtures	Gas A%/ Gas B%	Colors as above major gas for background/minor gas for text	None
Nonmedical air (Level 3 gas-powered device)	—	Yellow-and-white diagonal stripe/black	None
Nonmedical and Level 3 vacuum	—	White-and-black diagonal stripe/black boxed	None
Laboratory air	—	Yellow-and-white checkerboard/black	None
Laboratory vacuum	—	White-and-black checkerboard/black boxed	None
Instrument air	—	Red/white	160–185 psi

For SI units: 1 inch = 25.4 mm, 1 pound-force per square inch = 6.8947 kPa

TABLE 13-2
MINIMUM FLOW RATES (cubic feet per minute)

MEDICAL SYSTEM	FLOW RATE
Oxygen	.71 CFM per outlet ¹
Nitrous Oxide	.71 CFM per outlet ¹
Medical Compressed Air	.71 CFM per outlet ¹
Nitrogen	15 CFM free air per outlet
Vacuum	1 SCFM per inlet ²
Carbon Dioxide	.71 CFM per outlet ¹
Helium	.71 CFM per outlet

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, while maintaining a system pressure of not less than 12 inches of mercury (41 kPa) at the nearest adjacent vacuum inlet.

TABLE 13-3
MINIMUM OUTLETS/INLETS PER STATION

LOCATION	OXYGEN	MEDICAL VACUUM	MEDICAL AIR	NITROUS OXIDE	NITROGEN	HELIUM	CARBON DIOXIDE
Patient rooms for medical/surgical, obstetrics, and pediatrics	1/bed	1/bed	1/bed	—	—	—	—
Examination/treatment for nursing units	1/bed	1/bed	—	—	—	—	—
Intensive care (all)	3/bed	3/bed	2/bed	—	—	—	—
Nursery ¹	2/bed	2/bed	1/bed	—	—	—	—
General operating rooms	2/room	3/room ⁴	2/room	1/room	1/room	—	—
Cystoscopic and invasive special procedures	2/room	3/room ⁴	2/room	—	—	—	—
Recovery delivery and labor/delivery/recovery rooms ²	2/bed 2/room	2/bed 3/room ⁴	1/bed 1/room	—	—	—	—
Labor rooms	1/bed	1/bed	1/bed	—	—	—	—
First aid and emergency treatment ³	1/bed	1/bed ⁴	1/bed	—	—	—	—
Autopsy	—	1/station	1/station	—	—	—	—
Anesthesia workroom	1/station	—	1/station	—	—	—	—

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.

TABLE 13-4
SYSTEM SIZING – FLOW REQUIREMENTS FOR STATION INLET/OUTLET¹

NUMBER OF INLET/OUTLET TERMINAL UNITS PER FACILITY	DIVERSITY PERCENTAGE OF AVERAGE FLOW PER INLET/OUTLET TERMINAL UNITS	MINIMUM PERMISSIBLE SYSTEM FLOW OF ALL PRESSURIZED MEDICAL GAS SYSTEMS ² (standard cubic feet per minute)
1–10	100%	Actual Demand
11–25	75%	7.0
26–50	50%	13.1
51–100	50%	17.5

Notes:

- ¹ Flow rates of station inlets/outlets in accordance with Table 13-2.
- ² The minimum system flow is the average inlet/outlet flow times the number of station inlets/outlets times the diversity percentage.

**TABLE 13-5
OUTLET RATING FOR VACUUM PIPING SYSTEMS**

LOCATION OF MEDICAL-SURGICAL VACUUM OUTLETS	FREE AIR ALLOWANCE, EXPRESSED AS CFM (LPM AT 1 ATMOSPHERE)		ZONE ALLOWANCES CORRIDORS-RISERS MAIN SUPPLY LINE-VALES	
	PER ROOM	PER OUTLET	SIMULTANEOUS USAGE, FACTOR PERCENT	AIR TO BE TRANSPORTED CFM (LPM)*
Operating Rooms				
Major "A"(Radical, Open Heart)	3.5 (99.1)	—	100.3.5 (99.1)	—
(Organ Transplant)	3.5 (99.1)	—	100.3.5 (99.1)	—
(Radical Thoracic)	3.5 (99.1)	—	100.3.5 (99.1)	—
Major "B"(All Other Major ORs)	2.0 (56.6)	—	100.2.0 (56.6)	—
Minor	1.0 (28.3)	—	100.1.0 (28.3)	—
Delivery Rooms	1.0 (28.3)	—	100.1.0 (28.3)	—
Recovery Rooms (Post-Anesthesia) and Intensive Care Units (a minimum of 2 outlets per bed in each such department)				
1st outlet at each bed	—	3.0 (85.0)	50.1.5 (42.5)	—
2nd outlet at each bed	—	1.0 (28.3)	50.1.5 (42.5)	—
3rd outlet at each bed	—	1.0 (28.3)	10 0.1 (2.8)	—
All others at each bed	—	1.0 (28.3)	10 0.1 (2.8)	—
Emergency Rooms	—	1.0 (28.3)	—	100.1.0 (28.3)
Patient Rooms				
Surgical –	—	1.0 (28.3)	—	500.5 (14.2)
Surgical –	—	1.0 (28.3)	—	10.01 (85.0)
Surgical –	—	0.5 (28.3)	—	10.01 (85.0)
Treatment and Examining Rooms	—	0.5 (28.3)	—	10.01 (85.0)
Autopsy Area	—	0.5 (28.3)	—	10.01 (85.0)
Inhalation Therapy, Central Supply and Instructional Areas	—	0.5 (28.3)	—	10.01 (85.0)

Notes:

* Free air at 1 atmosphere

- (6) Size each section of branch piping not previously sized by measuring the distance from the source equipment location to the most remote inlet/outlet in that branch, and follow the procedures of Section 1314.2(2) through Section 1314.2(5). Size branch piping in the order of the distance from the source location, beginning with the most distant outlet not previously sized.

1314.3 Engineering Methods. For conditions other than those covered by Section 1314.1 of this section, such as longer runs of greater gas or vacuum demands, the size of each gas or vacuum piping system shall be determined by standard engineering methods acceptable to the building official, and each system shall be so designed that the total pressure drop or gain between the source equipment and an inlet/outlet shall not exceed the allowable pressures shown in Table 13-1.

1315.0 Workmanship.

1315.1 Accepted Engineering Practices. Design, construction, and workmanship shall be in conformity with accepted engineering practices and shall meet the requirements of this code.

1315.2 Imperfections. Cracks, holes, or other imperfections in materials shall not be concealed by welding, brazing, or soldering, or by using paint, wax, tar, other leak-sealing or repair agents.

1315.3 Burred Ends. Burred ends of all tubing shall be deburred using a deburring tool to the full bore of the tube, and all chips shall be removed.

1316.0 Materials.

1316.1 General. The provisions of this section apply to the field-installed piping for the distribution of medical piped gases.

1316.2 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 CGA 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]

1316.3 Delivery. Each length of tube shall be delivered plugged or capped by the manufacturer and kept sealed until prepared for installation. Fittings, valves, and other components shall be delivered sealed, labeled, and kept sealed until prepared for installation. [NFPA 99:5.1.10.1.2, 5.1.10.1.3]

1316.4 Tubes. Tubes shall be hard-drawn seamless copper ASTM B 819 medical gas tube, Type L, except that where operating pressures are exceeding a gauge pressure of 185 psi (1276 kPa), Type K shall be used for sizes exceeding DN80 (NPS 3) (3 1/8 in. O.D.).

ASTM B 819 medical gas tube shall be identified by the manufacturer's markings "OXY," "MED," "OXY/MED,"

TABLE 13-6
SIZE OF GAS/VACUUM PIPING

MAXIMUM DELIVERY CAPACITY ³ (standard cubic feet per minute)						
LENGTH OF PIPING (feet) ¹						
MEDICAL SYSTEM	GAS PIPE SIZE (inches) ²	100	250	500	750	1000
Oxygen	½	15.0	10.6	7.4	5.9	5.1
	¾	40.0	28.3	19.6	15.7	13.3
	1	50.0	50.0	40.2	32.2	27.7
Nitrous Oxide	½	15.0	9.5	6.5	5.3	4.5
	¾	30.0	24.7	17.1	13.7	11.7
	1	40.0	40.0	34.7	28.2	24.3
Medical Air	½	18.1	11.1	7.8	6.3	5.3
	¾	40.0	29.9	21.0	16.5	14.1
	1	50.0	50.0	42.1	35.8	29.2
Vacuum	1	22.8	13.7	9.5	7.6	6.5
	1¼	40.1	24.5	16.7	13.3	11.2
	1½	63.7	38.9	26.8	21.1	17.9
	2	132.7	81.4	56.0	45.0	38.3
Nitrogen	½	25.0	25.0	25.0	23.8	20.6
	¾	60.0	60.0	60.0	60.0	54.2
	1	110.0	110.0	110.0	110.0	110.0

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

Notes:

¹ Length of piping includes a 30 percent allowance for fittings.

² One-half inch (15 mm) diameter pipe is the minimum size allowed in medical gas systems.

³ Based on the following maximum pressure drops:

(a) Oxygen, nitrous oxide, and medical air – 5 psig (34 kPa)

(b) Vacuum – 1.96 psig (13.5 kPa)

(c) Nitrogen – 20 psig (138 kPa)

"OXY/ACR," or "ACR/MED" in blue (Type L) or green (Type K). [NFPA 99:5.1.10.1.4, 5.1.10.1.5]

Piping for vacuum systems shall be constructed of one of the following:

- (1) Hard-drawn seamless copper tube in accordance with one of the following:
 - (a) ASTM B 88 (Types K, L, M)
 - (b) ASTM B 280 (copper AR tube)
 - (c) ASTM B 819 copper medical gas tubing (Type K or L)
- (2) Stainless steel tube. [NFPA 99:5.1.10.2.1]:
 - (a) Piping systems shall be designed and sized to deliver the required flow rates at the utilization pressures.
 - (b) Mains and branches in medical gas piping systems shall be not less than DN15 (NPS ½) (15 mm) (⅝ of an inch O.D.) size.
 - (c) Mains and branches in medical-surgical vacuum systems shall be not less than DN20 (NPS ¾) (20 mm) (⅞ of an inch O.D.) size.
 - (d) Drops to individual station outlets and inlets shall be not less than DN15 (NPS ½) (15 mm) (⅝ of an inch O.D.) size.
 - (e) Runouts to alarm panels and connecting tubing for gauges and alarm devices shall be permitted to be DN8 (NPS ¼) (8 mm) (⅜ of an inch O.D.) size. [NFPA 99:5.1.10.10.1.1 – 5.1.10.10.1.5]

1316.5 Changes in Direction. Turns, offsets, and other changes in direction in welded or brazed medical gas and vacuum piping shall be made with wrought-copper capillary fittings in accordance with ASME B16.22 or brazed fittings complying with ASME B16.50. [NFPA 99:5.1.10.3.1]

1316.5.1 Cast-Copper Alloy Fittings. Cast-copper alloy fittings shall not be permitted. [NFPA 99:5.1.10.3.2]

1316.5.2 Branch Connections. Branch connections in vacuum piping systems shall be permitted to be made using mechanically formed, drilled, and extruded tee-branch connections that are formed in accordance with the tool manufacturer's instructions and brazed. [NFPA 99:5.1.10.3.3]

1316.6 Special Fittings. The following special fittings shall be permitted to be used in lieu of brazed joints:

- (1) Memory-metal couplings having temperature and pressure ratings joints not less than that of a brazed joint.
- (2) Listed or approved metallic gas tube fittings that, where made up, provide a permanent joint having the mechanical, thermal, and sealing integrity of a brazed joint.
- (3) Dielectric fittings, where required by the manufacturer of special medical equipment to electrically isolate the equipment from the piping distribution system.

1316.7 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) The use of pipe-crimping tools to permanently stop the flow.
- || (4) Removable and no removable push-fit fittings that employ a quick assembly push-fit connector. [NFPA 99:5.1.10.10]

1316.7.1 Threaded Joints. Threaded joints in medical gas and vacuum distribution piping shall meet the following requirements:

- (1) Be limited to connections to pressure/ vacuum indicators, alarm devices, and source equipment.
- (2) Be tapered pipe threads in accordance with ASME B1.20.1.
- (3) Be made up with polytetrafluoroethylene (such as Teflon™) tape or other thread sealant recommended for oxygen service, with the sealant applied to the male threads only. [NFPA 99:5.1.10.8]

1316.8 Shutoff Valves. New or replacement shutoff valves shall be as follows:

- (1) Quarter turn, full ported ball type.
- (2) Brass or bronze construction.
- (3) Have extensions for brazing.
- (4) Have a handle indicating open or closed.
- (5) Consist of three pieces permitting in-line serviceability. [NFPA 99:5.1.4.3]

|| **1316.9 Soldered Joints.** Soldered joints in Category 3 gas-powered systems piping shall be made in accordance with ASTM B 828 using a lead-free solder filler metal containing not more than 0.2 percent lead by volume that complies with ASTM B 32, standard specification for solder metal. [NFPA 99:5.3.7.2.3.3]

1317.0 Cleaning for Medical Gas Piping Systems.

1317.1 Cleaning. The interior surfaces of tube ends, fittings, and other components that were cleaned for oxygen service by the manufacturer, but become 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 1 pound to 3 gallons (0.5 kg to 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 above, provided that they are as recommended in CGA G-4.1, and are listed in CGA O2-DIR. [NFPA 99:5.1.10.5.3.10, 5.1.10.5.3.11]

1317.2 Contaminated Materials. Material that has become contaminated internally and is not clean for oxygen service shall not be installed. [NFPA 99:5.1.10.5.3.12]

1318.0 Installation of Piping.

1318.1 Pipe Protection. Piping shall be protected against freezing, corrosion, and physical damage. [NFPA 99:5.1.10.11.2]

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]

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]

1318.2 Location. Piping risers shall be permitted to be installed in pipe shafts where protected from physical damage, effects of excessive heat, corrosion, or contact with oil.

Piping shall not be installed in kitchens, elevator shafts, elevator machine rooms, areas with open flames, electrical service equipment exceeding 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.

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 shall not exceed 130°F (54°C).

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 99:5.1.10.11.3.1 - 5.1.10.11.3.4]

1318.3 Frost Penetration. Buried piping outside of buildings shall be installed below the local level of frost penetration. [NFPA 99:5.1.10.11.5.1]

1318.4 Underground Piping. The installation procedure for underground piping shall protect the piping from physical damage while being backfilled. [NFPA 99:5.1.10.11.5.2]

Where 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]

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]

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 physical damage is otherwise prevented. [NFPA 99:5.1.10.11.5.5]

Trenches shall be excavated so that the pipe enclosure has firm, substantially continuous bearing on the bottom of the trench. [NFPA 99:5.1.10.11.5.6]

Backfill shall be clean, free from material that can damage the pipe, and compacted. [NFPA 99:5.1.10.11.5.7]

A continuous tape or marker placed immediately above the enclosure shall clearly identify the pipeline by specific name. [NFPA 99:5.1.10.11.5.8]

A continuous warning means shall also be provided above the pipeline at approximately one-half the depth of bury. [NFPA 99:5.1.10.11.5.9]

Where underground piping is installed through a wall sleeve, the ends of the sleeve shall be sealed to prevent the entrance of groundwater into the building. [NFPA 99:5.1.10.11.5.10]

1318.5 Connectors. Hose and flexible connectors, both metallic and nonmetallic, shall not be longer than necessary and shall not penetrate or be concealed in walls, floors, ceilings, or partitions. Flexible connectors, metallic or nonmetallic, shall have a minimum burst pressure, with a gauge pressure of 1000 psi (6895 kPa). [NFPA 99:5.1.10.11.6.1, 5.1.10.11.6.2]

1318.6 Positive-Pressure Medical Gas Piping Distribution Systems. Where a positive-pressure medical gas-piping distribution system, originally used or constructed for the use at one pressure and for one gas, is converted for operation at another pressure or for another gas, the provisions of Section 1316.0 shall apply as if the system were new. [NFPA 99:5.1.10.11.9.1]

A vacuum system shall not be permitted to be converted for use as a gas system. [NFPA 99:5.1.10.11.9.2]

1318.7 Support. Piping shall be supported from the building structure.

Hangers and supports shall comply with MSS SP-58. [NFPA 99:5.1.10.11.4.2]

Supports for copper tube shall have a copper finish and be sized for copper tube. [NFPA 99:5.1.10.11.4.3]

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 99:5.1.10.11.4.4]

Maximum support spacing shall be in accordance with Table 13-7. [NFPA 99: Table 5.1.11.4.5]

1318.8 Seismic Provisions. Where required, medical gas and vacuum piping shall be seismically restrained against earthquakes in accordance with the applicable building code. [NFPA 99:5.1.10.11.4.6]

Seismic considerations shall comply with the requirements of this code and the building official.

1319.0 Joints.

1319.1 General. This section sets forth the requirements for pipe joint installation for positive-pressure medical gas systems.

1319.2 Brazed Joints. 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 99:5.1.10.4.1.3]

Brazed tube joints shall be the socket type. [NFPA 99:5.1.10.4.1.4]

Filler metals shall bond with and be metallurgically compatible with the base metals being joined. [NFPA 99:5.1.10.4.1.5]

Filler metals shall comply with AWS A.5.8. [NFPA 99:5.1.10.4.1.6]

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]

Flux shall only be used when brazing dissimilar metals, such as copper and bronze or brass, using a silver (BAg series) brazing filler material. [NFPA 99:5.1.10.4.4.1]

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]

1319.3 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]

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]

The cut ends of the tube shall be deburred with a sharp, clean deburring tool, taking care to prevent chips from entering the tube. [NFPA 99:5.1.10.4.2.3]

1319.4 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]

The exterior surfaces of tube ends shall be cleaned prior to brazing to remove surface oxides. [NFPA 99:5.1.10.4.3.2]

Where cleaning the exterior surfaces of tube ends, no matter shall be permitted to enter the tube. [NFPA 99:5.1.10.4.3.3]

Where the interior surfaces of fitting sockets become contaminated prior to brazing, they shall be recleaned for oxygen in accordance with Section 1317.1 and shall be cleaned for brazing with a clean, oil-free wire brush. [NFPA 99:5.1.10.4.3.4]

Clean, nonshedding, abrasive pads shall be used to clean the exterior surfaces of tube ends. [NFPA 99:5.1.10.4.3.5]

The use of steel wool or sand cloth shall be prohibited. [NFPA 99:5.1.10.4.3.6]

The cleaning process shall not result in grooving of the surfaces to be joined. [NFPA 99:5.1.10.4.3.7]

After being abraded, the surfaces shall be wiped using a clean, lint-free white cloth. [NFPA 99:5.1.10.4.3.8]

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]

The interior surfaces of tube ends, fittings, and other components that were cleaned for oxygen service by the manufacturer, but become contaminated prior to being installed,

TABLE 13-7
MAXIMUM PIPE SUPPORT SPACING
[NFPA 99:5.1.11.4.5]

PIPE SIZE			HANGER SPACING (feet)
DN8	(NPS ¼)	(¾ of an inch O.D.)	5
DN10	(NPS ⅜)	(½ of an inch O.D.)	6
DN15	(NPS ½)	(¾ of an inch O.D.)	6
DN20	(NPS ¾)	(7⁄8 of an inch O.D.)	7
DN25	(NPS 1)	(1½ of an inch O.D.)	8
DN32	(NPS 1¼)	(1¾ of an inch O.D.)	9
DN40 and larger	(NPS 1½)	(1⅝ of an inch O.D.)	10
Vertical risers, all sizes, every floor but not to exceed:			15

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

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 1 pound to 3 gallons (0.5 kg to 11 L) of potable water and thoroughly rinsing them with clean, hot potable water. [NFPA 99:5.1.10.4.3.10]

Other aqueous cleaning solutions shall be permitted to be used for on-site recleaning permitted in NFPA 99:5.1.10.5.3.10, provided that they are as recommended in CGA G-4.1 and are listed in CGA O2-DIR. [NFPA 99:5.1.10.4.3.11]

Material that has become contaminated internally and is not clean for oxygen service shall not be installed. [NFPA 99:5.1.10.4.3.12]

Joints shall be brazed within 8 hours after the surfaces are cleaned for brazing. [NFPA 99:5.1.10.4.3.13]

1319.5 Flux. Flux shall only be used where 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]

Surfaces shall be cleaned for brazing in accordance with Section 1319.4. [NFPA 99:5.1.10.4.4.2]

Flux shall be applied sparingly to minimize contamination of the inside of the tube with flux. [NFPA 99:5.1.10.4.4.3]

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 99:5.1.10.4.4.4]

Short sections of copper tube shall be brazed onto the noncopper component and the interior of the subassembly shall be cleaned of flux prior to installation in the piping system. [NFPA 99:5.1.10.4.4.5]

On joints DN20 (NPS ¾) (20 mm) (7⁄8 of an 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]

1319.6 Heat and Brazing. 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 ANSI/ASME B16.50. [NFPA 99:5.1.10.4.6.1]

Where flux is permitted, the joint shall be heated slowly until the flux has liquefied. [NFPA 99:5.1.10.4.6.2]

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 99:5.1.10.4.6.3]

Techniques for heating the joint; applying the brazing filler metal; and making horizontal, vertical, and large-diameter joints shall be as stated in sections on Applying Heat and Brazing and Horizontal and Vertical Joints in Chapter VII, Brazed Joints, in the CDA Copper Tube Handbook. [NFPA 99:5.1.10.4.6.4]

1319.7 Purge Gas. Where being brazed, 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]

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]

The purge gas flow rate shall be controlled by the use of a pressure regulator and flow meter or combination thereof. [NFPA 99:5.1.10.4.5.3]

Pressure regulators alone shall not be used to control purge gas flow rates. [NFPA 99:5.1.10.4.5.4]

In order to assure 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 is to begin. [NFPA 99:5.1.10.4.5.5]

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]

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]

The flow of purge gas shall be maintained until the joint is cool to the touch. [NFPA 99:5.1.10.4.5.8]

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]

|| 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]

|| 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 portions of both the new and existing piping shall be tested in accordance with NFPA Section 99:5.1.12.3.9. [NFPA 99:5.1.10.4.5.11]

Where 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]

1319.8 Prohibited Joints. After brazing, the outside of all joints shall be cleaned by washing with water and a wire brush to remove residue and permit clear visual inspection of the joint. [NFPA 99:5.1.10.4.7.1]

Where flux has been used, the wash water shall be hot. [NFPA 99:5.1.10.4.7.2]

Each brazed joint shall be visually inspected after cleaning the outside surfaces. [NFPA 99:5.1.10.4.7.3]

Joints exhibiting the following conditions shall not be permitted:

- (1) Flux or flux residue (where 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 around the joint at the interface between the socket and the tube.
- (5) Cracks in the tube or component.
- (6) Cracks in the brazed filler metal.
- (7) Failure of the joint to hold the test pressure under the installer-performed initial pressure test (Section 1327.9) and standing pressure test (Section 1327.10). [NFPA 99:5.1.10.4.7.4]

Brazed joints that are identified as defective under conditions of Section 1319.8(2) or Section 1319.8(5) shall be replaced. [NFPA 99:5.1.10.4.7.5]

Brazed joints that are identified as defective under Section 1318.7(1), Section 1318.7(3), Section 1318.7(4), Section 1318.7(6), or Section 1318.7(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]

1320.0 Valves – Requirements, Locations, and Labeling.

1320.1 General Requirements. Shutoff valves accessible to other than authorized personnel shall be installed in valve boxes with frangible or removable windows large enough to permit manual operation of valves. [NFPA 99:5.1.4.2.1]

Shutoff valves for use in certain areas, such as psychiatric or pediatric, shall be permitted to be secured with the approval of the building official to prevent inappropriate || access. [NFPA 99:5.1.4.2.2]

1320.1.1 Enclosures. Where valves are concealed in an enclosure, the door or entry to the enclosure shall be identified and color coded with the type of gas service installed, as described in Section 1323.2. Enclosures shall be of sufficient size to permit valve operation. Valve handles in the off position shall prevent closure of the access panel or door.

1320.2 In-Line Shutoff Valves. In-line shutoff valves intended for use to isolate piping for maintenance or modification shall meet the following requirements:

- (1) Be located in a restricted area.
- (2) Be locked or latched open.
- (3) Be identified in accordance with Section 1323.2 [NFPA 99:5.1.4.9.1]

1320.3 Future Piping. Shutoff valves provided for the connection of future piping shall meet the following requirements:

- (1) Be locked in a restricted area.
- (2) Be locked or latched closed.
- (3) Be identified in accordance with Section 1323.2 [NFPA 99:5.1.4.10]

1320.3.1 Labeled. Future connection valves shall be labeled as to gas content. [NFPA 99:5.1.4.10.1]

1320.3.2 Downstream Piping. Downstream piping shall be closed with a brazed cap with tubing allowance for cutting and rebrazing. [NFPA 99:5.1.4.10.2]

1320.3.3 Zone Valve. A zone valve shall be located immediately outside each vital life-support, critical care, and anesthetizing location in each medical gas, vacuum line, or both and located so as to be readily accessible in an emergency. [NFPA 99:5.1.4.8.7]

1320.3.4 Special Installations. Gas-delivery columns, hose reels, ceiling tracks, control panels, pendants, booms, or other special installations shall be located downstream of the zone valve. [NFPA 99:5.1.4.8.7.1]

1320.3.5 Arrangement. Zone valves shall be so arranged that shutting off the supply of gas to one operating room or anesthetizing location will not affect the others. [NFPA 99:5.1.4.8.7.2]

1320.4 Source Valve. A shutoff valve shall be placed at the immediate connection of each source system to the distribution piping to permit the entire source, including all accessory devices (e.g., air dryers, final line regulators, etc.), to be isolated from the facility. [NFPA 99:5.1.4.4]

1320.4.1 Location. The source valve shall be located in the immediate vicinity of the source equipment. [NFPA 99:5.1.4.4.1]

1320.4.2 Labeled. The source valve shall be labeled in accordance with Section 1323.2, Source Valve for the (Source Name). [NFPA 99:5.1.4.4.2]

1320.5 Main Valves. A shutoff valve shall be provided in the main supply line inside of the building, 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 99:5.1.4.5]

1320.5.1 Access. The main line valve shall be located to permit access by authorized personnel (e.g., by locating above a ceiling or behind a locked access door). [NFPA 99:5.1.4.5.1]

1320.5.2 Location. The main line valve shall be located on the facility side of the source valve and outside of the source room, enclosure, or where the main line first enters the building. [NFPA 99:5.1.4.5.2]

1320.5.3 Labeled. The main line shall be labeled in accordance with Section 1323.2. [NFPA 99:5.1.4.5.3]

1320.6 Riser Valves. Each riser supplied from the main line shall be provided with a shutoff valve adjacent to the riser connection. Riser valves shall be permitted to be located above ceilings, but shall remain accessible and not be obstructed. [NFPA 99:5.1.4.6, 5.1.4.6.1]

1320.7 Zone Valves. Station outlets/inlets shall be supplied through a zone valve as follows:

- (1) The zone valve shall be placed such that a wall intervenes between the valve and outlets/inlets that it controls.
- (2) The zone valve shall serve outlets/inlets located on that same story. [NFPA 99:5.1.4.8]

1320.7.1 Readily Operable. Zone valves shall be readily operable from a standing position in the corridor on the same floor they serve. [NFPA 99:5.1.4.8.1]

1320.7.2 Arrangement. Zone valves shall be so arranged that 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. [NFPA 99:5.1.4.8.2]

1320.8 Service Valves. Service valves shall be placed in the branch piping prior to a zone valve box assembly on that branch. [NFPA 99:5.1.4.7.2]

1320.8.1 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. [NFPA 99:5.1.4.7.1]

1320.8.2 Servicing. 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 99:5.1.4.7]

1321.0 Pressure-Regulating Equipment.

1321.1 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 shutoff valves shall be provided for each pressure.

1321.2 Pressure-Relief Valves. Each central supply system shall have a pressure-relief valve set at 50 percent above normal line pressure, installed downstream of the pressure regulator and upstream of the shutoff valve. This pressure-relief valve shall be permitted to be set at a higher pressure, provided another pressure-relief valve set at 50 percent above normal line pressure is installed in the main supply line.

1321.2.1 Excess Pressure. Pressure-relief valves shall close automatically where excess pressure has been released.

1321.2.2 Venting. Pressure-relief valves set at 50 percent shall be vented to the outside from gas systems, except medical air, or where the total capacity of the supply system is in excess of 3000 cubic feet (84.95 m³) of gas.

1321.2.3 Design. Pressure-relief valves shall be of brass or bronze and specially designed for the gas service involved.

1321.2.4 Isolation. A pressure-relief valve shall not be isolated from its intended use by any valve.

1321.3 Pressure Gauges. Pressure and 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]

1322.0 Station Outlets/Inlets.

1322.1 General. Station outlets and inlets shall be installed in strict accordance with the manufacturers installation instructions.

1322.2 Post Installation. After installation of the piping, but before installation of the station outlets/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 by means of oil-free, dry nitrogen.

1323.0 Labeling and Identification.

1323.1 General. The gas content of medical gas piping systems shall be readily identifiable by labeling with the name and pressure contained. Such labeling shall be by means of metal tags, stenciling, stamping, or adhesive markers, in a manner that is not readily removable. Where supplementary color identification of piping is used, it shall be in accordance with the gases and colors indicated in CGA C-9, See Table 13-1.

1323.2 Post Labeling. Piping shall be labeled by stenciling or adhesive markers that identify the medical gas, support gas, or vacuum system and include:

- (1) The name of the gas/vacuum system or the chemical symbol shall comply with Table 13-1.

- (2) The gas or vacuum system color code shall comply with Table 13-1.
- (3) Where positive-pressure gas piping systems operate at pressures other than the standard gauge in Table 13-1, the pipe labeling shall include the operating pressure in addition to the name of the gas. [NFPA 99:5.1.11.1.1]
Pipe labels shall be located as follows:
 - (a) At intervals of not more than 20 feet (6096 mm).
 - (b) Not less than once in or above every room.
 - (c) On both sides of walls or partitions penetrated by the piping.
 - (d) Not less than once in every story height traversed by risers. [NFPA 99:5.1.11.1.2]

1323.3 Shutoff Valve Identification. Shutoff valves shall be identified as follows:

- (1) The name or chemical symbol for the specific medical gas or vacuum system.
- (2) The room or areas served.
- (3) A caution to not close or open valve except in emergency. [NFPA 99:5.1.11.2.1]

1323.4 Station Outlet/Inlet Identification. Station outlets and inlets shall be identified as to the name or chemical symbol for the specific medical gas or vacuum provided. [NFPA 99:5.1.11.3.1]

1323.5 Shutoff Valve Labeling. The shutoff valves described in Sections 1320.0 shall be labeled to reflect the rooms that are controlled by such valves. Labeling shall be kept current from initial construction through acceptance. Valves shall be labeled in substance as follows:

Source valves shall be labeled in substance as follows:

**SOURCE VALVE
FOR THE (SOURCE NAME)**

Main line valves shall be labeled in substance as follows:

**MAIN LINE VALVE FOR THE
(GAS/VACUUM NAME) SERVING THE
(NAME OF BUILDING)**

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)**

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 99:5.1.11.2.2 – 5.1.11.2.6]

1324.0 Alarms.

1324.1 General. 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 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) A cancelable audible indication of each alarm condition that produces a sound with a minimum level of not less than 80 decibels at 3 feet (914 mm).
- (4) A means to visually identify a lamp or LED failure.
- (5) Visual and audible indication that the wiring to 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 and area alarms from the life safety branch of the emergency electrical system as described in NFPA 99 Chapter 4, Electrical Systems.
- (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) Wiring from switches or sensors that is supervised or protected as required by Section 517.30(C)(3) of NFPA 70, for life and critical branch 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 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 startup) without giving false signals or requiring manual reset.
- (15) Alarm switches/sensors installed so as to be removable. ||

1324.2 Components. Functioning of alarm components shall be verified in accordance with testing and monitoring requirements of the manufacturer and the building official. ||

1325.0 Medical Air System.

1325.1 General. Medical air compressors shall be installed in a well-lit, ventilated, and clean location and shall be acces-

sible. The location shall be provided with drainage facilities. The medical air compressor area shall be located separately from medical gas cylinder system sources, and shall be readily accessible for maintenance.

1325.2 Medical Air Compressors. 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 less than two compressors. [NFPA 99:5.1.3.6.3.10(b)]

Medical air compressor systems shall consist of the following:

- (1) Components
 - (a) Compressors for medical air
 - (b) Aftercoolers
 - (c) Medical air receivers
 - (d) Medical air dryers
 - (e) Medical air filters
 - (f) Medical air regulators
 - (g) Medical air local alarms

Components shall be arranged to permit service and a continuous supply of medical air in the event of a single fault failure. Component arrangement shall be permitted to vary in accordance with the technology(ies) employed, provided an equal level of operating redundancy and medical air quality is maintained. [NFPA 99:5.1.3.5.11.1]

- (2) An automatic means to prevent backflow from on-cycle compressors through off-cycle compressors.
- (3) A 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-mufflers of the dry type.
- (5) Pressure relief valves set at 50 percent above line pressure.
- (6) Piping between the compressor and the source shutoff valve compatible with oxygen that does not contribute to contaminant levels. [NFPA 99:5.1.3.6.2]
- (7) Materials and devices used between the medical air intake and the medical air source valve shall be permitted to be of a design or construction appropriate for the service, as determined by the manufacturer as long as such materials and devices do not contribute to contaminant levels. [NFPA 99:5.1.3.5.3.2(7)]

1325.3 Air Source. The medical air compressors shall draw their air from a source of clean air located where no contamination is anticipated from engine exhausts, fuel storage vents, medical-surgical vacuum system discharges, particulate matter, or odor. [NFPA 99:5.1.3.6.3.12]

1325.4 Air Intakes. Compressor intake piping shall be hard-drawn seamless copper, and one of the following:

- (1) ASTM B 88 (Types K or L).
- (2) ASTM B 280 (Copper ACR tube).
- (3) ASTM B 819 (Types K or L).

The compressor air intake shall be located outdoors above roof level, at a distance not less than of 10 feet (3048 mm) from a door, window, exhaust, other intake, or opening in the building and a distance of not less than 20 feet (6096 mm) above ground. [NFPA 99:5.1.3.6.3.12]

Where 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 days-per-week basis.
- (2) Ventilating systems having fans with motors or drive belts located in the air stream shall not be used as a source of medical air intake. [NFPA 99:5.1.3.6.3.12]

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 back pressure in accordance with the manufacturer's recommendations.
- (2) Each compressor can be isolated by manual or check valve, blind flange, or tube cap to prevent open inlet piping where compressors are removed from service and consequent backflow of room air into the other compressor(s). [NFPA 99:5.1.3.6.3.12]

1325.4.1 Isolation Valve. Each medical air compressor shall have an isolation valve installed so that shutting off or failure of the largest unit will not affect the operation of the other unit(s).

1325.5 Drains. Drains shall be installed on dryers, aftercoolers, separators, and receivers.

1325.6 Medical Air Receivers. Medical air receivers shall be provided with proper valves to allow the flow of compressed air to enter and exit out of separator receiver ports during normal operation and allow the receiver to be bypassed during service without shutting down the medical air system. [NFPA 99:5.1.3.6.3.10]

1325.7 Requirements for Medical Air Receivers. Receivers for medical air shall meet the following requirements:

- (1) Be made of corrosion-resistant materials or otherwise be made corrosion resistant.
- (2) Comply with Section VIII of the ASME Boiler and Pressure Vessel Code.
- (3) Be equipped with a pressure-relief valve, automatic drain, manual drain, sight glass, and pressure indicator.
- (4) Be of a capacity sufficient to prevent the compressor from short cycling. [NFPA 99:5.1.6.3.6]

Piping within compressor systems upstream of the source shutoff valve shall comply with Section 1316.0 and Section 1319.0, except that stainless steel shall be permitted to be used as a piping material.

1326.0 Medical Vacuum Pump System.

1326.1 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. 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.

1326.2 Medical-Surgical Vacuum Sources. Medical-surgical vacuum sources 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) An automatic means to prevent backflow from on-cycle vacuum pumps through off-cycle vacuum pumps.
- (3) A 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) A vacuum receiver.
- (5) Piping between the vacuum pump(s), discharge(s), receiver(s), and the vacuum source shutoff valve shall be in accordance with Section 1316.4, except that brass, galvanized, or black steel pipe shall be permitted to be used.
- (6) Except as defined in NFPA 99:5.1.3.7.1.2(1) through NFPA 99:5.1.3.7.1.2(5), materials and devices used between the medical vacuum exhaust and the medical vacuum source shall be permitted to be of a design or construction appropriate for the service, as determined by the manufacturer. [NFPA 99 5.1.3.7.1.2(1), (2), (3), (4), (5), (6)]

1326.2.1 Pumps. Additional pumps shall automatically activate where the pumps in operation are incapable of maintaining the required vacuum.

Automatic or manual alternation of pumps shall allow division of operating time. Where automatic alternation of pumps is not provided, the facility staff shall arrange a schedule for manual alternation. [NFPA 99:5.1.3.7.6.1, 5.1.3.7.6.2]

1326.3 Exhausts. The medical-surgical vacuum pumps shall exhaust in a manner and location that will minimize the hazards of noise and contamination to the facility and its environment.

The exhaust shall be located as follows:

- (1) Outdoors.
- (2) Not less than 10 feet (3048 mm) from a door, window, air intake, or other openings in buildings.
- (3) At a level different from air intakes.
- (4) Where prevailing winds, adjacent buildings, topography, or other influences that would not divert the exhaust into occupied areas or prevent dispersion of the exhaust.

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 non-corroding material.

The exhaust shall be piped of materials approved for medical-surgical vacuum piping under Section 1316.4 (Vacuum tubes).

The exhaust shall be free of dips and loops that might trap condensate or oil. Where such low points are unavoidable, a drip leg and valved drain shall be installed. [NFPA 99:5.1.3.7.7.1 – 5.1.3.7.7.4]

1326.3.1 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 where pumps are removed for service and consequent flow of exhaust air into the room. [NFPA 99:5.1.3.7.7.5]

1326.4 Receivers. Receivers for vacuum shall meet the following requirements:

- (1) Be made of ferrous and/or nonferrous materials.
- (2) Comply with Section VIII of the ASME Boiler and Pressure Vessel Code.
- (3) Withstand a gauge pressure of 60 psi (414 kPa) and 29.9 inch (759 mm) gauge HgV.
- (4) Be equipped with a manual drain.
- (5) Be of a capacity based on the technology of the pumps. [NFPA 99:5.1.3.7.3]

1326.5 Piping. Piping between vacuum pumps, discharges, receivers, and the vacuum main line valve shall be in accordance with Section 1316.4, except that stainless, galvanized, or black steel pipe shall be permitted to be used. [NFPA 99:5.1.3.7.1.2(5)]

1326.6 Drains. Drains shall be installed and terminate in an approved location.

1327.0 Testing and Inspection.

1327.1 Where. Inspection and testing shall be performed on new piped gas systems, additions, renovations, temporary installations, or repaired systems, to assure the facility, by a documented procedure, that the applicable provisions of this document have been adhered to and system integrity has been achieved or maintained. [NFPA 99:5.1.12.1.1.]

1327.2 Systems. Systems that are breached and components that are subject to additions, renovations, or replacement (e.g., new gas sources: bulk, manifolds, compressors, dryers, alarms) shall be inspected and appropriately tested. [NFPA 99:5.1.12.1.3]

1327.2.1 Breached. Systems shall be deemed breached at the point of pipeline intrusion by physical separation, by system component removal, replacement, or addition.

Breached portions of the systems subject to inspection and testing shall be confined to the specific altered zone and components in the immediate zone or area that is located upstream for vacuum systems and down stream for pressure gases at the point or area of intrusion. [NFPA 99:5.1.12.1.4, 5.1.12.1.5]

1327.3 Advance Notice. It shall be the duty of the person doing the work authorized by the permit to notify the building official, 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.

1327.4 Responsibility. The equipment, material, and labor necessary for inspection and testing shall be furnished by the permit holder or by the person who is requiring the inspection.

1327.5 Testing. The test shall be conducted in the presence of the building official or a duly appointed representative.

1327.6 Retesting. Where the building official finds that the work does not pass tests, necessary corrections shall be made and the work shall then be resubmitted for test or inspection.

1327.7 Initial Pressure Test – Piped Gas Systems. Before attachment of system components (e.g., pressure-actuating switches for alarms, manifolds, pressure gauges, or pressure-relief valves), but after installation of the station outlets and inlets, with test caps in place, each section of the piping system shall be subjected to a test pressure of one and one-half times the working pressure [150 psig (1034 kPa gauge)] with oil-free dry nitrogen. This test pressure shall be maintained until each joint has been examined for leakage by means of soapy water or other equally effective means of leak detection safe for use with oxygen. The source shutoff valve shall be closed. Leaks shall be located, repaired, and retested in accordance with this section. [NFPA 99:5.1.12.2.3 – 5.1.12.2.3.6]

1327.8 Cross-Connection Test – Piped Gas Systems. It shall be determined that no cross-connections exist between the various medical gas and vacuum piping systems.

Piping systems shall be reduced to atmospheric pressure.

Sources of test gas shall be disconnected from piping systems except for the one system being tested.

The system under test shall be charged with oil-free, dry nitrogen NF to a gauge pressure of 50 psi (345 kPa).

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 from the piping system being tested. [NFPA 99: 5.1.12.2.4 – 5.1.12.2.4.4]

1327.8.1 Source of Test Gas. The source of test gas shall be disconnected, and the system tested shall be reduced to atmospheric pressure. [NFPA 99:5.1.12.3.3(E)] The cross-connection test shall be repeated for each installed medical gas and vacuum piping system. [NFPA 99:5.1.12.2.4.5]

1327.8.2 Cross-Connection Testing. Where a medical vacuum system is installed, the cross-connection testing shall include that piped vacuum system with medical gas piping systems.

1327.8.3 Medical-Surgical Vacuum Systems. Medical-surgical vacuum systems shall be in operation so that these vacuum systems are tested at the same time the medical gas systems are tested.

The proper labeling and identification of system outlets/inlets shall be confirmed during these tests. [NFPA 99:5.1.12.2.4.6]

1327.9 Standing Pressure Test – Piped Gas Systems. After successful completion of the initial pressure tests under Section 1327.6, medical gas distribution piping shall be subject to a standing pressure test.

Tests shall be conducted after the final installation of station outlet valve bodies, face plates, and other distribution system components (e.g., pressure alarm devices, pressure indicators, line pressure-relief valves, manufactured assemblies, hose, etc.).

The source valve shall be closed during this test.

The piping systems shall be subjected to a 24 hour standing pressure test using oil-free, dry nitrogen NF.

Test pressures shall be 20 percent above the normal system operating line pressure. [NFPA 99:5.1.12.2.6 – 5.1.12.2.6.4]

1327.9.1 Requirements. After the piping system is filled with test gas, the supply valve and outlets shall be closed and the source of test gas disconnected.

Tests shall be conducted after the final installation of station outlet valve bodies, face plates, and other distribution system components (e.g., pressure alarm devices, pressure indicators, line pressure-relief valves, manufactured assemblies, hose, etc.). [NFPA 99:5.1.12.2.6.1]

The source valve shall be closed during this test. [NFPA 99:5.1.12.2.6.2]

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]

Test pressures shall be 20 percent above the normal system operating line pressure. [NFPA 99:5.1.12.2.6.4]

Leaks shall be located, repaired (where permitted), or replaced (where required), and retested. [NFPA 99:5.1.12.2.6.6]

At the conclusion of the tests, there shall be no change in the test pressure other than that attributed to changes of ambient temperature. [NFPA 99:5.1.12.2.6.5]

1327.10 Initial Pressure Test – Piped Vacuum Systems. Each section of the piping in medical gas and vacuum systems shall be pressure-tested.

Initial pressure tests shall be conducted as follows:

- (1) After installation of station outlets/inlets rough-in assemblies. Test caps shall be permitted to be used.
- (2) 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, line pressure-relief valves, manufactured assemblies with flexible hose, etc.).

The source shutoff valve shall remain closed during these tests.

The test pressure for pressure gases shall be one and one-half times the system working pressure not less than a gauge pressure of 150 psi (1034 kPa).

The test pressure for vacuum shall be not less than a gauge pressure of 60 psi (414 kPa).

The test pressure shall be maintained until each joint has been examined for leakage by means of soapy water

or other equally effective means of leak detection that is safe for use with oxygen.

Leaks shall be located, repaired (where permitted), replaced (where required), and retested. [NFPA 99:5.1.12.2.3.1 – 5.1.12.2.3.7]

1327.11 Standing Pressure Test – Piped Vacuum Systems. After successful completion of the initial pressure tests under Section 1327.9, vacuum distribution piping shall be subjected to a standing vacuum test.

Tests shall be conducted after installation of components of the vacuum system. [NFPA 99:5.1.12.2.7.1]

The piping systems shall be subjected to a 24 hour standing vacuum test. [NFPA 99:5.1.12.2.7.2]

Test pressure shall be between 12 inch (305 mm) gauge HgV and full vacuum.

During the test, the source of test vacuum shall be disconnected from the piping system.

At the conclusion of the test, there shall be no change in the vacuum other than that attributed to changes of ambient temperature, as permitted in this section.

Test vacuum changes due to expansion or contraction shall be permitted to be determined by means of the following pressure temperature relationship:

- (1) The calculated final absolute pressure equals the initial absolute pressure times the final absolute temperature, divided by the initial absolute temperature.
- (2) Absolute pressure is the gauge pressure reading plus 14.7 psi (101 kPa).
- (3) Absolute temperature is the temperature reading plus 460°F (238°C).
- (4) The final allowable gauge pressure reading equals the final allowable absolute pressure minus a gauge pressure of 14.7 psi (101 kPa).

Leaks shall be located, repaired (where permitted), or replaced (where required), and retested. [NFPA 99:5.1.12.2.7 – 5.1.12.2.7.7]

1327.12 Corrections. Notices of correction or violation shall be written by the building official and posted at the site of the work, mailed or delivered to the permittee or an authorized representative. Refusal or failure to comply with such notice or order within 30 days of receipt thereof shall be considered a violation of this code, and shall be subject to the penalties set forth elsewhere in this code for violations.

1327.13 Approval. Upon satisfactory completion of tests and certification of the medical gas and medical vacuum systems, a certificate of approval shall be issued by the building official to the permittee.

1327.14 Covering or Use. No medical gas or medical vacuum system or part thereof shall be covered, concealed, or put into use until it has been tested, inspected, and accepted as required in this code.

1327.15 Uncovering. A medical gas and vacuum system or part thereof that is covered or concealed before testing and inspected as required in this code shall be uncovered for inspection, after notice to uncover the work has been issued to the permittee or his authorized representative by the building official.

Part III – Category 2 Medical Gas and Vacuum Systems.

1328.0 Category 2 Medical Gas and Vacuum Systems.

Category 2 systems shall be in accordance with the requirements of Category 1 systems with the following exceptions:

- (1) Medical air compressor and accessories shall be permitted to be simplex. The facility shall develop their emergency plan to deal with the loss of medical air. [NFPA 99:5.2.3.5]
- (2) Medical vacuum and waste anesthetic gas disposal systems shall be permitted to be simplex. The facility staff shall develop their emergency plan to deal with the loss of medical vacuum. [NFPA 99:5.2.3.6, 5.2.3.7]
- (3) Warning system shall be permitted to be a single alarm panel located in an area of continuous surveillance while the facility is in operation. 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]

Part IV – Category 3 Piped Gas and Vacuum Systems.

1329.0 Category 3 Piped Gas and Vacuum Systems

1329.1 Medical gas supply systems (oxygen and nitrous oxide) shall be in accordance with the requirements of Category 2 gas systems. [NFPA 99:5.3.1.2]

1329.2 Piped gas systems (compressed air or nitrogen) shall be cylinder systems or air compressor systems that include filters, receivers, dryers, regulators, relief valves, valves, and indicators. [NFPA 99:5.3.3.5]

1329.3 Piped vacuum systems shall include pump(s) suited for dry service or for wet service with a liquid/air separator. [NFPA 99:5.3.3.6]

1329.4 Where central supply systems are remote from the facility use points, emergency shut off valves shall be located within the facility. [NFPA 99:5.3.4]

1329.5 Warning systems shall be provided for medical gas systems and shall include an alarm panel located in an area of continuous surveillance while the facility is in operation to monitor main line pressure and changeover. [NFPA 99:5.3.9]

1329.6 Piping for systems shall be ASTM B819 cleaned copper for medical gas systems, ASTM B 819 cleaned copper or B 88 copper for piped gas systems, and ASTM B819 cleaned copper, ASTM B88 copper, or PVC Schedule 40 minimum for piped vacuum systems. [NFPA 99:5.3.10]

1329.7 Labels shall be provided for piping, valves, and outlets/inlets. [NFPA 99:5.3.11]

1329.8 Inspection and testing shall be performed on all new gas and vacuum systems, additions, renovations, temporary installations, or repaired systems. [NFPA 99:5.3.12]

- (1) Initial tests shall include blow down, pressure and leak, cross connection, piping purge, and standing pressure.

