2006

NATIONAL STANDARD PLUMBING CODE

PHCC

PLUMBING-HEATING-COOLING CONTRACTORS ASSOCIATION

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PLUMBING-HEATING-COOLING CONTRACTORS—NATIONAL ASSOCIATION

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FOREWORD

Since its founding as the National Association of Master Plumbers in 1883, the National Association of Plumbing-Heating-Cooling Contractors has maintained a serious interest in plumbing standards, codes and good plumbing design practices.

The Association published the NAMP "Standard Plumbing Code" in 1933 and furnished revised editions until 1942. NAPHCC participated in the development of special standards for war-time plumbing and later was represented on the National Plumbing Code Coordinating Committee, whose work ultimately resulted in the adoption of A40.8 as a standard or model plumbing code in 1955.

NAPHCC served as a sponsor in the early 1960's of the project which attempted to update the 1955 document. This project was operated through the procedures of the American National Standards Institute. However, the A40.8 revision project was not completed because consensus could not be achieved.

In order to provide local and state governments, code administrative bodies and industry with a modern, updated code, NAPHCC published the "National Standard Plumbing Code," in 1971, following the format and sequence of the A40.8 to provide for maximum convenience of users.

With the June 1973 revision, the American Society of Plumbing Engineers joined this effort by co-sponsoring the National Standard Plumbing Code. ASPE maintained its co-sponsorship status until September, 1980. Upon ASPE's withdrawal of co-sponsorship, the Code Committee composition was changed to include not only members of the contracting and engineering communities but also members of the inspection community. Contractors, engineers and inspectors now comprise the National Standard Plumbing Code Committee.

NATIONAL STANDARD PLUMBING CODE

Title:

National Standard Plumbing Code

Scope:

The development of a recommended code of plumbing practice, design, and installation, including the establishment of performance criteria predicated on the need for protection of health and safety through proper design, installation, and maintenance of plumbing systems. This scope excludes the development of specific standards related to the composition, dimensions, and/or mechanical and physical properties of materials, fixtures, devices, and equipment used or installed in plumbing systems.

Purpose:

To provide practices and performance criteria for the protection of health and safety through proper design of plumbing systems.

Exceptions:

In case of practical difficulty, unnecessary hardship or new developments, exceptions to the literal requirements may be granted by the authority having jurisdiction to permit the use of other devices or methods, but only when it is clearly evident that equivalent protection is thereby secured.

INTRODUCTORY NOTE

The material presented in this Code does not have legal standing unless it is adopted by reference, or by inclusion, in an act of state, county, or municipal government. Therefore, administration of the provisions of this Code must be preceded by suitable legislation at the level of government where it is desired to use this Code.

In some places in this Code, reference is made to “Authority Having Jurisdiction.” The identity of an Authority Having Jurisdiction will be established by the act which gives legal standing to the Code provisions.

Meetings for purposes of review and revision are scheduled each year with proper public notices.

Suggestions and requests for revisions can be made by any interested party and should be submitted on the special forms provided by the Committee.

Personal appearance before the Committee for a hearing on any Code matter can be had by interested parties after a request in writing.

In the course of revision, certain outdated sections have been deleted. In order to maintain consistency and perpetuity of the numbering system, those deleted sections and numbers have been removed from this printed text, or placed in reserve.

All changes from the previous edition of this Code are marked by a vertical line in the margin.

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Contents

Administration

ADM 1.1 TITLE

The regulations contained in the following chapters and sections shall be known as the “National Standard Plumbing Code" and may be cited as such, and hereinafter referred to as “this Code”.

ADM 1.2 SCOPE

The provisions of this Code shall apply to every installation, including the erection, installation, alteration, relocation, repair, replacement, addition to, use or maintenance of the plumbing system as defined within this Code.

ADM 1.3 PURPOSE

This Code establishes the minimum requirements and standards pertaining to the design, installation, use and maintenance of the plumbing system as defined within this Code.

ADM 1.4 APPLICABILITY

1.4.1 Addition or Repair

Additions, alterations or repairs in compliance to this Code may be made to any existing plumbing system without requiring the existing installation to comply with all the requirements of this Code. Additions, alterations or repairs shall not cause an existing system to become unsafe, insanitary or overloaded.

1.4.2 Existing Plumbing Installation

Plumbing systems that were lawfully installed prior to the adoption of this Code may continue their use, maintenance or repairs, provided the maintenance or repair is in accordance with the original design, location, and no hazard has been created to life, health or property by such plumbing system.

1.4.3 Existing Use

The lawful use of any plumbing installation, appliances, fixtures, fittings and appurtenances may have their use continued, provided no hazards to life, health or property have been created by their continued use.

1.4.4 Maintenance and Repairs

The maintenance of all plumbing systems, materials, appurtenances, devices or safeguards, both existing and new, shall be maintained in a safe and proper condition. The owner, or his designated agent, shall be responsible for the maintenance of the plumbing system.

Minor repairs to or replacement of any existing systems are permitted, provided they are made in the same manner and arrangement as the original installation and are approved.

1.4.5 Change of Building Use

The plumbing systems of any building or structure that is proposed for a change in use or occupancy shall comply to all the requirements of this Code for the new use or occupancy.

1.4.6 Moved Buildings or Structures

The plumbing system in any building or structure to be moved into this jurisdiction shall comply with the provisions of this Code for new construction.

1.4.7 Special Historic Buildings

The provisions of this Code relating to the additions, alterations, repair, replacement or restoration of those structures designated as historic buildings shall not be mandatory when such work is deemed to be safe and in the public interest of health, safety and welfare by the Authority Having Jurisdiction.

1.4.8 Appendices

The provisions in the appendices are intended to supplement the requirements of this Code and are considered to be part of this Code when adopted by the Authority Having Jurisdiction

ADM 1.5 APPROVALS

1.5.1 Alternates

The provisions cited in this Code are not intended to prevent the use of any material or method of installation when it is determined to meet the intent of this Code and approved by the Authority Having Jurisdiction

1.5.2 Authority Having Jurisdiction

The Authority Having Jurisdiction may approve any such alternate material or method of installation not expressly conforming to the requirements of this Code, provided it finds the proposed material or method of installation is at least the equivalent of that required in the Code or that the alternate material or method of installation conforms to other nationally accepted plumbing standards. A record of such approval shall be kept and shall be available to the public.

1.5.3 Tests Required

The Authority Having Jurisdiction shall require sufficient evidence to substantiate any claims made regarding the equivalency of any proposed alternate material or method of installation. When the Authority Having Jurisdiction determines that there is insufficient evidence to substantiate the claims, it may require tests to substantiate the claims be made by an approved testing agency at the expense of the applicant.

1.5.4 Test Procedure

The Authority Having Jurisdiction shall require all tests be made in accordance with approved standards; but, in the absence of such standards, the Authority Having Jurisdiction shall specify the test procedure.

1.5.5 Retesting

The Authority Having Jurisdiction may require any tests to be repeated if, at any time, there is reason to believe that any material or method of installation no longer conforms to the requirements on which the original approval was based.

ADM 1.6 ORGANIZATION AND ENFORCEMENT

1.6.1 Authority Having Jurisdiction

The Authority Having Jurisdiction shall be the individual official, board, department or agency duly appointed by the jurisdiction as having the authority to administer and enforce the provisions of this Code as adopted or amended.

1.6.2 Deputies

In accordance with the procedures set forth by the jurisdictional authority, the Authority Having Jurisdiction may appoint such assistants, deputies, inspectors or other designated employees to carry out the administration and enforcement of this Code.

1.6.3 Right of Entry

When inspections are required to enforce the provisions of this Code, or there is reasonable cause to believe there exists in any building, structure or premises, any condition or violation of this Code causing the building, structure or premises to be unsafe, insanitary, dangerous or hazardous, the Authority Having Jurisdiction or its designated representative may enter such building, structure or premises at reasonable times to inspect or perform the duties imposed by this Code. When the building, structure or premises are occupied, proper credentials shall be presented to the occupant when entry is required. In the event the building, structure or premises is unoccupied, and entry is required, a reasonable effort shall be made to locate the owner or his agent in charge of such building, structure or premises. In the event the occupant or owner of such building, structure or premises refuses entry, the Authority Having Jurisdiction shall have recourse to the remedies provided by law to gain entry.

1.6.4 Stop Work Order

Upon notice from the Authority Having Jurisdiction, work being done on any building, structure or premises contrary to the provisions of this Code, or in an unsafe and dangerous manner, shall be stopped immediately. The stop work notice shall be in writing, served on the owner of the property, or his agent, or to the person doing such work. It shall state the conditions under which the Authority Having Jurisdiction may grant authorization to proceed with the work.

1.6.5 Authority to Condemn

When the Authority Having Jurisdiction determines that any plumbing system or portion thereof that is regulated by this Code has become insanitary or hazardous to life, health or property, it shall order in writing that such plumbing system or portion thereof be repaired, replaced or removed so as to be in code compliance. The written order shall fix a reasonable time limit for the work to be brought into code compliance, and no person shall use the condemned plumbing system until such work is complete and approved by the Authority Having Jurisdiction.

1.6.6 Authority to Abate

Any plumbing system, or portion thereof that is found to be insanitary or constitute a hazard to life, health or property is hereby declared to be a nuisance. Where a nuisance exists, the Authority Having Jurisdiction shall require the nuisance to be abated and shall seek such abatement in the manner prescribed by law.

1.6.7 Liability

The Authority Having Jurisdiction, or any individual duly appointed or authorized by the Authority Having Jurisdiction to enforce this Code, acting in good faith and without malice, shall not thereby be rendered personally liable for any damage that may occur to persons or property as a result of any act, or by reason of any act or omission in the lawful discharge of his duties. Should a suit be brought against the Authority Having Jurisdiction or duly appointed representative because of such act or omission, it shall be defended by legal counsel provided by this jurisdiction until final termination of the proceedings.

1.6.8 Work Prior to Permit

Where work for which a permit is required by this Code is started prior to obtaining the prescribed permit, the applicant shall pay a double fee. In the event of an emergency where it is absolutely necessary to perform the plumbing work immediately, such as nights, weekends or holidays, said fee shall not be doubled if a permit is secured at the earliest possible time after the emergency plumbing work has been performed.

ADM 1.7 VIOLATIONS AND PENALTIES

1.7.1 Violations

It shall be unlawful for any individual, partnership, firm or corporation to, or cause to, install, construct, erect, alter, repair, improve, convert, move, use or maintain any plumbing system in violation of this Code.

1.7.2 Penalties

Any individual, partnership, firm or corporation who shall violate or fail to comply with any of the requirements of this Code shall be deemed guilty of a ________, and if convicted, shall be punishable by a fine or imprisonment or both as established by this jurisdiction. Each day during which a violation occurs or continues, shall constitute a separate offense.

ADM 1.8 PERMITS

1.8.1 Permits Required

It shall be unlawful for any individual, partnership, firm or corporation to commence, or cause to commence, any installation, alteration, repair, replacement, conversion or addition to any plumbing system, or part thereof, regulated by this Code, except as permitted in Section 1.8.2, without first obtaining a plumbing permit for each separate building or structure, on forms prepared and provided by the Authority Having Jurisdiction.

1.8.2 Permits Not Required for the Following

a. Permits shall not be required for the following work:

1. The stoppage of leaks in drains, soil, waste or vent pipes. However, should the defect necessitate removal and replacement with new material, it shall constitute new work and a permit shall be obtained and inspection made as required in this Code.
2. The clearing of stoppages.
3. The repairing of leaks in valves or fixtures.
4. The removing and reinstallation of a water closet for a cleanout opening provided the reinstallation does not require replacement or rearrangement of valves, pipes or new fixtures.

b. Exemptions from obtaining a permit required by this Code shall not be construed as to authorize any work to be performed in violation of this Code.

ADM 1.9 PROCESS FOR OBTAINING PERMITS

1.9.1 Application

a. Applications for a permit shall be made in writing by the person, or his agent, proposing to do such work covered by the permit. The applicant shall file such application in writing on a form prepared and provided by the Authority Having Jurisdiction. Every such permit shall:

1. Describe in detail the work to be done for which the permit was obtained.
2. Describe in detail the parcel of land on which the proposed work is to be done by legal description, street address or other means to definitely locate the site or building where the work is to be performed.
3. List the type of occupancy or use.
4. Provide plans, drawings, diagrams, calculations or other data as required by Section 1.9.2.
5. Be signed by the person or agent making application.
6. Provide any other information the Authority Having Jurisdiction may require.

1.9.2 Plans

Two or more sets of plans shall be submitted with each permit application. The plans shall contain all the engineering calculations, drawings, diagrams and other data as required for approval. The Authority Having Jurisdiction may also require that the plans, drawings, diagrams and calculations be designed by an engineer and/or architect licensed by the state in which the work is to be performed.

Except that the Authority Having Jurisdiction may waive the submission of plans and other data, provided it is determined that the nature of the work covered by the permit does not require plan review to obtain code compliance.

1.9.3 Specifications

All specifications required to be on the plans shall be drawn to scale and sufficiently clear to indicate the nature, location and extent of the proposed work so as to show how it will conform to the requirements of this Code.

1.9.4 Permit Issuance

If, after reviewing the plans and specifications, the Authority Having Jurisdiction finds that they are complete and conform to the requirements of this Code, it shall authorize a permit to be issued upon payment of all the fees specified in Section 1.10.1.

1.9.5 Approved Plans

When the Authority Having Jurisdiction issues a permit and plans were required, it shall endorse, either in writing or stamp the plans "APPROVED", and all work shall be done in accordance with the plans without deviation.

1.9.6 Plans Retention

The Authority Having Jurisdiction shall retain one set of approved plans until final approval of the work contained therein. One set of approved plans shall be returned to the applicant and this set of approved plans shall be kept on the job site at all times until final approval of the work contained therein.

1.9.7 Permit Validity

The issuance of a permit by the Authority Having Jurisdiction is not and shall not be construed to be authorization or approval of any violation of the requirements of this Code. Any presumption of a permit to be authorization to violate or cancel any provisions of this Code shall be invalid. The issuance of a permit based on plans submitted shall not prevent the Authority Having Jurisdiction from requiring the correction of any errors in the plans or preventing the progress of the construction when it is in violation of any provision of this Code.

1.9.8 Permit Expiration

Every permit issued by the Authority Having Jurisdiction, in accordance with the provisions of this Code, shall expire by limitation and become null and void when such work authorized by the permit has not commenced within days from the date of issuance or if such work is suspended or abandoned for a period of ____ days after commencement of such work. In order for such work to recommence, a new permit shall be obtained and a fee of percent of the original permit fee shall be charged, provided no changes have been made or will be made to the original plans as submitted. The Authority Having Jurisdiction may grant an extension to any permit provided the request is in writing by the permittee stating the reason or circumstances that prevented him from completing such work as required by this Code.

1.9.9 Revocation or Suspension

At any time, the Authority Having Jurisdiction may suspend or revoke a permit issued in error or on the basis of incorrect information submitted or in violation of any section of this Code. The suspension or revocation of such permit shall be in written form by the Authority Having Jurisdiction stating the reason or purpose of such suspension or revocation.

ADM 1.10 PERMITS

1.10.1 Fees Schedule

The permit fees for all plumbing work shall be set forth by the Authority Having Jurisdiction of the jurisdiction having authority.

1.10.2 Plan Review Fees

When plans are reviewed as a requirement prior to issuance of a permit, the fee shall be equal to ___ percent of the total permit fee as set forth in Section 1.10.1.

1.10.3 Plan Review Expiration

Permit application and plan review for which no permit is issued shall expire by limitation within ___ days following the date of application. All plan review fees shall be forfeited and the plans may be destroyed by the Authority Having Jurisdiction or returned to the applicant.

l.10.4 Work Without a Permit

When any plumbing work is commenced without first obtaining a permit from the Authority Having Jurisdiction, an investigation of such work shall be made before a permit may be issued. The investigation fee shall be collected whether or not a permit is then or subsequently issued. Any investigation fee shall equal the amount of the permit fee, if a permit were to be issued in accordance with this Code. If the investigation fee is collected, it shall not exempt any person from compliance or penalties set forth in this Code.

1.10.5 Refunding of Fees

Any fee collected by the Authority Having Jurisdiction that was erroneously paid or collected may be refunded, provided not more than ____ percent of the fee payment shall be refunded when no work has been done. Any request for the refunding of any fee shall be in writing by the applicant no later than ___ days after the date of fee payment.

ADM 1.11 INSPECTIONS

1.11.1 Required Inspections

All new plumbing systems, and parts of existing systems that require a permit shall be tested and inspected by the Authority Having Jurisdiction prior to being covered or concealed. Where any such work has been covered or concealed, the Authority Having Jurisdiction shall require such work exposed for inspection and testing. All equipment, material and labor required for testing the plumbing system shall be furnished by the permittee. The Authority Having Jurisdiction shall not be liable for any expense incurred by the removal or replacement of materials required to permit inspection or testing. Such expense is the responsibility of the permittee. Upon completion of the rough plumbing installation, prior to covering or concealing any such work, the Authority Having Jurisdiction shall inspect the work and any such test, as prescribed hereinafter, to disclose any leaks or defects. After completion of the plumbing system and the plumbing fixtures are set and their traps filled with water, a final inspection shall be conducted as required by this Code. Additional inspections may be required when alternate materials or methods of installation are approved by the Authority Having Jurisdiction.

1.11.2 Exception:

For moved-in or relocated structures, minor installations and repairs, the Authority Having Jurisdiction may make other such inspections or tests as necessary to assure that the work has been performed and is safe for use in accordance with the intent of this Code.

1.11.3 Use of Existing Plumbing

The operation of any plumbing installation to replace existing systems or fixtures serving an occupied portion of any building or structure shall not be considered by the requirements of this Code to prohibit such operation, provided a request for inspection has been made to the Authority Having Jurisdiction within 48 hours of such work and before any such work is covered or concealed.

1.11.4 System Testing

All new plumbing systems and parts of existing systems shall be tested and approved as required elsewhere in this Code.

1.11.5 Requests for Inspection

The Authority Having Jurisdiction shall be notified by the person doing the work, authorized by the permit, that such work is subjected to the required tests and is ready for inspection. The method of request, whether in writing or by telephone, shall be established by the Authority Having Jurisdiction.

It shall be the duty of the permittee doing the work authorized by a permit to provide reasonable access and means for accomplishing proper inspections.

1.11.6 Other Inspections

The Authority Having Jurisdiction may require other inspections, in addition to those required by this Code, of any plumbing work in order to ascertain compliance with the requirements of this Code.

1.11.7 Reinspection Fees

a. The assessment of a reinspection fee may be required for any of the following:

1. For any portion of work not completed for which inspection was requested.
2. For any required corrections that have not been completed and for which reinspection was requested.
3. For not having the approved plans on site and readily available to the inspector.
4. Failure to provide access for inspection on the date inspection was requested.
5. Deviation from the approved plans that would require reapproval of the Authority Having Jurisdiction.
6. Failure to provide correct address.

b. This provision is intended to control the practice of calling for inspections prior to having work ready for inspection and not for the first time job rejection for not complying with the installation requirements.

c. Upon the assessment of a reinspection fee, the applicant shall pay the reinspection fee in accordance with Section 1.10.1 and no additional inspections shall be performed until all fees have been paid.

ADM 1.12 FINAL CONNECTIONS

1.12.1 Energy or Fuel

It shall be unlawful for any person to make, or cause to make, any connection to any source of energy or fuel to any plumbing system or equipment regulated by this Code prior to the approval of the Authority Having Jurisdiction.

1.12.2 Water and Sewer

It shall be unlawful for any person to make, or cause to make, any connection to any water supply or sewer system to any plumbing system or equipment regulated by this Code prior to the approval of the Authority Having Jurisdiction.

1.12.3 Temporary Connection

By authorization of the Authority Having Jurisdiction, a temporary connection may be made to any plumbing equipment to a source of energy or fuel for testing purposes only.

ADM 1.13 UNCONSTITUTIONALITY

Should any chapter, section, subsection, sentence, clause or phrase of this Code be held for any reason as unconstitutional, such decision shall not affect the validity of the remaining chapters, sections, subsections, sentences, clause or phrases of this Code.

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Basic Principles

This Code is founded upon certain basic principles of environmental sanitation and safety through properly designed, acceptably installed, and adequately maintained plumbing systems. Some of the details of plumbing construction may vary but the basic sanitary and safety principles desirable and necessary to protect the health of the people are the same everywhere.

The establishment of trade jurisdictional areas is not within the scope of this Code. This inclusion of material, even though indicated as approved for purposes of this Code, does not infer unqualified endorsement as to its selection or serviceability in any or every installation.

As interpretations may be required, and as unforeseen situations arise which are not specifically covered in this Code, the twenty-two principles which follow shall be used to define the intent.

Principle No. 1—ALL OCCUPIED PREMISES SHALL HAVE POTABLE WATER
All premises intended for human habitation, occupancy, or use shall be provided with a supply of potable water. Such a water supply shall not be connected with unsafe water sources, nor shall it be subject to the hazards of backflow.

Principle No. 2—ADEQUATE WATER REQUIRED
Plumbing fixtures, devices, and appurtenances shall be supplied with water in sufficient volume and at pressures adequate to enable them to function properly and without undue noise under normal conditions of use.

Principle No. 3—HOT WATER REQUIRED
Hot water shall be supplied to all plumbing fixtures which normally need or require hot water for their proper use and function.

Principle No. 4—WATER CONSERVATION
Plumbing shall be designed and adjusted to use the minimum quantity of water consistent with proper performance and cleaning.

Principle No. 5—SAFETY DEVICES
Devices for heating and storing water shall be so designed and installed as to guard against dangers from explosion or overheating.

Principle No. 6—USE PUBLIC SEWER WHERE AVAILABLE
Every building with installed plumbing fixtures and intended for human habitation, occupancy, or use, and located on premises where a public sewer is on or passes said premises within a reasonable distance, shall be connected to the sewer.

Principle No. 7—REQUIRED PLUMBING FIXTURES
Each family dwelling unit shall have at least one water closet, one lavatory, one kitchen-type sink, and one bathtub or shower to meet the basic requirements of sanitation and personal hygiene.
All other structures for human habitation shall be equipped with sufficient sanitary facilities. Plumbing fixtures shall be made of durable, smooth, non-absorbent and corrosion resistant material and shall be free from concealed fouling surfaces.

Principle No. 8—DRAINAGE SYSTEM

The drainage system shall be designed, constructed, and maintained to guard against fouling, deposit of solids and clogging, and with adequate cleanouts so arranged that the pipes may be readily cleaned.

Principle No. 9—DURABLE MATERIALS AND GOOD WORKMANSHIP

The piping of the plumbing system shall be of durable material, free from defective workmanship and so designed and constructed as to give satisfactory service for its reasonable expected life.

Principle No. 10—FIXTURE TRAPS

Each fixture directly connected to the drainage system shall be equipped with a liquid seal trap.

Principle No. 11—TRAP SEALS SHALL BE PROTECTED

The drainage system shall be designed to provide an adequate circulation of air in all pipes with no danger of siphonage, aspiration, or forcing of trap seals under conditions of ordinary use.

Principle No. 12—EXHAUST FOUL AIR TO OUTSIDE

Each vent terminal shall extend to the outer air and be so installed as to minimize the possibilities of clogging and the return of foul air to the building.

Principle No. 13—TEST THE PLUMBING SYSTEM

The plumbing system shall be subjected to such tests as will effectively disclose all leaks and defects in the work or the material.

Principle No. 14—EXCLUDE CERTAIN SUBSTANCES FROM THE PLUMBING SYSTEM

No substance which will clog or accentuate clogging of pipes, produce explosive mixtures, destroy the pipes or their joints, or interfere unduly with the sewage-disposal process shall be allowed to enter the building drainage system.

Principle No. 15—PREVENT CONTAMINATION

Proper protection shall be provided to prevent contamination of food, water, sterile goods, and similar materials by backflow of sewage. When necessary, the fixture, device, or appliance shall be connected indirectly with the building drainage system.

Principle No. 16—LIGHT AND VENTILATION

No water closet or similar fixture shall be located in a room or compartment which is not properly lighted and ventilated.

Principle No. 17—INDIVIDUAL SEWAGE DISPOSAL SYSTEMS

If water closets or other plumbing fixtures are installed in buildings where there is no sewer within a reasonable distance, suitable provision shall be made for disposing of the sewage by some accepted method of sewage treatment and disposal.

Principle No. 18—PREVENT SEWER FLOODING

Where a plumbing drainage system is subject to backflow of sewage from the public sewer or private disposal system, suitable provision shall be made to prevent its overflow in the building.

Principle No. 19—PROPER MAIN TENANCE

Plumbing systems shall be maintained in a safe and serviceable condition from the standpoint of both mechanics and health.

Principle No. 20—FIXTURES SHALL BE ACCESSIBLE

All plumbing fixtures shall be so installed with regard to spacing as to be accessible for their intended use and for cleaning.

Principle No. 21—STRUCTURAL SAFETY

Plumbing shall be installed with due regard to preservation of the strength of structural members and prevention of damage to walls and other surfaces through fixture usage.

Principle No. 22—PROTECT GROUND AND SURFACE WATER

Sewage or other waste shall not be discharged into surface or sub-surface water unless it has first been subjected to some acceptable form of treatment.

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Chapter 1

Definitions

1.1 GENERAL

For the purpose of this Code, the following terms shall have the meaning indicated in this chapter. No attempt is made to define ordinary words that are used in accordance with their established dictionary meaning, except where it is necessary to define their meaning as used in this Code to avoid misunderstanding.

1.2 DEFINITION OF TERMS

Accessible and Readily Accessible:

> Accessible: access thereto without damaging building surfaces, but that first may require the removal of an access panel, door or similar obstructions with the use of tools.
>
> Readily accessible: access without requiring the use of tools for removing or moving any panel, door or similar obstruction.

Acid Waste: See "Special Wastes"

Adopting Agency (See also "Authority Having Jurisdiction") The agency, board or authority having the duty and power to establish the plumbing code that will govern the installation of all plumbing work to be performed in the jurisdictions.

Air Break (drainage system): A piping arrangement in which a drain from a fixture, appliance, or device discharges into a fixture, receptor, or interceptor at a point below the flood level rim and above the trap seal of the receptor.

Air Chamber: A pressure surge absorbing device operating through the compressibility of air.

Air Gap (drainage system): The unobstructed vertical distance through the free atmosphere between the outlet of the waste pipe and the flood level rim of the receptor into which it is discharging.

Air Gap (water distribution system): The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of the receptor.

Anchors: See "Supports"

Anti-scald Valve: See "Water Temperature Control Valve"

Approved: Accepted or acceptable under an applicable standard stated or cited in this Code, or accepted as suitable for the proposed use under procedures and powers of the Authority Having Jurisdiction as defined in Section 3.12.

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 (See also "Adopting Agency")
The individual official, board, department or agency established and authorized by a state, county, city or other political subdivision created by law to administer and enforce the provisions of the plumbing code as adopted or amended.

Automatic Flushing Device: A device that automatically flushes a fixture after each use without the need for manual activation.

Auxiliary Floor Drain: A floor drain that does not receive the discharge from any indirect waste pipe. Auxiliary floor drains have no DFU loading.

Backflow Connection: Any arrangement whereby backflow can occur.

Backflow (drainage): A reversal of flow in the drainage system.

Backflow Preventer: A device or means to prevent backflow.

Backflow (Water Distribution): The flow of water or other liquids, mixtures or substances from any source or sources into the distribution pipes of a potable water system. Back-siphonage is one type of backflow.

Backpressure Backflow: Backflow caused by a higher pressure in the non-potable system than in the potable supply system.

Back-siphonage: Backflow caused by a greater negative pressure in the potable system than in the non-potable supply system.

Backwater Valve: A device installed in a drain pipe to prevent backflow.

Baptistery: A tank or pool for baptizing by total immersion.

Bathroom Group: A group of fixtures in a dwelling unit bathroom consisting of one water closet, one or two lavatories, and either one bathtub, one combination bath/shower or one shower stall. Other fixtures within the bathing facility shall be counted separately when determining the water supply and drainage fixture unit loads.

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

Bedpan Steamer: A fixture used for scalding bedpans or urinals by direct application of steam.

Boiler Blow-off: An outlet on a boiler to permit emptying or discharge of sediment.

Boiler Blow-off Tank: A vessel designed to receive the discharge from a boiler blow-off outlet and to cool the discharge to a temperature that permits its safe discharge to the drainage system.

Branch: Any part of the piping system other than a riser, main or stack.

Branch, Fixture: See "Fixture Branch"

Branch, Horizontal: See "Horizontal Branch Drain"

Branch Interval: A distance along a soil or waste stack corresponding, in general, to a story height, but in no case less than 8 feet within which the horizontal branches from one floor or story of a building are connected to the stack.

Branch Vent: See "Vent, Branch"

Building: A structure having walls and a roof designed and used for the housing, shelter, enclosure, or support of persons, animals, or property.

Building Classification: The arrangement adopted by the Authority Having Jurisdiction for the designation of buildings in classes according to occupancy.

Building Drain: The lowest piping in a drainage system that receives the discharge from stacks and horizontal fixture branches within a building that convey sewage, waste, or other drainage to a building sewer beginning three (3) feet outside the building wall. Horizontal fixture branches are sized according to Table 11.5.1B until they connect to the building drain or a branch of the building drain that serves two or more horizontal fixture branches.

Building Drain, Combined: A building drain that conveys both sewage and storm water or other drainage.

Building Drain, Sanitary: A building drain that conveys sewage only.

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

Building Sewer: That part of the drainage system that extends from the end of the building drain and conveys its discharge to a public sewer, private sewer, individual sewage disposal system or other point of disposal. The building sewer begins at a point three feet beyond the outside face of the building.

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 or building drain.

Building Trap: A device, fitting, or assembly of fittings, installed in the building drain to prevent circulation of air between the drainage system of the building and the building sewer.

Cesspool: A lined and covered excavation in the ground that receives the discharge of domestic sewage or other organic wastes from a drainage system, so designed as to retain the organic matter and solids, but permitting the liquids to seep through the bottom and sides.

Chemical Waste: See "Special Wastes"

Circuit Vent: See "Vent, Circuit"

Clear Water Waste: Effluent in which impurity levels are less than concentrations considered harmful by the Authority Having Jurisdiction, such as cooling water and condensate drainage from refrigeration and air conditioning equipment, cooled condensate from steam heating systems, and residual water from ice making processes.

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

Code: These regulations, or any emergency rule or regulation that the Authority Having Jurisdiction may lawfully adopt.

Combination Fixture: A fixture combining one sink and laundry tray, or a two- or three-compartment sink or laundry tray in one unit.

Combination Thermostatic/Pressure Balancing Valve: See "Thermostatic/Pressure Balancing Valve, Combined"

Combination Waste and Vent System: A 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 Drain: See "Building Drain , Combined"

Combined Building Sewer: See "Building Sewer , Combined"

Common Vent: See "Vent, Common"

Conductor: A pipe within a building that conveys stormwater from a roof to its connection to a building storm drain or other point of disposal.

Contamination:
The 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. (See the definition of "pollution").

Continuous Vent: See "Vent, Continuous"

Continuous Waste: A drain from two or more fixtures connected to a single trap.

Critical Level: The marking on a backflow prevention device or vacuum breaker established by the manufacturer, and 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 must be installed. When a backflow prevention device does not bear a critical level marking, the bottom of the vacuum breaker, combination valve, or the bottom of any approved device constitutes the critical level.

Cross Connection: Any connection or arrangement between two otherwise separate piping systems, one of that contains potable water and the other either water of questionable safety, steam, gas, or chemical, whereby there may be a flow from one system to the other, the direction of flow depending on the pressure differential between the two systems (See "Backflow and Back-Siphonage).

Day Care Center: A facility for the care and/or education of children ranging from 2-1/2 years of age to 5 years of age.

Day Nursery: A facility for the care of children less than 2-1/2 years of age.

Dead End, Potable Water: A branch line terminating at a developed length of two (2) feet or more from an active potable water line by means of a plug or cap.

Dead End, Soil, Waste, or Vent: A branch leading from a soil, waste or vent pipe, building drain, or building sewer line and terminating at a developed length of two (2) feet or more by means of a plug, cap, or other closed fitting.

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

Diameter: See "Size of Pipe & Tubing"

Domestic Sewage: The water-borne wastes derived from ordinary living processes.

Double Check Valve Assembly: A backflow prevention device consisting of two independently acting check valves, internally force loaded to a normally closed position between two tightly closing shut-off valves, and with means of testing for tightness.

Double Offset: See "Offset, Double"

Downspout: See "Leader"

Drain: Any pipe that carries waste or water-borne wastes in a building drainage system.

Drainage Pipe: See "Drainage System"

Drainage, Sump : A liquid and air-tight tank that receives sewage and/or liquid waste, located below the elevation of a gravity drainage system, that is emptied by pumping.

Drainage System: All the piping within public or private premises that conveys sewage, rain water, or other liquid wastes to a point of disposal. It does not include the mains of a public sewer system or private or public sewage-treatment facilities.

Drainage System, Building Gravity: A drainage system that drains by gravity into the building sewer.

Drainage System, Sub-building: See "Building Subdrain"

Dry Vent: See "Vent, Dry"

Dry Well: See "Leaching Well"

Dual Vent: See "Vent, Common"

Dwelling Unit, Multiple: A room, or group of rooms, forming a single habitable unit with facilities that are used, or intended to be used, for living, sleeping, cooking and eating; and whose sewer connections and water supply, within its own premise, are shared with one or more other dwelling units. Multiple dwelling units include guest rooms in hotels and motels.

Dwelling Unit, Single: A room, or group of rooms, forming a single habitable unit with facilities that are used, or intended to be used, for living, sleeping, cooking and eating; and whose sewer connections and water supply are, within its own premise, separate from and completely independent of any other dwelling.

DWV: An acronym for "drain-waste-vent" referring to the combined sanitary drainage and venting systems. This term is equivalent to "soil-waste-vent" (SWV).

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) if the opening is not circular, the diameter of a circle of equivalent cross-sectional area.

Equivalent Length: The length of straight pipe of a specific diameter that would produce the same frictional resistances as a particular fitting or line comprised of pipe and fittings.

Existing Plumbing System: An existing plumbing system, or any part thereof, installed prior to the effective date of this Code.

Existing Work: A plumbing system, or any part thereof, installed prior to the effective date of this Code.

Family: One or more individuals living together and sharing the same facilities.

Fixture: See "Plumbing Fixture"

Fixture Branch, Supply: A branch of the water distribution system supplying one fixture.

Fixture Branch, Drainage: A drain serving one or more fixtures that discharges into another drain.

Fixture Drain: The drain from the trap of a fixture to the junction of that drain with any other drain pipe.

Fixture Unit (Drainage -DFU): An index number that represents the load of a fixture on the drainage system so that the load of various fixtures in various applications can be combined. The value is based on the volume or volume rate of drainage discharge from the fixture, the time duration of that discharge, and the average time between successive uses of the fixture. One DFU was originally equated to a drainage flow rate of one cubic foot per minute or 7.5 gallons per minute through the fixture outlet.

Fixture Unit (Water Supply - WSFU): An index number that represents the load of a fixture on the water supply system so that the load of various fixtures in various applications can be combined. The value is based on the volume rate of supply for the fixture, the time duration of a single supply operation, and the average time between successive uses of the fixture. Water supply fixture units were originally based on a comparison to a flushometer valve water closet, which was arbitrarily assigned a value of 10 WSFU.

Flexible Water Connector: A connector under continuous pressure in an accessible location that connects a supply fitting, faucet, dishwasher, cloths washer, water heater, water treatment unit, or other fixture or equipment to a stop valve or its water supply branch pipe.

Flood Level: See "Flood Level Rim"

Flood Level Rim: The edge of the receptor or fixture over which water flows if the fixture is flooded.

Flooded: The condition that results when the liquid in a receptor or fixture rises to the flood level rim.

Flow Pressure: The pressure in the water supply pipe near the faucet or water outlet while the faucet or water outlet is fully open and flowing.

Flush Pipes and Fittings: The pipe and fittings that connect a flushometer valve or elevated flush tank to a water closet, urinal, or bed pan washer.

Flushing Type Floor Drain: A floor drain that is equipped with an integral water supply connection, enabling flushing of the drain receptor and trap.

Flush Valve: A device located at the bottom of a tank for flushing water closets and similar fixtures.

Flushometer Tank: A water closet flush tank that uses an air accumulator vessel to discharge a predetermined quantity of water into the closet bowl for flushing purposes.

Flushometer Valve: A device that discharges a predetermined quantity of water to fixtures for flushing and is closed by direct water pressure or other means.

Force Main: A main that delivers waste water under pressure from a sewage ejector or pump to its destination.

Full-way valve: Full-way valves include gate valves, full port ball valves, and other valves that are identified by their manufacturer as full port or full bore.

Grade: The fall (slope) of a line of pipe in reference to a horizontal plane.

Grease Interceptor: A plumbing appurtenance that is installed in the sanitary drainage system to intercept oily and greasy wastes from wastewater discharges, typically in commercial kitchens and food processing plants. Such equipment has the ability to intercept commonly occurring free-floating fats and oils.

Grease Recovery Device (GRD): A plumbing appurtenance that is installed in the sanitary drainage system to intercept and remove free-floating fats, oils, and grease from wastewater discharges, typically in commercial kitchens and food processing plants. Such equipment operates on a time or event- controlled basis and has the ability to remove the entire range of commonly occurring free-floating fats, oils, and grease automatically without intervention from the user except for maintenance. The removed material is essentially water-free, which allows for recycling of the removed product.

Grease Trap: See "Interceptor"

Grinder Pump: A pump for sewage that shreds or grinds the solids in the sewage that it pumps.

Ground Water: Subsurface water occupying the zone of saturation. (a) confined ground water - a body of ground water overlaid by material sufficiently impervious to sever free hydraulic connection with overlying ground water. (b) free ground water - ground water in the zone of saturation extending down to the first impervious barrier.

Half-Bath: A room that contains one water closet and one lavatory within a dwelling unit.

Hangers: See "Supports"

Health Hazard In backflow prevention, an actual or potential threat of contamination of the potable water supply to the plumbing system of a physical or toxic nature that would be a danger to health. Health hazards include any contamination that could cause death, illness, or spread of disease.

Horizontal Branch Drain: A drain pipe extending laterally from a soil stack, waste stack or building drain with or without vertical sections or branches, that receives the waste discharged from one or more fixture drains and conducts the waste to a soil stack, waste stack, or building drain.

Horizontal Pipe: Any pipe or fitting that makes an angle of less than 45^0 with the horizontal.

Hot Water: Potable water that is heated to a required temperature for its intended use.

House Drain: See "Building Drain"

House Sewer: See "Building Sewer"

House Trap: See "Building Trap"

Indirect Connection (Waste): The introduction of waste into the drainage system by means of an air gap or air break.

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

Individual Vent: See "Vent, Individual"

Industrial Wastes: Liquid or liquid-borne wastes resulting from the processes employed in industrial and commercial establishments.

Insanitary: Contrary to sanitary principles -- injurious to health.

Installed: Altered, changed or a new installation .

Interceptor: A device designed and installed so as to separate and retain deleterious, hazardous, or undesirable matter from normal wastes while permitting normal sewage or liquid wastes to discharge into the drainage system by gravity.

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

Leaching Well or Pit: A pit or receptor having porous walls that permit the liquid contents to seep into the ground.

Leader: An exterior vertical drainage pipe for conveying storm water from roof or gutter drains.

Load Factor: The percentage of the total connected fixture unit flow that is likely to occur at any point in the drainage system.

Local Ventilating Pipe: A pipe on the fixture side of the trap through which vapor or foul air is removed from a fixture.

Loop Vent: See "Vent, Loop"

Low Hazard: See "Hazard, Low"

Macerating Toilet System: A system that collects drainage from a single water closet, lavatory and/or bathtub located in the same room. It consists of a receiving container, a grinder pump, and associated level controls. The system pumps shredded or macerated sewage up to a point of discharge

Main: The principal pipe artery to which branches may be connected.

Main Sewer: See "Public Sewer"

May: The word "may" is a permissive term.

Medical Gas System: The complete system used to convey medical gases for direct application from central supply systems (bulk tanks, manifolds and medical air compressors) through piping networks with pressure and operating controls, alarm warning systems, etc., and extending to station outlet valves at use points.

Medical Vacuum Systems: A system consisting of central-vacuum-producing equipment with pressure and operating controls, shut-off valves, alarm warning systems, gauges and a network of piping extending to and terminating with suitable station inlets to locations where suction may be required.

Multiple Dwelling: A building containing two or more dwelling units.

Non-Health Hazard: In backflow prevention, an actual or potential threat to the physical properties or potability of the water supply to the plumbing system, but which would not constitute a health or system hazard.

Non-potable Water: Water not safe for drinking, personal or culinary use.

Nominal Size: A standard expression in inches and fractions thereof to denote equal. Existing in name only and not in actuality.

Nuisance: Public nuisance at common law or in equity jurisprudence; whatever is dangerous to human life or detrimental to health; whatever building, structure, or premises is not sufficiently ventilated, sewered, drained, cleaned, or lighted in reference to its intended or actual use; and whatever renders the air, human food, drink or water supply unwholesome.

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

Offset, Double: Two offsets installed in succession or series in a continuous pipe.

Offset, Return: A double offset installed so as to return the pipe to its original alignment.

Oil Interceptor: See "Interceptor"

Person: A natural person, his heirs, executors, administrators or assigns; including a firm, partnership or corporation, its or their successors or assigns. Singular includes plural; male includes female.

Pitch: See “Grade”

Plenum: An enclosed portion of the building structure, other than an occupiable space being conditioned, that is designed to allow air movement, and thereby serve as part of an air distribution system.

Plumbing
The practice, materials, and fixtures within or adjacent to any building structure or conveyance, used in the installation, maintenance, extension, alteration and removal of any piping, plumbing fixtures, plumbing appliances, and plumbing appurtenances in connection with any of the following:

a.. Sanitary drainage system and its related vent system,
b. Storm water drainage facilities,
c. Public or private potable water supply systems,
d. The initial connection to a potable water supply upstream of any required backflow prevention devices and the final connection that discharges indirectly into a public or private disposal system,
e. Medical gas and medical vacuum systems,
f. Indirect waste piping including refrigeration and air conditioning drainage,
g. Liquid waste or sewage, and water supply, of any premises to their connection with an approved water supply system or to an acceptable disposal facility.

NOTE: The following are excluded from the definition:

1. All piping, equipment or material used exclusively for environmental control.
2. Piping used for the incorporation of liquids or gases into any product or process for use in the manufacturing or storage of any product, including product development.
3. Piping used for the installation, alteration, repair or removal of automatic sprinkler systems installed for fire protection only.
4. The related appurtenances or standpipes connected to automatic sprinkler systems or overhead or underground fire lines beginning at a point where water is used exclusively for fire protection.
5. Piping used for lawn sprinkler systems downstream from backflow prevention devices.

Plumbing Appliance: Any one of a special class of plumbing fixture that is intended to perform a special plumbing function. Its operation and/or control may be dependent upon one or more energized components, such as motors, controls, heating elements, or pressure or temperature-sensing elements. Such fixtures 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 fixture may be manually adjusted or controlled by the user or operator.

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

Plumbing Fixture: A receptacle or device connected to the water distribution system of the premises, and demands a supply of water there from; or discharges used water, liquid-borne waste materials, or sewage either directly or indirectly to the drainage system of the premises; or which requires both a water supply connection and a discharge to the drainage system of the premises. Plumbing appliances as a special class of fixture are further defined.

Plumbing Inspector: See “Authority Having Jurisdiction”

Plumbing System: Includes the water supply and distribution pipes, plumbing fixtures and traps; soil, waste and vent pipes; sanitary and storm drains and building sewers; including their respective connections, devices and appurtenances to an approved point of disposal.

Pollution "Potable Water": An impairment of the quality of the potable water to a degree that does not create a hazard to the public health but that does adversely and unreasonably affect the aesthetic qualities of such potable water for domestic use. (See the definition of “contamination”).

Pool: See “Swimming Pool”

Potable Water: Water free from impurities present in amounts sufficient to cause disease or harmful physiological effects and conforming in its bacteriological and chemical quality to the requirements of the Public Health Service Drinking Water Standards or the regulations of the public health authority having jurisdiction.

Powder Room: See “Half-Bath.”

Pressure Assisted Water Closet: See Water Closet, Pressure Assisted.

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

Private Sewage Disposal System: A system for disposal of domestic sewage by means of a septic tank or mechanical treatment, designed for use apart from a public sewer to serve a single establishment or building.

Private Sewer: Any sewer not directly controlled by public authority.

Private Use, Public Use:

Private Use - Plumbing facilities for the private and restricted use of one or more individuals in dwelling units (including hotel and motel guest rooms), and other plumbing facilities that are not intended for public use. Refer to the definition of “Public Use”.

Public Use - Plumbing facilities intended for the unrestricted use of more than one individual (including employees) in assembly occupancies, business occupancies, public buildings, transportation facilities, schools and other educational facilities, office buildings, restaurants, bars, other food service facilities, mercantile facilities, manufacturing facilities, military facilities, and other plumbing installations that are not intended for private use. Refer to the definition of “Private Use”.

Private Water Supply: A supply, other than an approved public water supply, that serves one or more buildings.

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

Public Toilet Room: A toilet room intended to serve the transient public, such as in, but not limited to the following examples: service stations, train stations, airports, restaurants, and convention halls.

Public Water Main: A water supply pipe for public use controlled by public authority.

Pump Assisted Water Closet: See Water Closet, Pump Assisted.

Receptor: A fixture or device that receives the discharge from indirect waste pipes.

Reduced Pressure Backflow Preventer Assembly: See Reduced Pressure Zone Backflow Preventer Assembly

Reduced Pressure Principle Assembly: A reduced pressure zone backflow preventer assembly.

Reduced Pressure Zone Backflow Preventer Assembly: A backflow prevention device consisting of two independently acting check valves, internally force loaded to a normally closed position and separated by an intermediate chamber (or zone), in which there is an automatic relief means of venting to atmosphere internally loaded to a normally open position, and with means for testing for tightness of the checks and opening of the relief means.

Relief Vent: See "Vent, Relief"

Return Offset: See "Offset, Return"

Revent Pipe: See "Vent, Individual"

Rim: An unobstructed open edge of a fixture.

Riser: A water supply pipe that extends vertically one full story or more to convey water to branches or to a group of fixtures.

Roof Drain: A drain installed to receive water collecting on the surface of a roof and to discharge it into a leader or a 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, and vent piping, and the necessary fixture supports, or any fixtures that are built into the structure.

Safe Waste: See "Indirect Waste Pipe"

Sand Filter: A treatment device or structure, constructed above or below the surface of the ground, for removing solid or colloidal material of a type that cannot be removed by sedimentation, from septic tank effluent.

Sand Interceptor: See "Interceptor"

Sand Trap: See "Interceptor"

Sanitary Sewer: A sewer that carries sewage and excludes storm, surface and ground water.

SDR: An abbreviation for "standard dimensional ratio" that relates to a specific ratio of the average specified outside diameter to the minimum wall thickness for outside controlled diameter plastic pipe.

Seepage Well or Pit: See "Leaching Well"

Service Sink: A sink or receptor intended for custodial use that is capable of being used to fill and empty a janitor's bucket. Included are mop basins, laundry sinks, utility sinks, and similar fixtures. (See Table 7.21.1)

Septic Tank: A watertight receptacle that receives the discharge of a building sanitary drainage system or part thereof; and that is designed and constructed so as to separate solids from the liquid, 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 or perforated piping, or a seepage pit.

Sewage: Liquid containing human waste (including fecal matter) and/or animal, vegetable, or chemical waste matter in suspension or solution.

Sewage Ejector, Pneumatic Type: A unit that uses compressed air to discharge and lift sewage to a gravity sewage system.

Sewage Pump or Pump-Type Ejector: A non-clog or grinder-type sewage pump or ejector. Sewage pumps and pump-type ejectors are either the submersible or vertical type.

Shall: "Shall" is a mandatory term.

Shock Arrestor (mechanical device): A device used to absorb the pressure surge (water hammer) that occurs when water flow is suddenly stopped.

Short Term: A period of time not more than 30 minutes.

Side Vent: See "Vent, Side"

Sink, Commercial: A sink other than for a domestic application. Commercial sinks include, but are not limited to:

1. pot sinks
2. scullery sinks
3. sinks used in photographic or other processes
4. laboratory sinks

Size of Pipe and Tubing: The nominal inside diameter in inches as indicated in the material standards in Table 3.1.3. If outside diameter is used, the size will be followed by "o.d.".

Size of Pipe and Tubing, Incremental: Where relative size requirements are mentioned, the following schedule of sizes is recognized, even if all sizes may not be available commercially: 1/4, 3/8, 1/2, 3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, 3-1/2, 4, 4-1/2, 5, 6, 7, 8, 10, 12, 15, 18, 21, 24.

Slip Joint: A connection in drainage piping consisting of a compression nut and compression washer that permits drainage tubing to be inserted into the joint and secured by tightening the compression nut. Slip joints are typically used in trap connections for lavatories, sinks, and bathtubs. They permit the trap to be removed for cleaning or replacement, and to provide access to the drainage piping.

Slope: See "Grade"

Soil Pipe or Soil Stack: Pipes that convey sewage containing fecal matter to the building drain or building sewer.

Special Wastes: Wastes that require special treatment before entry into the normal plumbing system.

Special Waste Pipe: Pipes that convey special wastes.

Stack: A general term for any vertical line including offsets of soil, waste, vent or inside conductor piping. This does not include vertical fixture and vent branches that do not extend through the roof or that pass through not more than two stories before being reconnected to the vent stack or stack vent.

Stack Group: A group of fixtures located adjacent to the stack so that by means of proper fittings, vents may be reduced to a minimum.

Stack Vent: The extension of a soil or waste stack above the highest horizontal drain connected to the stack.

Stack Venting: A method of venting a fixture or fixtures through the soil or waste stack.

Standpipe (indirect waste receptor): A vertical drain pipe that has an open top inlet that provides an air break or air gap for indirect waste discharge.

Storm Drain: See "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.

Suction Line: The inlet pipe to a pump on which a negative pressure may exist under design conditions.

Sump: A tank or pit that receives only liquid wastes, located below the elevation of a gravity discharge, that is emptied by pumping.

Sump, Drainage (sewage): A liquid and air-tight tank that receives sewage and/or liquid waste, located below the elevation of a gravity drainage system, that is emptied by pumping.

Sump Pump: A permanently installed mechanical device for removing clear water or liquid waste from a sump.

Supports: Devices for supporting and securing pipe, fixtures and equipment.

Swimming Pool: Any structure, basin, chamber or tank containing a body of water for swimming, diving, or recreational bathing.

Tempered Water: A mixture of hot and cold water to reach a desired temperature for its intended use.

Thermostatic/Pressure Balancing Valve, Combination: A mixing valve that senses outlet temperature and incoming hot and cold water pressure and compenstates for fluctuations in incoming hot and cold water temperatures and/or pressures to stabilize its outlet temperatures.

Thermostatic (Temperature Control) Valve: A mixing valve that senses outlet temperature and compensates for fluctuations in incoming hot or cold water temperatures.

Toilet Facility: A room or combination of interconnected spaces in other than a dwelling that contains one or more water closets and associated lavatories, with signage to identify its intended use.

Trap: A fitting or device that provides a liquid seal to prevent the emission of sewer gasses without materially affecting the flow of sewage or waste water through it.

Trap Arm: That portion of a fixture drain between a trap and its vent.

Trap Primer: A device or system of piping to maintain a water seal in a trap.

Trap Seal: The maximum vertical depth of liquid that a trap will retain, measured between the crown weir and the top of the dip of the trap.

Vacuum: Any pressure less than that exerted by the atmosphere.

Vacuum Assisted Water Closet: See Water Closet, Vacuum Assisted.

Vacuum Breaker: See "Backflow Preventer"

Vacuum Breaker, Atmospheric Type: A vacuum breaker that is not designed to be subject to static line pressure.

Vacuum Breaker, Pressure Type: A vacuum breaker designed to operate under conditions of static line pressure.

Vacuum Breaker, Spill-resistant (SVB): A pressure-type vacuum breaker specifically designed to avoid spillage during operation, consisting 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 a means for testing.

Vacuum Relief Valve: A device to admit atmospheric air into a vessel if a vacuum is developed in that vessel.

Vent, Branch: A vent connecting one or more individual vents with a vent stack or stack vent.

Vent, Circuit: A vent that connects to a horizontal drainage branch and vents from two to eight traps or trapped fixtures connected in a battery.

Vent, Common: A vent connected at the common connection of two fixture drains and serving as a vent for both fixtures.

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

Vent, Dry: A vent that does not receive the discharge of any sewage or waste.

Vent, Individual: A pipe installed to vent a single fixture drain.

Vent, Loop: A circuit vent that loops back to connect with a stack vent instead of a vent stack.

Vent, Relief: An auxiliary vent that permits additional circulation of air in or between a drainage and vent system.

Vent, Side: A vent connecting to a drain pipe through a fitting at an angle not greater than 45° to the vertical.

Vent, Sterilizer: A separate pipe or stack, indirectly connected to the building drainage system at the lower terminal, that receives the vapors from non-pressure sterilizers, or the exhaust vapors from pressure sterilizers, and conducts the vapors directly to the outer air. Sometimes called vapor, steam, atmosphere or exhaust vent.

Vent, Wet: A vent that receives the discharge of wastes from fixtures other than water closets or kitchen sinks.

Vent, Yoke: A pipe connecting upward from a soil or waste stack to a vent stack for the purpose of equalizing the pressures in the stacks.

Vent Pipe: Part of the vent system.

Vent Stack: A vertical vent pipe that extends through one or more stories and that is intended to provide circulation of air to and from 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.

Vertical Pipe: Any pipe or fitting that makes an angle of 45° or more with the horizontal.

Wall Hung Water Closet: A water closet installed in such a way that no part of it touches the floor.

Waste: Any remaining liquid, or liquid-borne material or residue intended to be discharged to the drainage system after any activity or process, but not including any such materials that contain animal or human fecal matter.

Waste Pipe: A pipe that conveys only waste.

Waste Stack, Pipe or Piping: Pipes that convey the discharge from fixtures (other than water closets), appliances, areas, or appurtenances, that do not contain fecal matter.

Water Closet, Pressure Assisted: A low consumption water closet with an air accumulator vessel in the tank that stores water and air under pressure, using the water supply pressure. When flushed, the air produces a high velocity jet of water and air that forces the contents out of the bowl.

Water Closet, Pump Assisted: A low consumption water closet with a fractional horsepower pump in the tank that produces a high velocity jet in the trap way that assists the flushing action.

Water Closet, Vacuum Assisted: A low consumption water closet that uses the falling water level in the tank to induce a vacuum near the outlet of the trap way that assists the flushing action.

Water Distribution Piping: Piping within the building or on the premises that conveys water from the water-service pipe to the point of use.

Water Lift: See “Sewage Ejector”

Water Main: A water supply pipe available for public connection.

Water Outlet: A discharge opening through which water is supplied to a fixture, into the atmosphere (except into an open tank that is part of the water supply system), to a boiler or heating system, to any devices or equipment requiring water to operate but that are not part of the plumbing system.

Water Riser Pipe: See "Riser"

Water Service Pipe: The pipe from the water main, or other source of potable water supply, to the water distribution system of the building served.

Water Supply System: The water service pipe, the water distribution pipes, and the necessary connecting pipes, fittings, control valves, and appurtenances in or adjacent to the building or premises.

Water Temperature Control Valve: A valve of the pressure balance, thermostatic mixing, or combination pressure balance/thermostatic mixing type that is designed to control water temperature to reduce the risk of scalding.

Wet Vent: See "Vent, Wet"

Whirlpool Bathtub: A plumbing appliance consisting of a bathtub fixture that is equipped and fitted with a circulation piping system, pump, and other appurtenances and is so designed to accept, circulate, and discharge bathtub water upon each use.

Weir (trap or crown): The overflow level of a trap outlet.

Yoke Vent: See "Vent, Yoke"

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Chapter 2

General Regulations

2.1 RESERVED

2.2 RESERVED

2.3 CHANGES IN DIRECTION OF DRAINAGE PIPING

2.3.1 Uses for Drainage Fittings

a. Changes in direction of drainage piping shall be made with long radius drainage fittings. See Table 2.3.1.
EXCEPTION: Short radius drainage fittings shall be permitted in the drain piping for individual fixtures. See Table 2.3.1.

b. Short radius drainage fittings are those having radius or centerline dimensions that are approximately equal to or less than their nominal pipe size. The radius or centerline dimensions of long radius drainage fittings are greater than their nominal pipe size.

c. Long radius drainage fittings shall not be used to connect fixture trap arms to vertical drain and vent piping. Connections to fixture vents shall be above the top weir of the fixture trap.

2.3.2 Double Pattern Fittings

The uses for double pattern drainage fittings shall be the same as for single pattern fittings in Table 2.3.1.
EXCEPTION: Double sanitary tees and crosses shall not be used to connect blowout fixtures, back-outlet water closets, and fixtures or appliances having pumped discharge.

2.3.3 Back-to-Back Fixtures

Stack fittings, including carriers, for back-outlet fixtures installed back-to-back shall be either the wye pattern, incorporate baffles within the drainage fitting, or otherwise be designed to prevent crossflow or mixing of the discharges from the two fixtures prior to the change in direction.

2.4 FITTINGS AND CONNECTIONS IN DRAINAGE SYSTEMS

2.4.1 Prohibited Fittings

No running threads or saddles shall be used in the drainage or vent system. No drainage or vent piping shall be drilled, tapped, burned or welded.

Table 2.3.1 PERMISSIBLE DRAINAGE FITTINGS FOR CHANGES IN DIRECTION

PIPE MATERIAL	CHANGE IN DIRECTION		
	HORIZONTAL TO HORIZONTAL	HORIZONTAL TO VERTICAL	VERTICAL TO HORIZONTAL
CAST IRON HUB & SPIGOT CAST IRON NO-HUB	long sweep	sanitary tee (1)	eighth bend and wye
	short sweep	eighth bend and wye (2)	combination wye & eighth bend
	wye	combination wye & eighth bend (2)	long sweep
	combination wye & eighth bend	long sweep	short sweep 3" or larger
	fifth bend (72-deg)	short sweep	quarter bend (1)
	sixth bend (60-deg)	quarter bend (1)	short sweep (1)
	eighth bend (45-deg)		
	sixteenth bend (22 ½ deg)		
	quarter bend (1)		
CAST IRON DRAINAGE (threaded)	extra long turn 90-deg elbow	drainage tee (1)	long turn 90-deg TY
	long turn 90-deg elbow	short turn 90-deg TY (1)	extra long turn 90-deg elbow
	long turn 45-deg elbow	long turn 90-deg TY (2)	long turn 90-deg elbow
	short turn 22 ½ deg elbow	45-deg elbow and 45-deg Y branch (2)	short turn 90-deg elbow (1)
	short turn 11 ¼ deg elbow	extra long turn 90-deg elbow	45-deg elbow & 45-deg Y branch (1)
	long turn 90-deg TY	long turn 90-deg elbow	
	short turn 45-deg Y branch	short turn 90-deg elbow (1)	
	short turn 90-deg elbow (1)		
	short turn 60-deg elbow (1)		
	short turn 45-deg elbow (1)		
COPPER DWV	DWV 90-deg long radius elbow	DWV tee (1)	DWV long turn T-Y
	90-deg elbow - long radius	DWV 90-deg sanitary tee (1)	45-deg elbow and DWV 45-deg Y
	DWV long turn T-Y	DWV long turn T-Y (2)	DWV 90-deg long radius elbow
	DWV 45-deg Y	45-deg elbow & DWV 45-deg Y (2)	90-deg elbow - long radius
	DWV 90-deg elbow (1)	DWV 90-deg long radius elbow	DWV 90-deg elbow (1)
	DWV 45-deg elbow (1)	90-deg elbow - long radius	
		DWV 90-deg elbow (1)	
PLASTIC DWV	90-deg long turn elbow	sanitary tee (1)	long radius TY
	long sweep 1/4 bend	fixture tee (1)	45-deg elbow and 45-deg wye
	60-deg elbow or 1/6 bend	long radius TY (2)	90-deg long turn elbow
	45-deg elbow or 1/8 bend	45-deg elbow and 45-deg wye (2)	90-deg elbow or 1/4 bend (1)
	22 ½ deg elbow or 1/16 bend	90-deg long turn elbow	
	long radius TY	90-deg elbow or 1/4 bend (1)	
	45-deg wye		
	90-deg elbow or 1/4 bend (1)		
STAINLESS STEEL push-fit DWV	long sweep	tee (1)	eighth bend & wye (2)
	wye	sanitary tee (1)	combination wye & eighth bend
	combination wye & eighth bend	eighth bend & wye (2)	long sweep
	15-degree 1/24 bend	combination wye & eighth bend	90-degree 1/4 bend (1)
	22 ½ degree 1/16 bend	long sweep	
	30-degree 1/12 bend	90-degree 1/4 bend (1)	
	45-degree 1/8 bend		
	90-degree 1/4 bend (1)		

Footnotes for Table 2.3.1

(1) Short radius fittings shall be permitted only in drain piping for individual fixtures.

(2) Long radius fittings shall not be used to connect fixture trap arms to vertical drain and vent piping.

2.4.2 Heel or Side-Inlet Bends

A heel or side-inlet quarter bend shall not be used as a dry vent when the inlet is placed in a horizontal position or any similar arrangement of pipe or fittings producing a similar effect.

EXCEPTION: When the entire fitting is part of a dry vent arrangement system the heel or side-inlet bend shall be acceptable.

2.4.3 Obstruction to Flow

a. No fitting, connection, 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 greater than the normal frictional resistance to flow, shall be used unless it is indicated as acceptable in this Code.

b. 4x3 closet bends and 4x3 closet flanges shall not be considered as obstructions to flow.

2.4.4 Prohibited Joints

Cement mortar joints are prohibited.
EXCEPTION: When used for repairs and/or when used for connections to existing lines constructed with such joints.

2.5 HEALTH AND SAFETY

Where a health or safety hazard is found to exist on a premise, the owner or his agent shall be required to make such corrections as may be necessary to abate such nuisance, and bring the plumbing installation within the provisions of this Code.

2.6 TRENCHING, BEDDING, TUNNELING AND BACKFILLING

2.6.1 Trenching and Bedding

a. Trenching and excavation for the installation of underground piping shall be performed in compliance with occupational safety and health requirements. Trenches shall be of sufficient width to permit proper installation of the pipe. Where shoring is required, additional allowance shall be made in the width of the trench to provide adequate clearance.

b. A firm, stable, uniform bedding shall be provided under the pipe for continuous support. Bell holes shall be provided for joints in bell and spigot pipe and for other joints requiring such clearance. Blocking shall not be used to support the pipe.

c. The trench bottom may provide the required bedding when adequate soil conditions exist and when excavated to the proper depth and grade. Where trenches are excavated to depths below the bottom of the pipe, bedding shall be added beneath the pipe as required. Such bedding shall be of clean sand, gravel, or similar select material that is compacted sufficiently to provide the support required under 2.6.1.b.

d. Where rock is encountered in trenching, it shall be removed to a depth of not less than 6 inches below the bottom of the pipe and bedding shall be added as required under 2.6.1.c. The pipe shall not rest on rock at any point, including joints.

2.6.2 Side-fill

The haunch areas adjacent to the pipe between the bottom of the pipe and its horizontal centerline shall be filled with a clean coarse-grain material such as sand, gravel, or soil. Such side-fill shall be placed by hand, extending to the sides of the trench, and be compacted to provide lateral support for the pipe.

2.6.3 Initial Backfill

After installation of the side-fill, the trench shall be backfilled to a level not less than 2 feet above the top of the pipe. Backfill material shall be sand, gravel, or loose soil that is free of rocks and debris. Maximum particle size shall be 1-1/2 inches. Backfill shall be placed in not more than 6-inch layers, each tamped and compacted. Heavy compacting equipment shall not be used for the initial backfill.

2.6.4 Final Backfill

The trench shall be backfilled from the top of the compacted initial backfill to finish grade using suitable material. Heavy compacting equipment may be used for the final backfill.

2.6.5 Tunneling

When pipe is installed in a dug or bored earth tunnel, the space around the pipe between the pipe and the wall of the tunnel shall be completely filled with packed concrete or grout. When pipe is installed in a jacked-in-place conduit or sleeve, the space around the pipe between the pipe and the inside of the conduit or sleeve shall be sealed in an approved manner in accordance with Section 2.12.d.

2.6.6 Underground Plastic Pipe

a. Underground plastic pipe shall be installed in accordance with the requirements of Section 2.6.
EXCEPTIONS:

(1) The maximum particle size in the side-fill and initial backfill shall be not more than 1/2-inch for pipe 6" size and smaller, and 3/4-inch for pipe 8" and larger.

(2) For water service piping, refer to ASTM D2774, *Standard Practice for Underground Installation of Thermoplastic Pressure Piping*.

(3) For gravity-flow drainage pipe, refer to ASTM D2321, *Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-flow Applications.*

b. An insulated copper tracer wire or other approved conductor shall be installed adjacent to underground non-metallic water service piping and non-metallic force mains, to facilitate finding. One end shall be brought above ground inside or outside the building wall. The tracer wire for the water service shall originate at the curb valve required in Section 10.12.1. The tracer wire for the force main shall originate at the final point of disposal. The tracer wire shall not be less than 18 AWG insulated. The insulation shall not be yellow in color.

2.6.7 Underground Copper Piping

Underground copper piping shall be installed in accordance with the requirements of Section 2.6.
EXCEPTION: The maximum particle size in the side-fill and initial backfill shall be not more than 1/2-inch for pipe 6" size and smaller, and 3/4-inch for pipe 8" and larger.

2.6.8 Safety Precautions

Rules and regulations pertaining to safety and protection of workers, other persons in the vicinity, and neighboring property shall be adhered to where trenching or similar operations are being conducted.

2.6.9 Supervision

Where excavation, bedding or backfilling are performed by persons other than the installer of the underground piping, the pipe installer shall supervise the bedding, side-fill, and initial backfill, and shall be responsible for its conformance to this Code.

2.6.10 Trenchless Pipe Replacement Systems

Trenchless replacement of water and sewer piping shall be performed using equipment and procedures recommended by the equipment manufacturer. Where underground piping beneath paved surfaces or concrete floor slabs is replaced by this method, the manufacturer's recommendations for the specific conditions shall be used. Approved mechanical couplings shall be used to make the connections between new and existing piping.

2.7 SAFETY

Any part of a building or premise that is changed, altered, or required to be replaced as a result of the installation, alteration, renovation, or replacement of a plumbing system, or any part thereof, shall be left in a safe, non-hazardous condition.

2.8 INSTALLATION PRACTICES

Plumbing systems shall be installed in a manner conforming to this Code and industry installation standards.

2.9 PROTECTION OF PIPES

2.9.1 Breakage

Pipes passing under or through foundation walls shall be protected from breakage.

2.9.2 Corrosion

Pipe subject to corrosion by passing through or under corrosive fill, such as, but not limited to, cinders, concrete, or other corrosive material, shall be protected against external corrosion by protective coating, wrapping, or other means that will resist such corrosion.

2.9.3 Cutting or Notching

Any 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 or as required by the proper Authority Having Jurisdiction.

2.9.4 Penetration

a. Plastic and copper piping run through framing members to within one inch of the edge of the framing shall be protected by steel nail plates not less than 18 gauge. Where such piping penetrates top plates or sole plates of the framing, the nail plate shall extend at least two inches below top plates and two inches above sole plates.

b. Where plastic and copper piping runs through metal framing members, it shall be protected from abrasion caused by expansion and contraction of the piping or movement of the framing.

2.10 EXCLUSION OF MATERIALS DETRIMENTAL TO THE SEWAGE SYSTEM

2.10.1 General

No material shall be deposited into a building drainage system or sewer that would or could either obstruct, damage, or overload such system; that could interfere with the normal operation of sewage treatment processes; or that could be hazardous to people or property. This provision shall not prohibit the installation of special waste systems when approved by the Authority Having Jurisdiction.

2.10.2 Industrial Wastes

Waste products from manufacturing or industrial operations shall not be introduced into the public sewer system until it has been determined by the Authority Having Jurisdiction that the introduction thereof will not cause damage to the public sewer system or interfere with the functioning of the sewage treatment plant.

2.11 PIPING MATERIALS EXPOSED WITHIN PLENUMS:

All piping materials exposed within plenums shall comply with the provisions of other applicable Codes.

2.12 SLEEVES

a. All piping passing through concrete walls, floors, slabs, and masonry walls shall be provided with sleeves for protection.

EXCEPTION: Sleeves shall not be required for pipes passing through drilled or bored holes. Such holes shall provide 1/2 inch minimum clearance around the pipe and any thermal insulation.

b. Sleeves shall be sized so there is a minimum of 1/2-inch clearance around the pipe and/or insulation.

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

d. The annular space between sleeves and pipes shall be filled or tightly caulked with coal tar, asphaltum compound, lead, or other material found equally effective and approved as such by the Authority Having Jurisdiction.

e. All penetrations of construction required to have a fire resistance rating shall be protected in accordance with the applicable building regulations.

2.13 OPENINGS FOR PIPING

a. Openings for plumbing piping shall be sealed as required to maintain the integrity of the wall, floor, ceiling, or roof that has been penetrated.

b. Collars or escutcheon plates shall be provided to cover the openings around pipes where the piping penetrates walls, floors, or ceilings in finished areas that are exposed to view.

2.14 USED MATERIAL OR EQUIPMENT

Used plumbing material or equipment that does not conform to the standards and regulations set forth in this Code shall not be installed in any plumbing system.

2.15 CONDEMNED EQUIPMENT

Any plumbing equipment condemned by the Authority Having Jurisdiction because of wear, damage, defects or sanitary hazards, shall not be used for plumbing purposes.

2.16 FREEZING OR OVERHEATING

a. The plumbing system shall be protected from freezing or overheating. The following conditions shall be met:

1. Water service piping shall be installed below recorded frost lines. Minimum earth cover shall be _____ inches.
2. Minimum earth cover for building sewers that connect to public sewage systems shall be_____ inches. Minimum earth cover for building sewers that connect to individual sewage disposal systems shall be____ inches.
3. In systems that are used seasonally, water piping shall be installed to be drained.
4. Piping shall be installed so that the contents will not be heated due to close proximity to any heat source or from direct solar radiation.
5. In areas with seasonal freezing temperatures, all waste and water supply piping in exterior walls and other areas shall be protected from freezing.

2.17 PROTECTING FOOTINGS

Trenching parallel to and below the bottom of footings or walls shall not penetrate a 45° plane extending outward from the bottom corner of the footing or wall, unless the soil type is approved by the Authority Having Jurisdiction for a different angle of repose.

2.18 CONNECTIONS TO PLUMBING SYSTEMS REQUIRED

Every plumbing fixture, drain, appliance, or appurtenance thereto that is to receive or discharge any liquid waste or sewage shall discharge to the sanitary drainage system of the building in accordance with the requirements of this Code.

2.19 CONNECTION TO WATER AND SEWER SYSTEMS

2.19.1 Availability of Public Water and Sewer

The water distribution and drainage systems of any building in which plumbing fixtures are installed shall be connected to a public water supply and sewer system respectively if the public water supply and/or public sewer is within _____ feet of any property line of the premises, or other reasonable distance as determined by the Authority Having Jurisdiction.

2.19.2 Private Systems

Where either a public water supply or sewer system, or both, are not available, a private individual water supply or individual sewage disposal system, or both, shall be provided, and the water distribution system and drainage system shall be connected thereto. Such private systems shall meet the standards for installation and use established by the Health Department or other agency having jurisdiction. (See Chapters 16 and 17.)

2.20 WASHROOM & TOILET ROOM REQUIREMENTS

2.20.1 Light and Ventilation

Light and ventilation shall be provided as required by other applicable codes.

2.20.2 Location of Piping and Fixtures

Piping, fixtures, or equipment shall not be located in such a manner as to interfere with the normal operation of windows, doors, or other exit openings.

2.21 PIPING MEASUREMENTS

Except where otherwise specified in this Code, all measurements shall be made to the center lines of the pipes.

2.22 WATER CLOSET CONNECTIONS

a.Three-inch bends may be used on water closets or similar connections provided a 4-inch by 3-inch flange is installed to receive the closet fixture horn.

b. Four-inch by three-inch closet bends shall be permitted.

2.23 DEAD ENDS

a. In the installation or removal of any part of a drainage or vent system, dead ends shall be avoided. EXCEPTION: Where necessary to extend a cleanout so as to be accessible.

b. In the installation or removal of any part of a potable water system, dead ends shall be avoided

2.24 TOILET FACILITIES FOR CONSTRUCTION WORKERS

Suitable toilet facilities shall be provided and maintained in a sanitary condition for the use by workers during construction. Non-sewer type toilet facilities for construction workers shall conform to ANSI Z4.3.

2.25 FOOD HANDLING AREAS

a. Food or drink shall not be stored, prepared or displayed beneath overhead sewer or drain pipes unless such pipes are protected against leakage or condensation reaching the food or drink as described below for new construction. In newly constructed or remodeled establishments, soil or drain pipes located over food preparation, storage, display or serving areas are undesirable. 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 a vertical stack at the nearest wall or vertical building support and the construction shall be performed as follows:

1. All openings through floors over such areas shall be provided with sleeves securely bonded to the floor construction and projecting not less than 3/4 inch above top of the finished floor with space between sleeve and pipe or duct sealed.
2. Floor and shower drains installed above such areas shall be equipped with integral seepage pans.
3. Plumbing fixtures in rooms located above such areas shall be of the wall mounted type except bathtubs. Tubs shall have waste and overflow connections made above floor and piped to the trap below the floor. Connections through floors and traps shall conform with all other provisions of this regulation. No floor openings, other than sleeve for waste pipe, will be permitted for tubs.
4. All other soil or drain pipes shall be of an approved material as listed in Table 3.1.3 and Section 11.1. All materials shall conform to established standards. Cleanouts shall be extended through the floor construction above.
5. Soil and drain pipes located above such areas shall be subjected to a standing water test of not less than 25 feet.
6. Piping subject to operation at temperatures that will form condensation on the exterior of the pipe shall be thermally insulated.
7. 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.
8. In lieu of the above, any other method may be approved by the Authority Having Jurisdiction that does not conflict with applicable health codes.
9. The installation of vacuum collection systems in buildings where food is prepared, stored or displayed shall be permitted provided that the system is under constant vacuum. The piping shall be smooth bore and long pattern fittings shall be used. Bracing shall be in accordance with the manufacturer's instructions.
10. Floor sinks in food handling areas shall be of the sanitary design with smooth, corrosion-resistant interior surfaces that can be readily cleaned.

Chapter 3

Materials

3.1 MATERIALS

3.1.1 Minimum Standards

The standards cited in this chapter shall control all materials, systems, and equipment used in the construction, installation, alteration, repair, or replacement of plumbing or drainage systems or parts thereof.

EXCEPTIONS:

(1) The Authority Having Jurisdiction shall allow the extension, addition to or relocation of existing water, soil, waste, drainage and vent pipes with materials of like grade or quality as permitted in Section 3.12.2.

(2) Materials not covered by the standards cited in this chapter may be used with the approval of the Authority Having Jurisdiction as permitted in Section 3.12.2.

3.1.2 General Requirements

a. Materials, fixtures, or equipment used in the installation, repair or alteration of any plumbing system shall conform at least to the standards listed in this chapter, except as otherwise approved by the Authority Having Jurisdiction under the authority contained in Section 3.12.

b. Materials installed in plumbing systems shall be so handled and installed as to avoid damage so that the quality of the material will not be impaired.

c. No defective or damaged materials, equipment or apparatus shall be installed or maintained. (See Sections 2.14 and 2.15)

d. All materials used shall be installed in strict accordance with the standards under which the materials are accepted and approved, including the appendices of the standards, and in strict accordance with the manufacturer’s instructions. Where the provisions of material standards or manufacturer's instructions conflict with the requirements of this Code, this Code shall prevail.

3.1.3 Standards Applicable to Plumbing Materials

A material shall be considered approved if it meets one or more of the standards cited in Table 3.1.3, and in the case of plastic pipe, also the listed standard of the NSF International. Materials not listed in Table 3.1.3 shall be used only as provided for in Section 3.12.2 or as permitted elsewhere in this Code.

Note: Abbreviations in Table 3.1.3 refer to the following organizations:

AHAM Association of Home Appliance Manufacturers
1111 19th Street, NW - Suite 402
Washington, DC 20036 USA
tel: 1-202-872-5955
fax: 1-202-872-9354

ANSI	American National Standards Institute 25 West 43rd Street - 4th Floor New York, NY 10036 USA tel: 1-212-642-4900 fax:1-212-398-0023	IAPMO	International Association of Plumbing and Mechanical Officials 5001 E. Philadelphia Street Ontario, CA 91761 USA tel: 1-909-472-4100 fax: 1-909-472-4150
ASME	ASME International Three Park Avenue New York, NY 10016-5990 USA tel: 1-800-843-2763 fax: 1-212-591-7674	ISEA	International Safety Equipment Association 1901 N. Moore Street Arlington, VA 22209-1762 USA tel: 703-525-1695 fax: 703-528-2148
ASSE	ASSE International 901 Canterbury Road - Suite A Westlake, OH 44145 USA tel: 1-440-835-3040 fax: 1-440-835-3488	MSS	Manufacturers Standardization Society 127 Park Street NE Vienna, VA 22180 USA tel: 1-703-281-6613 fax: 1-703-281-6671
ASTM	ASTM International 100 Barr Harbor Drive - PO Box C700 West Conshohocken, PA 19428-2959 USA tel: 1-610-832-9585 fax: 1-610-832-9555	NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169-7471 USA tel: 1-617-770-3000 fax: 1-617-770-0700
AWWA	American Water Works Association 6666 W. Quincy Avenue Denver, CO 80235 USA tel: 1-800-926-7337 fax: 1-303-347-0804	NSF	NSF International 789 N. Dixboro Road Ann Arbor, MI 48113-0140 USA tel: 1-800-673-6275 fax: 1-734-769-0109
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Road - Suite 419 Chattanooga, TN 37421 USA tel: 1-423-892-0137 fax: 1-423-892-0817	PDI	Plumbing & Drainage Institute 800 Turnpike Street - Suite 300 North Andover, MA 01845 USA tel: 1-800-589-8956 fax: 1-978-557-0721
CSA	Canadian Standards Association 5060 Spectrum Way Mississauga, ON L4W 5N6 CANADA tel: 1-800-463-6727 fax: 1-416-747-2473	UL	Underwriters Laboratories Inc. 333 Pfingsten Road Northbrook, IL 60062-2096 USA tel: 1-847-272-8800 fax: 1-847-272-8129
FM	FM Global 1301 Atwood Avenue - PO Box 7500 Johnston, RI 02919 USA tel: 1-401-275-3000 fax: 1-401-275-3029		

3.1.4 Identification of Materials

Materials shall be identified as provided in the standard to which they conform.

3.2 SPECIAL MATERIALS

3.2.1 Miscellaneous Materials

Sheet and tubular copper and brass for the following uses shall be not less than:

a. General use - 12 oz. per square foot
b. Flashing for vent pipes - 8 oz. per square foot
c. Fixture traps and trap arms - 17 gauge or ASME A118.2/CSA B125.2
d. Fixture tailpieces - 20 gauge or ASME A118.2/CSA B125.2
e. Tailpieces with dishwasher connections - 20 gauge or ASME A118.2/CSA B125.2
f. Continuous wastes - 20 gauge or ASME A118.2/CSA B125.2

3.2.2 Lead

See Table 3.1.3. Sheet lead shall be not less than the following:

a. Shower pans—not less than 4 pounds per square foot (psf) and be coated with an asphalt paint or equivalent.

b. Flashings of vent terminals—not less than 3 pounds per square foot (psf).

c. Lead bends and lead traps shall not be less than 1/8" wall thickness.

3.2.3 Plastic

a. Trap and tailpiece fittings— minimum 0.062" wall thickness.
b. Piping— see specific application — Sections 3.4 to 3.11.
c. Shower pans—approved plastic sheeting material.

3.3 FITTINGS, FIXTURES, APPLIANCES & APPURTENANCES

3.3.1 Drainage Fittings

See Sections 2.3 and 2.4 for fittings and connections in drainage systems.

3.3.2 Cleanout Plugs and Caps

a. Cleanout plugs shall be of brass, plastic, stainless steel, or other approved materials and shall have raised or countersunk square heads, except that where raised heads will cause a tripping hazard, countersunk heads shall be used.

b. Cleanout caps shall be of brass, plastic, reinforced neoprene, cast-iron, or other approved material and shall be readily removable.

3.3.3 Fixtures

a. Plumbing fixtures shall be constructed from approved materials having smooth, non-absorbent surfaces and be free from defects, and except as permitted elsewhere in this Code, shall conform to the standards cited in Table 3.1.3.

b. Materials for special use fixtures not otherwise covered in this Code shall be constructed of materials especially suited to the use for which the fixture is intended.

3.3.4 Floor Flanges and Mounting Bolts

a. Floor flanges for water closets or similar fixtures shall be not less than 1/8" thick for brass, 1/4" thick and not less than 1-1/2" caulking depth for cast-iron or galvanized malleable iron. Approved copper and plastic flanges may be used.

b. If of hard lead, they shall weigh not less than 1 lb. 9 oz. and be composed of lead alloy with not less than 7.75 percent antimony by weight. Flanges shall be soldered to lead bends or shall be caulked, soldered, or threaded into other metal.

c. Closet screws and bolts shall be corrosion-resisting.

d. Connections between drainage piping and floor outlet water closets shall be made by means of an approved flange that is attached to the drainage piping in accordance with the provisions of this chapter. The floor flange shall be set on and securely anchored to the finished floor.

3.3.5 Flush Pipes and Fittings

Flush pipes and fittings shall be of nonferrous material. When of brass or copper tube, the material shall be at least 0.0313" in thickness (No. 20 U.S. gauge).

3.3.6 Reserved

3.3.7 Interceptors

Interceptors shall meet the requirements of Chapter 6.

3.3.8 Pressure Tanks and Vessels

a. Hot water storage tanks shall meet construction requirements of ASME, AGA or UL as appropriate. (See Table 3.1.3)

b. Storage tanks less in volume than those requirements specified by ASME shall be of durable materials and constructed to withstand 125 p.s.i. with a safety factor of 2.

3.3.9 Roof Drains

Roof drains shall be of cast-iron, copper, lead, or other approved corrosion-resisting materials.

3.3.10 Safety Devices for Pressure Tanks

Safety devices shall meet the requirements of the American National Standards Institute, American Society of Mechanical Engineers, or the Underwriters Laboratories. Listing by Underwriters Laboratories, American Gas Association or National Board of Boiler and Pressure Vessel Inspectors shall constitute evidence of conformance with these standards. Where a device is not listed by any of these, it shall have certification by an approved laboratory as having met these requirements. (See Section 10.16.)

3.3.11 Septic Tanks

a. Plans for all septic tanks shall be submitted to the Authority Having Jurisdiction for approval. Such plans shall show all dimensions, reinforcing, structural calculations and such other pertinent data as may be required.

b. Septic tanks shall be constructed of sound durable materials, not subject to excessive corrosion or decay and shall be watertight. (See Sections 16.6.5 and 16.6.6.)

3.3.12 Carriers and Supports

Carriers and supports for plumbing fixtures shall comply with ASME A112.6.1, ASME A112.6.2 or ASME A112.19.12.

3.4 POTABLE WATER PIPING

3.4.1 Plastic Piping

Plastic piping materials used for the conveyance of potable water shall comply with NSF 14 and be marked accordingly.

3.4.2 Water Service Piping

Water service piping to the point of entrance into the building shall be of materials listed in Table 3.4. and shall be water pressure rated not less than 160 psi at 73°F. See Table 3.4.2.

3.4.3 Water Distribution Piping

Water piping for the distribution of hot or cold water within buildings shall be of materials listed in Table 3.4. and shall be water pressure rated for not less than 100 psi at 180°F. Plastic piping used for hot water distribution shall be installed in accordance with the requirements of Section 10.15.8.

NOTE: The working pressure rating for certain approved plastic piping materials varies depending on pipe size, pipe schedule and methods of joining. See Table 3.4.3.

3.4.4 Fittings

Fittings for water supply piping shall be compatible with the pipe material used.

3.4.5 Material Ratings and Installation

a. Piping used for domestic water shall be suitable for the maximum temperature, pressure, and velocity that may be encountered, including temporary increases and surges.

b. Relief valve temperature and pressure relief settings shall not exceed the approved standard rating for hot and cold water distribution piping.

c. Pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and the applicable material standards, recognizing any limitations in use.

3.4.6 Limit on Lead Content

a. Materials used in the potable water supply system, including faucets and valves, shall not contain more than 8 percent lead.

b. Drinking water system components shall comply with the lead leachate requirements as specified for covered products of NSF International 61.

3.5 SANITARY DRAINAGE PIPING

3.5.1 Aboveground Piping - Soil, Waste and Indirect Waste

Aboveground soil and waste piping within buildings shall be of materials listed in Table 3.5.

3.5.2 Underground Building Sanitary Drains

Underground building drains and other underground sanitary drain and waste piping within buildings shall be of materials listed in Table 3.5.

3.5.3 Building Sanitary Sewer

Sanitary sewer piping outside of buildings shall be of materials listed in Table 3.5. Joints shall be watertight and root proof.

3.5.4 Plastic Piping

a. Pipe and fittings classified by standard dimension ratio that are underground outside of buildings shall be SDR 35 or heavier (lower SDR number). Pipe and fittings within buildings shall be SDR 26 or heavier (lower SDR number).

b. Pipe and fittings classified by pipe stiffness that are underground outside of the buildings shall be PS-45 or heavier (higher PS number). Pipe and fittings within buildings shall be PS-100 minimum.

3.5.5 Vitrified Clay Pipe

Vitrified clay pipe shall be joined using compression joints or couplings. Vitrified clay pipe installed underground within buildings shall be extra strength and shall have 12" minimum earth cover.

3.5.6 Fittings

Fittings in drainage systems shall be compatible with the pipe used and shall have no ledges, shoulders, or reductions that can retard or obstruct flow. Threaded fittings shall be the recessed drainage type.

3.6 VENT PIPING

3.6.1 Aboveground Piping

Aboveground vent piping in buildings serving sanitary, waste, or storm drainage systems shall be of materials listed in Table 3.6.

3.6.2 Underground Piping

Vent piping installed underground shall be of materials listed in Table 3.6.

3.6.3 Plastic Piping

a. Pipe and fittings classified by standard dimension ratio that are underground outside of buildings shall be SDR 35 or heavier (lower SDR number). Pipe and fittings within buildings shall be SDR 26 or heavier (lower SDR number).

b. Pipe and fittings classified by pipe stiffness that are underground outside of buildings shall be PS-45 or heavier (higher PS number). Pipe and fittings within buildings shall be PS-100 minimum.

3.6.4 Fittings

Fittings in vent piping shall be compatible with the pipe material used. Where threaded pipe is used, fittings shall be either the drainage or pressure type, galvanized or black.

3.7 STORM DRAINAGE PIPING

3.7.1 Exterior Gutters and Leaders

Exterior gutters and rain leaders shall be of galvanized sheet metal, aluminum, plastic or other approved material.

3.7.2 Interior Conductors

Stormwater drain piping installed aboveground in buildings shall be of materials listed in Table 3.7.

3.7.3 Underground Building Storm Drains

Underground building storm drains and other underground stormwater piping within buildings shall be of materials listed in Table 3.7.

3.7.4 Building Storm Sewer

Building storm sewer piping outside of buildings shall be of materials listed in Table 3.7.

3.7.5 Plastic Piping

a. Pipe and fittings classified by standard dimension ratio that are underground outside of buildings shall be SDR 35 or heavier (lower SDR number). Pipe and fittings within buildings shall be SDR 26 or heavier (lower SDR number), except that SDR 35 fittings shall be permitted.

b. Pipe and fittings classified by pipe stiffness that are underground outside of buildings shall be PS-45 or heavier (higher PS number). Pipe and fittings within buildings shall be PS-100 minimum.

3.7.6 Vitrified Clay Pipe

Vitrified clay pipe shall be joined using compression joints or couplings. Vitrified clay pipe installed underground within buildings shall be extra strength and shall have 12" minimum earth cover.

3.7.7 Fittings

Fittings in drainage systems shall be compatible with the pipe used and shall have no ledges, shoulders, or reductions that can retard or obstruct flow. Threaded fittings shall be the recessed drainage type.

3.8 FOUNDATION DRAINS AND SUBSOIL DRAINAGE

Piping for foundation drains and other subsoil drainage shall be of materials listed in Table 3.8.

3.9 AIR CONDITIONING CONDENSATE DRAIN PIPING

Indirect waste piping from air conditioning unit drains to the point of disposal shall be of a material approved for either potable water, sanitary drainage or storm drainage.

3.10 CONDENSATE DRAINS FROM COMBUSTION PROCESSES

Piping used to convey condensate from combustion processes (such as from flues and chimneys) shall conform to the equipment manufacturer's instructions.

3.11 CHEMICAL AND SPECIAL WASTE SYSTEMS

3.11.1 Drain Piping

Separate drainage systems for chemical wastes shall be of corrosion resistant material approved by the Authority Having Jurisdiction. Materials acceptable for chemical waste drainage systems include chemically resistant glass pipe, high silicon content cast-iron pipe, vitrified clay pipe, plastic pipe, plastic lined pipe, Type 316L stainless steel DWV pipe, and lead pipe.

3.11.2 Vent Piping

Vent piping on chemical waste systems shall conform to that required for chemical waste pipe except as may be otherwise authorized by the Authority Having Jurisdiction, and shall be installed independently through the roof.

3.12 ALTERNATE MATERIALS AND METHODS

3.12.1 Existing Buildings

a. Plumbing work performed in existing buildings shall conform to the requirements of this Code, unless the Authority Having Jurisdiction finds that such conformance would result in an undue hardship.

b. The Authority Having Jurisdiction may grant a variation to the extent necessary to relieve the undue nature of the hardship.

c. A record, open to the public, shall be kept of each variation granted under this section.

3.12.2 Approval

a. The Authority Having Jurisdiction may approve the use of any material or method not expressly conforming to the requirements of this Code provided all of the following conditions are met:

1. The material or method is not expressly prohibited by this Code.
2. The material or method is determined to be of such design or quality as to appear suitable for the proposed use.
3. A record of such approval is kept and shall be available to the public.

3.12.3 Tests

When there is insufficient evidence to verify claims for alternate materials, the Authority Having Jurisdiction may require tests of compliance as proof of suitability. Such tests shall be made by an approved testing agency at the expense of the applicant.

3.12.4 Test Procedure

Tests shall be made in accordance with approved standards; but in the absence of such standards, the Authority Having Jurisdiction shall specify the test procedure.

3.12.5 Repeated Tests

The Authority Having Jurisdiction may require tests to be repeated if, at any time, there is reason to believe that an alternate material no longer conforms to the requirements on which its approval was based.

Table 3.1.3
STANDARDS FOR APPROVED PLUMBING MATERIALS AND EQUIPMENT

I. FERROUS PIPE AND FITTINGS		
1	Hub & Spigot Cast-Iron Soil Pipe and Fittings:	**ASTM A74-05.**
2	Hubless Cast-Iron Soil Pipe and Fittings:	**CISPI 301-05, ASTM A888-05.**
3	Ductile-Iron Pressure Pipe:	**ASTM A377-03, AWWA C151/A21.51-02.**
4	Ductile-Iron and Gray-Iron Fittings (3" and larger):	**AWWA C110/A21.10-03.**
5	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings:	**AWWA C104/A21.4-03.**
6	Steel Pipe, Galvanized, Welded and Seamless:	**ASTM A53/A53M-04a, ASME B36.1M-2004**
7	Cast-Iron Threaded Drainage Fittings:	**ASME B16.12-1998.**
8	Cast-Iron Threaded Fittings, Classes 125 and 250:	**ASME B16.4-1998.**
9	Malleable-Iron Threaded Fittings, Class 150 and 300:	**ASME B16.3-1998.**
10	Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads:	**ASME B16.14-1991.**
11	Stainless Steel DWV Pipe and Fittings, Types 304 and 316L (3)	**ASME A112.3.1-1993**

II. NON-FERROUS METALLIC PIPE AND FITTINGS		
1	Brass Pipe, Red, Seamless, Standard Sizes:	**ASTM B43-98(R2004).**
2	Cast Bronze Threaded Fittings, Classes 125 & 250:	**ASME B16.15-1985 (R2004**).
3	Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500, 2500, and Flanged Fittings, Classes 150 and 300:	**ASME B16.24.2001.**
4	Cast Copper Alloy Solder Joint Drainage Fittings - DWV:	**ASME B16.23-2002.**
5	Cast Copper Alloy Solder Joint Pressure Fittings:	**ASME B16.18-2001.**
6	Copper Drainage Tube (DWV):	**ASTM B306-02.**
7	Copper Pipe, Seamless, Standard Sizes:	**ASTM B42-02.e1**
8	Copper Pipe, Threadless (TP):	**ASTM B302-02.**
9	Copper Water Tube, Seamless (K, L, M):	**ASTM B88-03.**
10	Grooved & Shouldered Joints (split couplings, for copper tube):	**AWWA C606-04.**
11	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings-DWV:	**ASME B16.29-2001.**
12	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings:	**ASME B16.22-2001.**
13	Reserved	
14	Reserved	
15	Cast Copper Alloy Fittings for Flared Copper Tubes:	**ASME B16.26-1998.**
16	Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings:	**ASME B16.50.2001.**

III. NON-METALLIC PIPE AND FITTINGS

1	Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR) (1/8"- 12"):	**ASTM D2282-(2005)**
2	Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80 (1/8"- 12"):	**ASTM D1527-99e1.**
3	Reserved	
4	Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings (1-1/4"- 6"):	**ASTM D2661-02.**
5	Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core (1-1/4"- 6"):	**ASTM F628-01.**
6	Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and fittings (3"- 12"):	**ASTM D2751-05.**
7	Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Pipe (6"- 15"):	**ASTM D2680-01.**
8	Poly (Vinyl Chloride) (PVC) Pressure Pipe for Water (4"- 12"):	**AWWA C900-97**
9	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 (1/8"- 24"):	**ASTM D1785-05.**
10	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; socket-type (1/8" - 8"):	**ASTM D2466-05.**
11	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; socket-type (1/8"- 8"):	**ASTM D2467-04e1.**
12	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, Threaded (1/8"- 6"):	**ASTM D2464-99e1.**
13	Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe, (SDR Series) (1/8"- 36"):	**ASTM D2241-04b**.
14	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings (1-1/4"- 12"):	**ASTM D2665-04ae1.**
15	Poly (Vinyl Chloride) (PVC) Schedule 40 Drainage and DWV Fabricated Fittings:	**ASTM F1866-05.**
16	3.25" Outside Diameter Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings:	**ASTM D2949-01ae1.**
17	Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (2"-6"):	**ASTM D2729-03.**
18	Poly (Vinyl Chloride) (PVC) Gasketed Sewer Fittings (4"-27"):	**ASTM F1336-02.**
19	Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core; Non-Pressure Uses, IPS Schedule 40 (1-1/4"-12"):	**ASTM F891-04.**
20	Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core; Non-Pressure Uses, PS and Sewer/Drain Series (2"-18"):	**ASTM F891-04.**
21	Reserved	
22	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (4"- 15"):	**ASTM D3034-04a.**
23	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems (3/8"- 2"):	**ASTM D2846-99e1.**
24	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR) (1/4"- 12"):	**ASTM F442-99.**
25	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80 (1/4"- 12"):	**ASTM F441-02.**
26	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; Socket-type (1/4"- 8"):	**ASTM F439-02e1.**
27	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80, Threaded (1/4"- 6"):	**ASTM F437-99.**
28	Polyethylene (PE) Pressure Pipe and Tubing for Water Service (1/2"- 3"):	**AWWA C901-02.**

29	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter (1/2"- 6"):	**ASTM D3035-03a.**
30	Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter (1/2"- 6"):	**ASTM D2239-03.**
31	Reserved	
32	Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter (1/2"- 12"):	**ASTM D2447-03.**
33	Polyethylene (PE) Plastic Tubing (1/2"- 2"):	**ASTM D2737-03.**
34	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing (1/2"- 48"):	**ASTM D3261-03.**
35	Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe (1/2"- 4"):	**ASTM D2609-02.**
36	Corrugated Polyethylene (PE) Tubing and Fittings (3"- 6"):	**ASTM F405-97.**
37	Smoothwall Polyethylene (PE) Pipe for use in Drainage and Waste Disposal Absorption Fields (3"- 6"):	**ASTM F810-01.**
38	Styrene-Rubber (SR) Plastic Drain Pipe and Fittings (2"- 6"):	**ASTM D2852-95(R2002).**
39	Reserved	
40	Fiberglass Pressure Pipe (1" and larger):	**AWWA C950-01.**
41	Fiberglass (GFR) Sewer and Industrial Pressure Pipe (8" and larger):	**ASTM D3754-04.**
42	Fiberglass (GFR) Sewer Pipe (8" and larger):	**ASTM D3262-04.**
43	Fiberglass (GFR) Non-Pressure Pipe Fittings (8" and larger):	**ASTM D3840-01**.
44	Reserved	
45	Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated (3" and larger):	**ASTM C700-02.**
46	Concrete Drain Tile (4" and larger):	**ASTM C412-03.**
47	Concrete Sewer, Storm Drain, and Culvert Pipe; non-reinforced (4" and larger):	**ASTM C14-03.**
48	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (12" and larger):	**ASTM C76-05.**
49	Perforated Concrete Pipe (4" and larger):	**ASTM C444-03.**
50	Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems:	**ASTM F877-05.**
51	Crosslinked Polyethylene (PEX) Tubing:	**ASTM F876-04.**
52	Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Crosslinked Polyethylene (PEX) Tubing:	**ASTM F1807-04.**
53	Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing:	**ASTM F1960-05.**
54	Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Composite Pressure Pipe (3/8" – 1"):	**ASTM F1281-03.**
55	Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe (3/8"–1")	**ASTM F1282-03.**
56	Metal Insert Fittings for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) and Polyethylene/Aluminum/Polyethylene Composite Pressure Pipe (PE-AL-PE):	**ASTM F1974-04.**
57	Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe Systems (1/4" – 1"):	**CSA B137.9-02.**
58	Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Composite Pressure Pipe Systems (1/4" – 1"):	**CSA B137.10-02.**
59	Polyethylene (PE) Plastic Pipe (SDR-PR) Based Upon Outside Diameter:	**ASTM F714-05.** (See Tables 3.4, 3.5, & 3.7 for minimum SDR values for trenchless replacement systems.)

60	Reserved	
61	Stainless Steel Clamps for Securing SDR 9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert Fittings:	**ASTM F 2098-04.**
62	Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Tubing OD Controled SDR-9 (1/2" - 1"):	**ASTM F2262-04.**
63	Pressure-rated Composite Pipe and Fittings for Elevated Temperature Service, Classes 1 and 2 (16mm – 50mm)	**ASTM F1335-04.**
	IV. PIPE JOINTS, JOINING MATERIALS, COUPLINGS, GASKETS	
1	Pipe Threads, Tapered, General Purpose:	**ASME B1.20.1-1983 (R2001**).
2	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube:	**ASTM B813-00(e1).**
3	Solder Metal:	**ASTM B32-04.**
4	Brazing Filler Metal:	**AWS A5.8/A5.8M-2004.**
5	Pig Lead:	**ASTM B29-03**.
6	Grooved and Shouldered Joints (Split Couplings):	**AWWA C606-04.**
7	Flexible Transition Couplings for Underground Piping Systems:	**ASTM C1173-02.**
8	Rubber Sheet Gaskets:	**ASTM D1330-04.**
9	Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings:	**ASTM C1173-02; AWWA C111/ A21.11-00.**
10	Rubber Gaskets for Cast-Iron Soil Pipe and Fittings:	**ASTM C564-03a.**
11	Couplings for Hubless Cast-Iron Soil Pipe and Fittings:	**FM 1680-89, CISPI 310-04, ASTM C1277-04; ASTM C1540-04.**
12	Compression Joints for Vitrified Clay Pipe and Fittings:	**ASTM C425-04.**
13	Rubber Gasket Joints in Circular Concrete Sewer and Culvert Pipe:	**ASTM C443-03.**
14	Elastomeric Seals (gaskets) for Push-On Joints in Plastic Pipe:	**ASTM F477-02e1.**
15	Flexible Elastomeric Seals for Plastic Pressure Pipe:	**ASTM D3139-98 (R2005).**
16	Flexible Elastomeric Seals for Plastic Drain and Sewer Pipe:	**ASTM D3212-96a (R2003)e1.**
17	Socket-end IPS PVC Pipe Joints:	**ASTM D2672-96a (R2003).**
18	Primers for Solvent Cement Joints in PVC Plastic Pipe and Fittings:	**ASTM F656-02.**
19	Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings:	**ASTM D2235-04.**
20	Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems:	**ASTM D2564-04.**
21	Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Non-Pressure Piping Components:	**ASTM D3138-04.**
22	Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings:	**ASTM F493-04.**
23	Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings:	**ASTM D3122-95(R2002).**
24	Mechanical Couplings for Drain, Waste and Vent Pipe and Sewer Pipe:	**CSA B602-99 (R2002).**
25	Fittings for Connecting Water Closets to the Sanitary Drainage System:	**ASME A112.4.3-1999 (R2004).**
26	Standard Specification for Mechanical Couplings Using Thermoplastic Elastomeric (TPE) Gaskets for Joining Drain, Waste and Vent (DWV), Sewer, Sanitary and Storm Plumbing Systems for Above and Below Ground Use:	**ASTM C1461-02.**
27	Non-Reinforced Extruded Tee Connections for Piping Applications:	**ASTM F2014-00.**
28	Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Pipe and Fittings	**ATSM C1540-04.**

V. PLUMBING FIXTURES		
1	Bathtubs, Plastic:	**IAPMO Z124.1.2-2005; CSA B45.5 of CSA B45 Series-02 with B45S1-04 Supplement**
2	Ceramic Plumbing Fixtures, Non-Vitreous:	**ASME A112.19.9M-1991 (R2002); CSA B45.1 of CSA B45 Series-02 with B45S1-04 Supplement.**
3	Drains for Prefabricated and Precast Showers:	**ASME A112.18.2-2005/CSA B125.2-05**
4	Drinking Fountains and Water Coolers, Self Contained, Mechanically Refrigerated:	**ARI 1010-2002, UL 399 Edition 6-1993.**
5	Enameled Cast-Iron Plumbing Fixtures:	**ASME A112.19.1M -1994 (R2004); CSA B45.2 of CSA B45 Series-02 with B45S1-04 Supplement**
6	Enameled Steel Plumbing Fixtures:	**ASME A112.19.4M-1994(R2004); CSA B45.3 of CSA B45 Series-02 with B45S1-04 Supplement**
7	Floor and Trench Drains:	**ASME A112.6.3-2001.**
8	Lavatories, Plastic:	**ANSI Z124.3-1995; CSA B45.5 of CSA B45 Series-02 with B45S1-04 Supplement**
9	Roof, Deck, and Balcony Drains:	**ANSI A112.6.4-2003.**
10	Shower Receptors and Shower Stalls, Plastic:	**IAPMO Z124.1.2-2005; CSA B45.5 of CSA B45 Series-02 with B45S1-04 Supplement**
11	Stainless Steel Plumbing Fixtures (residential design):	**ASME A112.19.3M -1994 (R2004); CSA B45.4 of CSA B45 Series-02 with B45S1-04 Supplement**
12	Vitreous China Plumbing Fixtures:	**ASME A112.19.2-2003, CSA B45.1 of CSA B45 Series-02 with B45S1-04 Supplement**
13	Water Closet Bowls and Tanks, Plastic:	**ANSI Z124.4-1996; ASME A112.19.2-2003; CSA B45.5 of CSA B45 Series-02 with B45S1-04 Supplement**
14	Whirlpool Bathtub Appliances:	**ASME A112.19.7M-1995.**
15	Reserved	
16	Urinals, Plastic:	**ANSI Z124.9-1994; CSA B45.5 of CSA B45 Series-02 with B45S1-04 Supplement**
17	Fabricated Stainless Steel Security Water Closets:	**IAPMO PS-61-92; CSA B45.4 of CSA B45 Series-02 with B45S1-04 Supplement**
18	Hydraulic Performance of Water Closets and Urinals:	**ASME A112.19.2-2003.**
19	Wall Mounted and Pedestal Mounted Adjustable and Pivoting Lavatory and Sink Carrier Systems:	**ASME A112.19.12-2000 (R2004)**

20	Plastic Sinks:	**ANSI Z124.6-1997; CSA B45.5 of CSA B45 Series-02 with B45S1-04 Supplement**
21	Prefabricated Spa Shells:	**ANSI Z124.7-97.**
22	Plastic Bathtub Liners:	**ANSI Z124.8-90.**
23	Bathtubs and Whirlpool Bathtubs with Pressure Sealed Doors:	**ASME A112.19.15-2001.**
24	Emergency Showers and Eyewash Stations:	**ISEA Z358.1-2004.**
25	Six Liter Water Closets Equipped with a Dual Flushing Device:	**ASME A112.19.14-2001 with Supplement 1-2003**
26	Electro-hydraulic Water Closets:	**ASME A112.19.13-2002**
27	Enameled and Epoxy Coated Cast Iron and PVC Plastic Sanitary Floor Sinks:	**ASME A112.6.7-2001**

VI. PLUMBING FIXTURE TRIM

1	Anti-siphon Fill Valves (Ballcocks) for Gravity Water Closet Flush Tanks:	**ASSE 1002-1999, CSA B125.3-05**
2	Individual Thermostatic, Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings	**ASSE 1016-2005, ASME A112.18.1-2005/CSA B125.1-05**
3	Divertors for Plumbing Faucets with Hose Spray, Anti-Siphon Type, Residential Application:	**ASSE 1025-1978; CSA B125-01.**
4	Plumbing Fixture Fittings:	**ASME A112.18.1-2005/CSA B125.1-05**
5	Flushometers (Pressurized Flushing Devices):	**ASSE 1037-1990, CSA B125.3-05**
6	Laboratory Faucet Vacuum Breakers:	**ASSE 1035-2002.**
7	Showers, Hand Held:	**ASME A112.18.1-2005/ CSA B125.1-05**
8	Supports for Off-The-Floor Plumbing Fixtures:	**ASME A112.6.1M-1997 (R2002).**
9	Trim for Water Closet Bowls, Tanks, and Urinals (dimensional standards):	**ASME A112.19.5-1999, CSA B125.3-05**
10	Flexible Water Connectors:	**ASME A112.18.6-2003.**
11	Water Closet Seats, Plastic:	**ANSI Z124.5-1997.**
12	Whirlpool Suction Fittings:	**ASME A112.19.8-1987 (R1996).**
13	Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings:	**ASME A112.18.1-2005/CSA B125.1-05**
14	Temperature Actuated Flow Reduction (TAFR) Valves for Individual Fixture Fittings:	**ASSE 1062-1997.**
15	Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings:	**ASSE 1066-1997.**
16	Deck Mounted Bath/Shower Transfer Valves with Integral Backflow Protection:	**ASME A112.18.7-1999 (R2004)**
17	Plumbing Fixture Waste Fittings:	**ASME A112.18.2-2005/CSA B125.2-05**
18	Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings; for Waste Connections (1-1/4", 1-1/2"):	**ASTM F409-02.**
19	Dual Flush Devices for Water Closets:	**ASME A112.19.10 - 2003**
20	Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System:	**ASME A112.4.3-1999 (R2004)**

21	Wall Mounted and Pedestal Mounted, Adjustable and Pivoting Lavatory and Sink Carrier Systems:	**ASME A112.3.4 - 2000 (R2004)**
22	Water Closet Personal Hygiene Devices:	**ASME A112.4.2 - 2003**
23	Safety Vacuum Release Systems (SVRS) for Spa and Hot Tub Suction Systems:	**ASME A112.4.2 – 2002**
	VII. PLUMBING APPLIANCES	
1	Clothes Washers:	**AHAM HLW-1-2002, ASSE 1007-1986**
2	Dishwashing Machines, Commercial:	**UL 921 Edition 5-1996, ASSE 1004-1990**
3	Dishwashers, Household:	**UL 749 Edition 7-1997, AHAM DW-1-2004, ASSE 1006-1986**
4	Food Waste Grinder Units, Commercial:	**ASSE 1009-1990.**
5	Food Waste Disposal Units, Household:	**AHAM FWD -1-2005, ASSE 1008-1986, UL 430 Edition 6-2004**
6	Hot Water Dispensers:	**ASSE 1023-1979.**
7	Water heater, Gas, Volume I, Storage Type, 75,000 BTUH Input or less	**ANSI Z21.10.1-2004/CSA 4.1-04**
8	Water Heaters, Gas, Volume III, Storage Type with Input above 75,000 BTUH Circulating and Instantaneous, Electric Storage Tank Type	**ANSI Z21.10.3-2004/CSA 4.3-04**
9	Water Heaters, Household Electric Storage Tank Type:	**UL 174 Edition 11-2004**
10	Water Heaters, Instantaneous. Electric, Point-of-use:	**UL 499 Edition 12-1997.**
11	Water Heaters, Oil-Fired Storage Type:	**UL 732 Edition 5-1995.**
12	Water Heater Relief Valve Drain Tubes:	**ASME A112.4.1-1993 (R2002).**
13	Water Softeners (CationExchange):	**NSF 44-2004**
14	Reverse Osmosis Drinking Water Treatment Systems:	**NSF 58-2004**
15	Macerating Toilet Systems and Related Components:	**ASME A112.3.4 -2000 (R2004), CSA B45.9 of CSA B45 Series-02 with B45S1-04 Supplement**
	VIII. VALVES AND APPURTENANCES	
1	Backwater Valves:	**ASME A112.14.1-2003, CSA B181.1-02 of CSA B1800 series (ABS), CSA B181.2-02 of CSA B1800 series (PVC)**
2	Anti-siphon Fill Valves (Ballcocks) for Gravity Water Closet Flush Tanks:	**ASME 1002-1999; CSA B125-01**
3	Bronze Gate, Globe, Angle and Check Valves:	**MSS SP-80-2003.**
4	Check Valves, Swing, Cast-Iron:	**MSS SP-71-1997.**
5	Cleanouts:	**ASME A112.36.2M-1991(R2002).**
6	Drain Valves, Water Heater:	**ASSE 1005-1999.**
7	Flushometers (Pressurized Flushing Devices):	**ASSE 1037-1990; CSA B125-01.**
8	Gate Valves, Cast-Iron, 125# and 250#:	**MSS SP-70-1998.**
9	Gate Valves, Iron Body (3" and larger):	**AWWA C500-02.**
10	Water Pressure Reducing Valves:	**ASSE 1003-2001.**

11	Relief Valves and Automatic Gas Shut-off Devices for Hot Water Supply	**ANSI Z21.22-1999/CSA 4.4-M99, ANSI Z21.22A-2000/CSA 4.4A-2000, ANSI Z21.22B-2001/CSA 4.4B-2001.**
12	Temperature Actuated Mixing Valves for Hot Water Distributions Systems:	**ASSE 1017-2003; CSA B125.3-05**
13	Trap Seal Primer Valves, Potable Water Supplied:	**ASSE 1018-2002.**
14	Water Hammer Arrestors:	**ASSE 1010-2004, PDI WH 201-1992.**
15	Pre-Pressurized Potable Water Tanks (for thermal expansion):	**IAPMO PS 88-2002.**
16	Reserved	
17	Ball Valves, Threaded, Socket-Welding, Solder Joints, Grooved, And Flared Ends:	**MSS SP-110 (1996).**
18	Water Temperature Limiting Devices	**ASSE 1070-2004.**
19	Wall Hydrants, Vacuum Breaker Type, Freeze Resistant, Automatic Draining:	**ASSE 1019-2004.**
20	Trap Seal Primer Devices - Drainage and Electronic Types:	**ASSE 1044-2002.**
21	Wall Hydrants, Dual Check Backflow Type, Freeze Resistant:	**ASSE 1053-2004.**
22	Pressure Balancing In-Line Mixing Valves for Individual Fixture Fittings:	**ASSE 1066-1997.**
23	Automatic Temperature Control Mixing Valves:	**ASSE 1069-2005.**

IX. BACKFLOW PREVENTION DEVICES

1	Air Gap Drain for Domestic Dishwashers:	**ASSE 1021-2001.**
2	Backflow Preventers with Intermediate Atmospheric Vent:	**ASSE 1012-2002.**
3	Detector Assembly, Double Check Type:	**ASSE 1048-2005.**
4	Detector Assembly, Reduced Pressure Type:	**ASSE 1047-2005.**
5	Double Check Valve Assembly:	**ASSE 1015-2005.**
6	Dual Check Valve Type Backflow Preventer:	**ASSE 1024-2004.**
7	Dual Check Valve for Carbonated Beverage Dispensers:	**ASSE 1032-2004.**
8	Reduced Pressure Principle Backflow Preventer:	**ASSE 1013-2005.**
9	Vacuum Breaker, Atmospheric (Pipe-Applied):	**ASSE 1001-2002.**
10	Vacuum Breaker, Hose Connection:	**ASSE 1011-2004.**
11	Vacuum Breaker, Laboratory Faucet:	**ASSE 1035-2002.**
12	Vacuum Breaker, Pressure:	**ASSE 1020-2004.**
13	Reserved	
14	Hose Connection Backflow Preventers:	**ASSE 1052-2004.**
15	Vacuum Breakers, Spill-Resistant:	**ASSE 1056-2002.**
16	Air Gaps in Plumbing Systems:	**ASME A112.1.2-2004.**
17	Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings:	**ASME A112.18.3-2002; CSA B125-01.**
18	Air Gap Fittings for Use with Plumbing Fixtures, Appliances and Appurtenances:	**ASME A112.1.3-2000.**
19	Outdoor Enclosures for Backflow Prevention Assemblies:	**ASSE 1060-1996.**
20	Backflow Prevention Devices for Hand-Held Showers:	**ASSE 1014-2005**
21	Backflow Preventers for (Carbonated) Beverage Dispensing Equipment:	**ASSE 1022-2003**

X.	MISCELLANEOUS	
1	Copper Flashing (sheet):	**ASTM B370-03.**
2	Lead Flashing (sheet):	**ASTM B749-03.**
3	Pipe Hangers and Supports (materials, design, manufacture):	**MSS SP-58-2002.**
4	Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Contaminant Membrane:	**ASTM D4551-96 (R2001).**
5	Shower Pan Liner (PVC Plastic Sheeting):	**ASTM D4551-96 (R2001).**
6	Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane:	**ASTM D4068-01.**
7	Shower Pan Liner (Plastic Sheeting):	**ASTM D4068-01.**
8	Grease Interceptors:	**ASME A112.14.3-2000.**
9	Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use:	**ASME A112.6.1M-1997 (R2002).**
10	Framing Affixed Supports for Off-the-Floor Plumbing Fixtures:	**ASME A112.6.2-2001 (R2004).**
11	Plastics Piping System Components and Related Materials:	**NSF 14-2004 with Addendum 1.0**
12	Drinking Water System Components-Health Effects:	**NSF 61-2004 with Addendum 1.0**
13	Grease Recovery Devices (GRD):	**ASME A112.14.4-2001.**
14	Non Sewered Waste Disposal Systems Minimum Requirements	**ANSI Z4.3 -1987 (R1995).**
15	Chemical Dispensing Systems	**ASSE 1055-1997.**

XI.	RECOMMENDED PRACTICES AND STANDARDS FOR QUALIFICATIONS, INSTALLATION, AND TESTING	
1	Installation of Ductile-Iron Water Mains and Appurtenances:	**AWWA C600-99.**
2	Installing Vitrified Clay Pipe Lines:	**ASTM C12-04e1.**
3	Safe Handling of Solvent Cements, Primers and Cleaners Used for Joining Thermoplastic Pipe and Fittings:	**ASTM F402-05.**
4	Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fitting:	**ASTM D2855-96 (R2002).**
5	Underground Installation of Thermoplastic Pressure Pipe (up to 6"):	**ASTM D2774-04.**
6	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications:	**ASTM D2321-04e1.**
7	Recommended Practice for Installation of Thermoplastic Pipe and Corrugated Tubing in Septic Tank Leach Fields:	**ASTM F481-97 (R2002).**
8	Plastic Fitting Patterns; Drain, Waste, and Vent (DWV):	**ASTM D3311-02e1.**
9	Selection and Application of Pipe Hangers and Supports:	**MSS SP-69-2003.**
10	Fabrication and Installation Standards for Pipe Hangers and Supports:	**MSS SP-89-2003.**
11	Field Test Procedures for Backflow Prevention Devices:	**ASSE 5010-2004.**
12	Professional Qualification Standard for Backflow Prevention Assembly Testers, Repairers, and Surveyors:	**ASSE Series 5000-2004**
13	Practice for Heat-Joining Polyolefin Pipe and Fittings:	**ASTM D2657-03.**
14	Practice for Electrofusion Joining Polylefin Pipe and Fittings:	**ASTM F1290-98 (R2004).**
15	Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings:	**ASTM B828-02.**

16	Standard for Health Care Facilities:	**NFPA 99-2005.**
17	Gas and Vacuum Systems:	**NFPA 99C-2005.**
18	Professional Qualification Standards for Medical Gas Systems Installers, Inspectors, Verifiers, Maintenance Personnel, and Instructors:	**ASSE Series 6000-2004.**
19	Installation Procedures for Stainless Steel Drainage Systems:	**ASME A112.3.1-1993**

NOTES FOR TABLE 3.1.3

(1) See application sections of Chapter 3 for limitations on specific piping materials.
(2) Pipe sizes contained in parentheses ( ) are provided for general information on the scope of the referenced standard and are not intended to limit use.
(3) Alloy shall be marked on pipe and fittings.

Table 3.4 – MATERIALS FOR POTABLE WATER (1) (2) (3) (6) (7)		WATER SERVICE PIPING	COLD WATER DISTRIBUTION	HOT WATER DISTRIBUTION
1	ABS Plastic Pipe, SDR (ASTM D2282)	A	X	X
2	ABS Plastic Pipe, Schedule 40 or 80 (ASTM D1527)	A	X	X
3	Brass Pipe (ASTM B43)	A	A	A
4	Copper Pipe (ASTM B42)	A	A	A
5	Copper Water Tube, Type K or L (ASTM B88)	A	A	A
6	Copper Water Tube, Type M (ASTM B88)	A	A	A
7	CPVC Plastic Pipe, Schedule 40, 80 (ASTM F441)	A	A	A
8	CPVC Plastic Pipe, SDR (ASTM F442)	A	A	A
9	CPVC Plastic Water Distribution Systems (ASTM D2846)	A	A	A
10	Ductile Iron Pipe, Cement-lined (ASTM A377, ANSI/AWWA C151/A21.51)	A	X	X
11	Fiberglass Pressure Pipe (AWWA C950)	A	X	X
12	Galvanized Steel Pipe (ASTM A53)	A	A	A
13	High-Density Polyethylene (HDPE) Plastic Pipe, SDR-11 (ASTM F714)	A	X	X
14	Reserved			
15	PE Plastic Pipe, Schedule 40, 80 (ASTM D2447, rated 160 psi minimum at 73 deg F)	A	X	X
16	PE Plastic Pipe, SDR (ASTM D3035)	A	X	X
17	PE Plastic Pipe, SIDR (ASTM D2239, rated 160 psi minimum at 73 deg F)	A	X	X
18	PE Plastic Tube (ASTM D2737)	A	X	X
19	PE Plastic Pressure Pipe and Tubing (AWWA C901, rated 160 psi minimum at 73 deg F)	A	X	X
20	PE-AL-PE Composite Pressure Pipe (ASTM F1282, CSA B137.9 pipe with ASTM F1974 metal insert fittings)	A	A	A
21	PEX-AL-PEX Composite Pressure Pipe (ASTM F1281, CSA B137.10 pipe with ASTM F1974 metal insert fittings)	A	A	A
22	Pressure-Rated Composite Pipe and Fittings for Elevated Temperature Service: (ASTM F1335)	X	A	A
23	Crosslinked Polyethylene (PEX) Tubing (ASTM F876)	A	A	A
24	ASTM F877 PEX Plastic Water Distribution Systems (ASTM F876 tubing with ASTM F1960 cold expansion fittings or ASTM F1807 metal insert fittings with ASTM F2098 clamps)	A	A	A
25	Crosslinked Polyethylene/Aluminum/Polyethylene (PEX-AL-PEX) Tubing, OD Controlled, SDR 9 (ASTM F2262)	A	A	A
26	PVC Plastic Pressure Pipe, (AWWA C900)	A	X	X
27	PVC Plastic Pipe, Schedule 40,80,120 (ASTM D1785)	A	X	X
28	PVC Plastic Pipe, SDR (ASTM D2241)	A	X	X
	Approved	A	A	A
	Not Approved	X	X	X

NOTES FOR TABLE 3.4

(1) Piping for potable water shall be water pressure rated for not less than 160 psi at 73°F.
(2) Piping for hot and cold water distribution shall be water pressure rated for not less than 100 psi at 180ºF and 160 psi at 73ºF.
(3) Plastic piping materials shall comply with NSF 14.
(4) Minimum SDR-11 for trenchless water service replacement systems.
(5) Permitted for trenchless replacement replacement of underground portions of piping within buildings.
(6) See Table 3.4.2 for plastic water service piping.
(7) See Table 3.4.3 for plastic hot and cold water distribution piping.

Table 3.4.2
PLASTIC WATER SERVICE PIPE (2)
(water pressure rated not less than 160 psi at 73 deg F)

MATERIAL	COMPOSITION	DIMENSIONS	JOINTS	PIPE SIZE
ABS (ASTM D1527)	ABS 1208	Schedule 40	not threaded	up thru 1"
		Schedule 80	threaded	none
		Schedule 80	not threaded	up thru 2"
	ABS 1210	Schedule 40	not threaded	up thru 1-1/2"
		Schedule 80	threaded	up thru 1"
		Schedule 80	not threaded	up thru 4"
	ABS 1316	Schedule 40	not threaded	up thru 5"
		Schedule 80	threaded	up thru 2-1/2"
		Schedule 80	not threaded	up thru 12"
	ABS 2112	Schedule 40	not threaded	up thru 3"
		Schedule 80	threaded	up thru 1-1/4"
		Schedule 80	not threaded	up thru 6"
ABS (ASTM D2282)	ABS 1316	SDR 21 and lower (1)	not threaded	all sizes
	ABS 2112	SDR 17 and lower (1)	not threaded	all sizes
	ABS 1210	SDR 13.5	not threaded	all sizes
	ABS 1208	none	none	none
PVC (ASTM D1785)	PVC 1120	Schedule 40	not threaded	up thru 8"
		Schedule 80	threaded	up thru 4"
		Schedule 80	not threaded	up thru 24"
		Schedule 120	threaded	up thru 12"
		Schedule 120	not threaded	up thru 12"
	PVC 1220	Schedule 40	not threaded	up thru 8"
		Schedule 80	threaded	up thru 4"
		Schedule 80	not threaded	up thru 24"
		Schedule 120	threaded	up thru 12"
		Schedule 120	not threaded	up thru 12"
	PVC 2120	Schedule 40	not threaded	up thru 8"
		Schedule 80	threaded	up thru 4"
		Schedule 80	not threaded	up thru 24"
		Schedule 120	threaded	up thru 12"
		Schedule 120	not threaded	up thru 12"
	PVC 2116	Schedule 40	not threaded	up thru 5"
		Schedule 80	threaded	up thru 2"
		Schedule 80	not threaded	up thru 24"
		Schedule 120	threaded	up thru 5"
		Schedule 120	not threaded	up thru 12"
	PVC 2112	Schedule 40	not threaded	up thru 3"
		Schedule 80	threaded	up thru 1-1/4"
		Schedule 80	not threaded	up thru 6"
		Schedule 120	threaded	up thru 1-1/2"
		Schedule 120	not threaded	up thru 12"

Table 3.4.2 (Continued)

	PVC 2110	Schedule 40	not threaded	up thru 1-1/2"
		Schedule 80	threaded	up thru 1"
		Schedule 80	not threaded	up thru 4"
		Schedule 120	threaded	up thru 1"
		Schedule 120	not threaded	up thru 12"
PVC (ASTM D2241)	PVC 1120	SDR 26 or lower (1)	not threaded	all sizes
	PVC 1220	SDR 26 or lower (1)	not threaded	all sizes
	PVC 2120	SDR 26 or lower (1)	not threaded	all sizes
	PVC 2116	SDR 21 or lower (1)	not threaded	all sizes
	PVC 2112	SDR 17 or lower (1)	not threaded	all sizes
	PVC 2110	SDR 13.5 or lower (1)	not threaded	all sizes
PVC (AWWA C900)	12454-A, -B	DR 14	not threaded	up thru 12"
CPVC (ASTM D2846)	CPVC 4120	SDR 11	not threaded	all sizes
CPVC (ASTM F441)	CPVC 4120	Schedule 40	not threaded	up thru 12"
	CPVC 4120	Schedule 80	threaded	up thru 4"
	CPVC 4120	Schedule 80	not threaded	up thru 16"
CPVC (ASTM F442)	CPVC 4120	SDR 26 or lower (1)	not threaded	up thru 12"
PE (ASTM D2239)	PE 3408	SIDR 9 or lower (1)	not threaded	all sizes
	PE 3306	SIDR 7 or lower (1)	not threaded	all sizes
	PE 3406	SIDR 7 or lower (1)	not threaded	all sizes
	PE 2306	SIDR 7 or lower (1)	not threaded	all sizes
	PE 2406	SIDR 7 or lower (1)	not threaded	all sizes
	PE 2305	SIDR 5.3	not threaded	all sizes
	PE 1404	none	none	none
PE (ASTM D2447)	PE 2306	Schedule 40	not threaded	1/2"
		Schedule 80	not threaded	up thru 1-1/4"
	PE 2406	Schedule 40	not threaded	1/2"
		Schedule 80	not threaded	up thru 1-1/4"
	PE 3306	Schedule 40	not threaded	1/2"
		Schedule 80	not threaded	up thru 1-1/4"
	PE 3406	Schedule 40	not threaded	1/2"
		Schedule 80	not threaded	up thru 1-1/4"
	PE 2305	Schedule 40	not threaded	none
		Schedule 80	not threaded	up thru 3/4"
	PE 1404	Schedule 40	not threaded	none
		Schedule 80	not threaded	1/2"
PE (ASTM D2737)	PE 2305	SDR 7.3	not threaded	all sizes
	PE 2306	SDR 9	not threaded	all sizes
	PE 2406	SDR 9	not threaded	all sizes
	PE 3306	SDR 9	not threaded	all sizes
	PE 3406	SDR 9	not threaded	all sizes
	PE 3408	SDR 11	not threaded	all sizes

Table 3.4.2 (Continued)

PE (ASTM D3035)	PE 3408	SDR 11 or lower (1)	not threaded	all sizes
	PE 2406	SDR 7	not threaded	all sizes
	PR 1404	none	none	none
PE (ASTM F714)	PE	SDR 11	not threaded	all sizes
PE (AWWA C901)	PE 2406	IDR 7	not threaded	up thru 3" (pressure class 160)
	PE 3406	IDR 7	not threaded	up thru 3" (pressure class 160)
	PE 3408	IDR 9	not threaded	up thru 3" (pressure class 160)
	PE 2406	DR 9	not threaded	up thru 3" (pressure class 160)
	PE 3406	DR 9	not threaded	up thru 3" (pressure class 160)
	PE 3408	DR 11	not threaded	up thru 3" (pressure class 160)
PE-AL-PE (ASTM F1282)	PE-AL-PE	ASTM F1282	not threaded	all sizes
PEX (ASTM F876)	PEX 1006	SDR 9	not threaded	all sizes
PEX (ASTM F877)	PEX	SDR 9	not threaded	all sizes
PEX-AL-PEX (ASTM F1281)	PEX-AL-PEX	ASTM F1281	not threaded	all sizes
PEX-AL-PEX (ASTM F2262)	PEX-AL-PEX	SDR 9	not threaded	all sizes
Composite (ASTM F1335)	PE-AL-PE	ASTM F1335	compression	all sizes
Composite (ASTM F1335)	PEX-AL-PE	ASTM F1335	compression	all sizes

NOTES

(1) Lower SDR numbers have heavier wall thicknesses and higher pressure ratings.

(2) Refer also to the manufacturer's recommendations, instructions and limitations.

Table 3.4.3
PLASTIC HOT AND COLD WATER DISTRIBUTION PIPING (1)

(water pressure rated for not less than 100 psi at 180 deg F and 160 psi at 73 deg F)

MATERIAL	COMPOSITION	DIMENSIONS	JOINTS	PIPE SIZES
CPVC (ASTM D2846)	CPVC 4120	SDR 11	not threaded	all sizes
CPVC (ASTM F441)	CPVC 4120	Schedule 40	not threaded	up thru 2"
		Schedule 80	threaded	up thru 2
		Schedule 80	not threaded	up thru 2"
CPVC (ASTM F442)	CPVC 4120	SDR 11 &13.5	not threaded	all sizes
PEX (ASTM F876)	PEX 1006	SDR 9	not threaded	all sizes
PEX (ASTM F877)	PEX	SDR 9	not threaded	all sizes
PE-AL-PE (ASTM F1282)	PE-AL-PE	ASTM F1282	not threaded	all size
PEX-AL-PEX (ASTM F2262)	PEX-AL-PEX	SDR 9	not threaded	all sizes
PEX-AL-PEX (ASTM F1281)	PEX-AL-PEX	ASTM F1281	not threaded	all sizes
Composite Pipe (ASTM F1335)	PE-AL-PE	ASTM D1335	compression	all sizes
Composite Pipe (ASTM F1335)	PEX-AL-PE	ASTM D1335	compression	all sizes

NOTES

(1) Refer also to the manufacturer's recommendations, instructions and limitations.

Table 3.5 – MATERIALS FOR SANITARY WASTE & DRAIN (1) (2) (3)

		SEWERS OUTSIDE OF BUILDINGS	UNDERGROUND WITHIN BUILDINGS	ABOVEGROUND WITHIN BUILDINGS
1	ABS Pipe and Fittings, Schedule 40 DWV (ASTM D2661)	A	A	A
2	ABS Pipe - Cellular Core (ASTM F628) and DWV Fittings	A	A	A
3	ABS Sewer Pipe and Fittings (for sewers outside of buildings) (ASTM D2751) (1)	A	X	X
4	ABS and PVC Composite Sewer Pipe (ASTM D2680)	A	X	X
5	Brass Pipe (ASTM B43)	X	X	A
6	Cast-Iron Soil Pipe and Fittings - Bell and Spigot (ASTM A74)	A	A	A
7	Cast-Iron Soil Pipe and Fittings - Hubless (CISPI 301, ASTM A888)	A	A	A
8	Cellular Core PVC Sewer and Drain Pipe (ASTM F891)	A	X	X
9	Cellular Core PVC Sewer and Drain Pipe (ASTM F891) (4)	X	A	X
10	Cellular Core PVC DWV Pipe, IPS Schedule 40 (ASTM F891)	A	A	A
11	Concrete Drain Pipe. Nonreinforced (ASTM C14)	A	X	X
12	Concrete Drain Pipe, Reinforced (ASTM C76)	X	X	A
13	Copper Pipe (ASTM B42)	A	A	A
14	Copper Tube - DWV (ASTM B306) and Copper Drainage Fittings (ASME B16.23)	A	A	A
15	Copper Water Tube - K,L,M (ASTM B88) and Copper Drainage Fittings (ASME B16.23)	A	A	A
16	Fiberglass Sewer and Pressure Pipe (ASTM D3754) and Fiberglass Non-Pressure Pipe Fittings (ASTM D3840)	A	X	X
17	Galvanized Steel Pipe (ASTM A53) and Cast-Iron Drainage Fittings (ASME B16.12)	X	X	A
18	High-Density Polyethylene (HDPE) Plastic Pipe (ASTM F714) (6)	A	X	X
19	PVC Pipe and Fittings, DWV (ASTM D2665)	A	A	A
20	PVC Schedule 40 Drainage and DWV Fabricated Fittings (ASTM F1866)	A	A	A
21	PVC Sewer Pipe (PS-46) and Fittings (ASTM F789) (2)	A	X	X
22	PVC Sewer Pipe (PSM) and Fittings (ASTM D3034) (2)	A	X	X
23	Stainless Steel DWV Systems - Type 316L (ASME A112.3.1) (5)	A	A	A
24	Stainless Steel DWV Systems - Type 304 (ASME A112.3.1) (5)	X	X	A
25	Vitrified Clay Pipe - Standard Strength (ASTM C700)	A	X	X
26	Vitrified Clay Pipe - Extra Strength (ASTM C700)	A	A	X
	Approved	A	A	A
	Not Approved	X	X	X

NOTES FOR TABLE 3.5

(1) Plastic drain, waste, and vent piping classified by standard dimensionn ratio shall be SDR 26 or heavier (lower SDR number).
(2) Plastic sewer pipe classified by pipe stiffness shall be PS-46 or stiffer (higher PS number).
(3) Piping shall be applied within the limits of its listed standard and the manufacturer's recommendations.
(4) PS-100 pipe or stiffer (higher PS number).
(5) Alloy shall be marked on pipe and fittings
(6) Minimum SDR-17 for trenchless sewer replacement systems.

Table 3.6 – MATERIALS FOR VENT PIPING (1)		UNDERGROUND	ABOVEGROUND
1	ABS Pipe and Fittings, Schedule 40 DWV (ASTM D2661)	A	A
2	ABS Pipe - Cellular Core (ASTM F628) and DWV Fittings	A	A
3	Brass Pipe (ASTM B43)	X	A
4	Cast-Iron Soil Pipe and Fittings -Bell and Spigot (ASTM A74)	A	A
5	Cast-Iron Soil Pipe and Fittings -Hubless (CISPI 301, ASTM A888)	A	A
6	Cellular Core PVC DWV Pipe, IPS Schedule 40 (ASTM F891)	A	A
7	Copper Pipe (ASTM B42)	X	A
8	Copper Tube – DWV (ASTM B306) and Copper Drainage Fittings (ASME B16.23)	A	A
9	Copper Tube - K, L, M (ASTM B88) and Copper Drainage Fittings (ASME B16.23)	A	A
10	Galvanized Steel Pipe (ASTM A53) and Cast-Iron Drainage Fittings (ASME B16.12)	X	A
11	PVC Pipe and Fittings, DWV (ASTM D2665)	A	A
12	PVC Schedule 40 Drainage and DWV Fabricated Fittings (ASTM F1866)	A	A
13	Stainless Steel DWV Systems–Type 316L (ASME A112.3.1) (2)	A	A
14	Stainless Steel DWV Systems–Type 304 (ASME A112.3.1) (2)	X	A
15	3.25" OD PVC Pipe and Fittings, DWV (ASTM D2949)	A	A
16	Vitrified Clay Pipe - Extra Strength (ASTM C700)	A	X
	Approved	A	A
	Not Approved	X	X

NOTES FOR TABLE 3.6
(1) Piping shall be applied within the limits of its listed standards and the manufacturer's recommendations.
(2) Alloy shall be marked on pipe and fittings.

Table 3.7 – MATERIALS FOR STORM DRAINAGE (1)		SEWERS OUTSIDE OF BUILDING	UNDERGROUND WITHIN BUILDING	ABOVEGROUND WITHIN BUILDINGS
1	ABS Pipe and Fittings, Schedule 40 DWV (ASTM D2661)	A	A	A
2	ABS Pipe - Cellular Core (ASTM F628) and DWV Fittings	A	A	A
3	ABS Sewer Pipe and Fittings (ASTM D2751) (2) (3)	A	X	X
4	ABS and PVC Composite Sewer Pipe (ASTM D2680)	A	X	X
5	Brass Pipe (ASTM B43)	X	X	A
6	Cast-Iron Soil Pipe and Fittings - Bell and Spigot (ASTM A74)	A	A	A
7	Cast-Iron Soil Pipe and Fittings - Hubless (CISPI 301, ASTM A888)	A	A	A
8	Cellular Core PVC Sewer and Drain Pipe (ASTM F891) (3)	A	X	X
9	Cellular Core PVC Sewer and Drain Pipe (ASTM F891) (4)	X	A	X
10	Cellular Core PVC DWV Pipe, IPS Schedule 40 (ASTM F891)	A	A	A
11	Concrete Drain Pipe, Nonreinforced (ASTM C14)	A	X	X
12	Concrete Drain Pipe, Reinforced (ASTM C76)	A	X	X
13	Copper Pipe (ASTM B42)	X	X	A
14	Copper Tube – DWV (ASTM B306) and Copper Drainage Fittings (ASME B16.23)	A	A	A
15	Copper Tube - K,L,M (ASTM B88) and Copper Drainage Fittings (ASME B16.23)	A	A	A
16	Galvanized Steel Pipe (ASTM A53) and Cast-Iron Drainage Fittings (ASME B16.12)	X	X	A
17	PE- High-Density Polyethylene (HDPE) Plastic Pipe, SDR-17, (ASTM F714)(6)	A	X	X
18	PVC Pipe and Fittings, DWV (ASTM D2665)	A	A	A
19	PVC Schedule 40 Drainage and DWV Fabricated Fitting (ASTM F1866)	A	A	A
20	PVC Sewer Pipe (PS-46) and Fittings (ASTM F789)	A	X	X
21	PVC Sewer Pipe (PSM) and Fittings (ASTM D3034) (2) (3)	A	X	X
22	Stainless Steel DWV Systems–Type 316L (ASME A112.3.1)(5)	A	A	A
23	Stainless Steel DWV Systems–Type 304 (ASME A112.3.1)(5)	X	X	A
24	Vitrified Clay Pipe - Standard Strength (ASTM C700)	A	X	X
25	Vitrified Clay Pipe - Extra Strength (ASTM C700)	A	A	X
	Approved	A	A	A
	Not Approved	X	X	X

NOTES FOR TABLE 3.7
(1) Piping shall be applied within the limits of its listed standards and the manufacturer's recommendations.
(2) SDR 35 pipe or heavier (lower SDR number).
(3) PS-46 pipe or stiffer (higher PS number).
(4) PS-100 pipe or stiffer (higher PS Number).
(5) Alloy shall be marked on pipe and fittings
(6) Minimum SDR-17 for trenchless sewer systems.

Table 3.8 – MATERIALS FOR FOUNDATION DRAINS AND SUB-SOIL DRAINAGE		
1	Clay Drain Tile (ASTM C498)	A
2	Concrete Drain Tile (ASTM C412)	A
3	Perforated Concrete Pipe (ASTM C444)	A
4	Corrugated Polyethylene Tube (ASTM F405)	A
5	SR Plastic Drain Pipe and Fittings, Perforated (ASTM D2852)	A
6	PVC Sewer Pipe and Fittings, Perforated (ASTM D2729)	A
7	Stainless Steel DWV Systems – Type 316L (ASME A112.3.1)	A
8	Vitrified Clay Pipe, Perforated, Standard and Extra Strength (ASTM C700)	A
	Approved	A

Chapter 4

Joints and Connections

4.1 GENERAL REQUIREMENTS

4.1.1 Tightness

Joints and connections in the plumbing system shall be gas tight and watertight for the pressure required by test, with the exceptions of those portions of perforated or open joint piping that are installed for the purpose of collecting and conveying ground or seepage water to the underground storm drains.

4.1.2 Joint Standards

a. Pipe and tube shall be cut 90° or perpendicular to the pipe center lines.

b. The inside diameter of pipe and tube ends shall be reamed, filed, or smoothed to size of bore and all chips removed. All burrs on the outside of the pipe and butt ends shall be removed before the installation.

c. Pipe and tube shall engage into fittings the full manufacturer's design depth of the fitting socket.

d. Male pipe threads shall be made of sufficient length to ensure the proper engagement.

e. Pipe shall not extend into a fitting or other pipe to such a depth that it will impede or restrict the design flow.

f. Joints made by bonding, welding, brazing, solvent cementing, soldering, burning, fusion or mechanical means shall be free from grease or other substances not specifically required to achieve a satisfactory joint.

g. Pipe sealing or lubricating compound required for threaded pipe joints shall be applied to the male pipe end only and shall be insoluable and nontoxic.

4.1.3 Expansion Joints

Mechanical type expansion joints requiring or permitting adjustment shall be accessible for adjustment and/or replacement.

4.1.4 Increasers and Reducers

Where different sizes of pipes or pipes and fittings are to be connected, increaser and reducer fittings or bushings shall be used. (See Section 2.4.3)

4.2 TYPES OF JOINTS FOR PIPING MATERIALS

4.2.1 Caulked

4.2.1.1 Cast-Iron Soil Pipe

Lead caulked joints for cast-iron hub and spigot soil pipe shall be firmly packed with oakum or hemp and filled with molten lead not less than 1 inch deep and not to extend more than 1/8 inch below the rim of the hub. No paint, varnish, or other coatings shall be permitted on the jointing material until after the joint has been tested and approved. Lead shall be run in one pouring and shall be caulked tight.

4.2.1.2 Cast-Iron Water Pipe

Lead caulked joints for cast-iron ball and spigot water pipe shall be firmly packed with clean dry jute, or treated paper rope packing. The remaining space in the hub shall be filled with molten lead according to the following schedule:

Pipe Size	Depth of Lead
Up to 20 inches	2-1/4 inches
24, 30, 36 inches	2-1/2 inches
Larger than 36 inches	3 inches

Lead shall be run in one pouring and shall be caulked tight.

4.2.2 Threaded

The threads in taper threaded pipe joints shall conform to ASME B.1.20.1.

4.2.3 Wiped

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 3/4 inch and at least as thick as the material being jointed. Wall or floor flange lead-wiped joints shall be made by using a lead ring or flange placed behind the joints at wall or floor. Joints between lead pipe and cast-iron, steel, or wrought iron shall be made by means of a caulking ferrule, soldering nipple, or bushing.

4.2.4 Soldered

a. Soldered joints in copper water piping shall be made using wrought pressure fittings complying with ASME B16.22, cast pressure fittings complying with ASME B16.18, or cast copper alloy flanges complying with ASME B16.24.

NOTE: Short-cup brazing fittings complying with ASME B16.50 and bearing the mark “BZ” shall not be used where joints are soldered.

b. Soldered joints in copper drain and vent piping shall be made with wrought drainage fittings complying with ASME B16.29 or cast drainage fittings complying with ASME B16.23.

c. Soldered joints shall be made in accordance with ASTM B828.

d. Solder shall comply with ASTM B32. Flux shall comply with ASTM B813.

e. Solder for joints in potable water piping shall contain not more than 0.2% lead.

4.2.5 Flared

Flared joints for copper water tube shall be made with fittings complying with ASME B16.26. The tube shall be reamed and then expanded with an approved flaring tool.

4.2.6 Mechanically Crimped (Pressed) Joints

a. Copper fittings for water supply and distribution, designed for mechanically crimped (pressed) connections to ASTM B88 hard drawn copper water tube, shall include an O-ring gasket complying with NSF 61 for potable water.
EXCEPTION: Mechanically crimped (pressed) joints shall be permitted with annealed copper water tube when such use is included in the fitting manufacturer’s technical data and installation instructions.

b. The fittings shall comply with the material and sizing requirements of ASME B16.22 (wrought copper or copper alloy fittings) or ASME B16.18 (cast copper alloy fittings).

c. During installation, the tube end shall be deburred and depth-marked to permit visual verification of full insertion of the tube into the fitting socket.

d. The joint shall be crimped (pressed) using a tool approved by the manufacturer of the fitting.

e. The joints shall be rated by the manufacturer for not less than 200 psig at 180 deg F.

f. The fittings shall be permitted to be installed in concealed locations.

4.2.7 Push-on Joints

a. Copper fittings for water supply and distribution, designed for manual push-on connections to ASTM B88 hard drawn copper tubing, shall include corrosion-resistant gripping fingers and an O-ring gasket complying with NSF 61 for potable water.
EXCEPTION: Push-on fittings shall be permitted to be used with annealed copper water tube and OD sized CPVC and PEX tubing if such use is included in the fitting manufacturer's technical data and installation instructions.
b. The fittings shall comply with the material and sizing requirements of ASME B16.22 (wrought copper or copper alloy fittings) or ASME B16.18 (cast copper alloy fittings).
c. During installation, the tube end shall be deburred and depth-marked to permit visual verification of full insertion of the tube into the fitting socket.
d. The fittings shall be rated by their manufacturer for not less than 200 psig at 180 deg F.
e. The fittings shall be permitted to be installed in concealed locations.

4.2.8 Brazed

4.2.8.1 General

a. Brazed joints in copper tubing shall be made in accordance with accepted industry practice. See Appendix L for an accepted practice for general plumbing.
b. Brazed joints in medical gas and vacuum piping shall be made in accordance with NFPA 99 or NFPA 99C.

4.2.8.2 Fittings

a. Fittings in copper tubing with brazed joints shall be wrought solder joint fittings complying with ASME B16.22 or short-cup brazing fittings complying with ASME B16.50. Short-cup brazed joint fittings shall be clearly marked by the manufacturer to differentiate them from solder-joint fittings and avoid their being used in piping with soldered joints.
b. Fittings for medical gas and vacuum piping shall be as required by NFPA 99 or NFPA 99C.

4.2.8.3 Mechanically Formed Tee Branches

a. Mechanically formed tee branches shall be permitted in copper tubing in water distribution systems. The branch connections shall be formed with appropriate tools and joined by brazing. The branch tube end shall be notched and dimpled with two sets of double dimples. The first dimples shall act as depth stops to prevent the branch tube from being inserted beyond the depth of the branch collar. The second dimples shall be 1/4" above the first dimples and provide a visual means of verifying that the branch connection has been properly fitted. The dimples in the branch tube shall be in line with the run of the main. The joints shall be brazed in accordance with Section 4.2.8.1 and ASTM F2014.
b. Mechanically former tee branches shall not be permitted in drainage piping.

4.2.9 Cement Mortar

a. Where permitted as outlined in Sec. 2.4.4, cement mortar joints shall be made in the following manner: 1. A layer of jute or hemp shall be inserted into the annular joint space and packed tightly to prevent mortar from entering the interior of the pipe or fitting.
2. Not more than 25 percent of the annular space shall be used for jute or hemp.
3. The remaining space shall be filled in one continuous operation with a thoroughly mixed mortar composed of one part cement and two parts sand, with only sufficient water to make the mixture workable by hand.
4. Additional mortar of the same composition shall then be applied to form a one to one slope with the barrel of the pipe.
5. The bell or hub of the pipe shall be left exposed for inspection.

6. When necessary, the interior of the pipe shall be swabbed to remove any mortar or other material that may have found its way into such pipe.

4.2.10 Burned Lead (Welded)

Burned (welded) joints shall be made in such a manner that the two or more sections to be joined shall be uniformly fused together into one continuous piece. The thickness of the weld shall be at least as thick as the lead being joined.

4.2.11 Mechanical (Flexible or Slip Joint)

4.2.11.1 Stainless Steel DWV Systems

a. Joints in stainless steel DWV systems shall be made with an elastomeric o-ring of a material that is suitable for the intended service.

b. Joints between stainless steel drainage systems and other piping materials shall be made with an approved adapter coupling.

4.2.11.2 Cast-Iron Soil Pipe

a. Hubless pipe: Joints for hubless cast-iron soil pipe and fittings shall be made with an approved elastomeric sealing sleeve and corrosion resisting clamping device or shall be made using a rigid unshielded TPE coupling with center stop installed per Section 4.3.8d.

b. Hub and Spigot: Joints for hub and spigot cast-iron soil pipe and fittings, designed for use with a compressed gasket, may be made using a compatible compression gasket that is compressed when the spigot is inserted into the hub of the pipe.

4.2.11.3 Cast-Iron Water Pipe

Mechanical joints in cast-iron water pipe shall be made with a flanged collar, a rubber ring gasket, and the approved number of securing bolts.

4.2.11.4 Clay Pipe

Joints in piping and/or fittings shall be made using flexible compression joints.

4.2.11.5 Concrete pipe

Flexible joints between lengths of concrete pipe may be made using approved compression type joints or elastomeric materials born on the spigot end and in the bell (or hub) end of the pipe.

4.2.11.6 Elastomeric Sleeves

Mechanical joints on drainage pipes below ground shall be made with an elastomeric seal conforming to ASTM D3212, CSA B602 or ASTM C1173. Joints shall be installed in accordance with the manufacturer's instructions.

4.2.12 Reserved

4.2.13 Reserved

4.2.14 Plastic

Joints in plastic piping shall be made with approved fittings by either solvent cement or heat joined connections; approved couplings consisting of elastomeric sleeves and corrosion resisting metal screw clamps; approved

insert fittings; approved mechanical fittings; or threaded joints according to approve standards. PVC solvent cemented joints shall use an approved primer appropriate for the material used. An approved purple colored primer and solvent cement not purple in color shall be used in joining PVC pipe and fittings. An approved color primer not orange in color and solvent cement orange in color or a single step solvent cement that is yellow in color and is third party certified as conforming to ASTM F493 shall be used in joining 1/2 inch through 2 inch in diameter CPVC pipe and fittings that are manufactured in accordance with ASTM D2846.
EXCEPTION: Primer shall be used for CPVC pipe and fittings where recommended by the manufacturer(s) of the pipe and fittings.

4.2.15 Slip

Slip joints shall be made using approved packing or gasket material, or approved ground joint brass compression rings. Ground joint brass connections that allow adjustment of tubing but provide a rigid joint when made up, shall not be considered as slip joints.

4.2.16 Expansion

Expansion joints shall be of approved type and its material shall conform with the type of piping in which it is installed.

4.2.17 Split Couplings

a. Split couplings consisting of two or more parts and a compression gasket, designed for use with grooved or plain end pipe and fittings, shall be permitted to be used for water service piping, hot and cold domestic water piping, storm water conductors and leaders, and sump pump discharge piping. The complete joint assembly shall be suitable for the intended use and comply with a standard listed in Table 3.1.3.

b. Galvanized steel pipe or other interior coated pipe shall not be joined using rolled grooves.

4.2.18 Butt Fusion

ASTM F714 high-density polyethylene (HDPE) pipe and ASTM D3261 fittings shall be joined by butt fusion in accordance with ASTM D2657.

4.2.19 Bending

Changes in direction in copper water tube shall be permitted to be made by the use of factory or field bends. Field bends shall be made in accordance with Table 4.2.19. Bends shall be made only with bending equipment and procedures intended for that purpose. Hard drawn tubing shall not be bent with tubing benders intended for only annealed (soft) tube. All bends shall be smooth and free from buckling, cracks, and other evidence of mechanical damage.

Table 4.2.19: BENDING COPPER TUBE

Nominal Tube Size -in.	Tube Type	Temper	Min. Bend Radius, in.
1/4 inch	K,L	Annealed (soft)	3 /4"
3/8 inch	K,L	Annealed (soft)	1-1/2"
3/8 inch	K,L,M	Drawn (hard)	1-3/4"
1/2 inch	K,L	Annealed (soft)	2-1/4"
1/2 inch	K,L,M	Drawn (hard)	2-1/2"
3/4 inch	K,L	Annealed (soft)	3"
3/4 inch	K,L	Drawn (hard)	3"
1 inch	K,L	Annealed (soft)	4"
1-1/4 inches	K,L	Annealed (soft)	9"

4.3 TYPES OF JOINTS BETWEEN DIFFERENT PIPING MATERIALS

4.3.1 Vitrified Clay to Other Material

Joints between vitrified clay and other piping materials shall be made with an approved joint.

4.3.2 Reserved

4.3.3 Reserved

4.3.4 Threaded Pipe to Cast-Iron

Joints between steel or brass and cast-iron pipe shall be either caulked or threaded or shall be made with approved adapter fittings.

4.3.5 Lead to Cast-Iron or Steel

Joints between lead and cast-iron or steel pipe shall be made by means of wiped joints to a caulking ferrule, soldering nipple, bushing, or by means of a mechanical adapter.

4.3.6 Cast-Iron to Copper Tube

Joints between cast-iron and copper tube shall be made by using an approved brass or copper caulking ferrule and by properly soldering the copper tube to the ferrule.

4.3.7 Copper Tube to Threaded Pipe Joints

a. Joints from copper tube to threaded pipe shall be made as follows:
1. DWV Systems: with copper or brass threaded adapters.
2. Potable Water Systems and Galvanized Steel Pipe: cast brass threaded adapters, dielectric unions or flanges (1-1/2" and larger), or dielectric waterway fittings that comply with IAPMO PS 66.
3. To any Non-Ferrous Piping: copper or brass threaded adapter.

b. The adapter fitting shall be soldered to the tubing by approved methods, and the threaded section assembled with National Pipe Threads—Tapered (NPT).

4.3.8 Special Joints and Couplings for Drainage Piping

a. Joints between two different drainage piping materials or between different size piping, of the same or different material, shall be made using fittings or mechanical couplings that are designed for the specific application, including adapter fittings, hubless pipe couplings, slip-on couplings, transition couplings, and repair couplings.

b. Fittings and couplings for use under this Section shall either (1) comply with a standard listed in Table 3.1.3, (2) be listed or labeled by a recognized listing agency, or (3) be approved by the Authority Having Jurisdiction if such products are not listed or labeled. Installation shall comply with the coupling manufacturer's instructions and intended use.

c. Shielded couplings shall consist of a flexible elastomeric sealing sleeve, a protecting and supporting continuous metal shield or shear ring, and metal screw clamping bands. All metal parts shall be corrosion-resisting. Shielded couplings shall be capable of withstanding a shear test based on a load of 50 pounds per inch of nominal pipe diameter, and shall be permitted to partially support the pipe being joined when such installation is recommended by the manufacturer's instructions. Shielded couplings may be installed aboveground or underground, as intended by the manufacturer.

d. Mechanical unshielded couplings using thermoplastic elastomer gaskets shall consist of a rigid or semi-rigid sealing sleeve and corrosion-resisting metal screw clamping bands. Mechanical unshielded couplings using thermoplastic elastomer gaskets shall not be installed where the operating internal or external temperatures exceed 130°F (54°C) or are below 0°F (-18°C). The pipe shall be supported on both sides of the coupling within 18 inches of the centerline of the coupling. Mechanical unshielded couplings using thermoplastic elastomer gaskets shall be permitted aboveground or underground. Mechanical unshielded couplings using thermoplastic elastomer gaskets shall not be installed in construction that has a fire rating that restricts the use of flammable materials or be installed in through penetrations or plenums without additional fire resistance protection.

e. Flexible unshielded couplings shall consist of an elastomeric sealing sleeve and corrosive-resisting metal screw clamping bands. The use of flexible unshielded couplings shall be limited to joints in underground sewer, drain or vent piping.

f. Couplings installed aboveground shall include center stops.

EXCEPTION: Slip-on repair couplings used for repair or rework.

g. The shear tests required under this Section shall be performed in accordance with the shear test procedures specified under any of the coupling standards listed in Table 3.1.3 that include such tests.

4.3.9 ABS or PVC Plastic DWV to Other Material

a. Threaded Joints: ABS or PVC DWV joints when threaded shall use the proper male or female threaded adapter. Use only approved thread tape or lubricant seal or other approved material as recommended by the manufacturer. Threaded joints shall not be over-tightened. After hand tightening the joint, make a one-half to one full turn with a strap wrench.

b. Cast-iron Hub Joints: Joints may be made by caulking with lead and oakum or by use of a compression gasket that is compressed when the plastic pipe is inserted into the cast-iron hub end of the pipe. No adapters are required for this connection.

c. Cast-iron Spigot Ends, Schedule 40 Steel Pipe or Copper DWV Tube: Joints between these materials and plastic shall be joined with an approved adapter fitting.

d. The solvent cemented non-pressure joint between dissimilar plastic materials, ABS/PVC building drains and/or building sewers, shall be made using an ASTM D3138 solvent cement intended for ABS/PVC transition joints.

4.4 CONNECTIONS BETWEEN DRAINAGE PIPING AND CERTAIN FIXTURES

a. Connections between drainage piping and floor outlet plumbing fixtures shall be made by means of an approved flange that is attached to the drainage piping in accordance with the provisions of this chapter. The floor flange shall be set on and securely anchored to the building structure.

b. Connections between drainage piping and wall hung water closets shall be made by means of an approved extension nipple or horn adapter.

c. Connections shall be bolted to the flange or carrier using corrosion resisting bolts or screws, or assemblies recommended by the manufacturer.

4.5 WATERPROOFING OF OPENINGS

a. Joints around vent pipes at the roof shall be made watertight by the use of lead, copper, aluminum, plastic, or other approved flashing or flashing materials. See Section 12.4.7.

b. Exterior wall openings shall be made watertight.

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Chapter 5

Traps, Cleanouts and Backwater Valves

5.1 SEPARATE TRAPS FOR EACH FIXTURE

a. Plumbing fixtures shall be separately trapped by a water seal trap placed as close as possible to the fixture outlet.

b. The vertical distance from the fixture outlet to the trap weir shall not exceed 24 inches.

c. Fixtures shall not be double-trapped unless a relief vent is provided between the two traps.

d. Fixture designs having integral dual traps within the fixture shall be permitted.

EXCEPTIONS:

(1) Fixtures that have integral traps.

(2) A combination-plumbing fixture may be installed on one trap provided the waste outlets are not more than 30 inches apart.

(3) One trap may be installed for up to three (3) compartment sinks, laundry trays or lavatories that are immediately adjacent to each other in the same room, and where the trap is centrally located when three such fixtures are installed.

(4) No clothes washer or laundry tub shall be discharged to a trap serving a kitchen sink.

(5) As otherwise permitted by this Code.

5.2 SIZE OF FIXTURE TRAPS

Fixture trap size (nominal diameter) shall be sufficient to drain the fixture rapidly and in no case less than given in Table 5.2. No trap shall be larger than the drainage pipe into which it discharges. Integral traps shall conform to appropriate standards.

5.3 GENERAL REQUIREMENTS FOR TRAPS

5.3.1 Design of Traps

Fixture traps shall be self-scouring and shall have no interior partitions except where such traps are integral with the fixture or where corrosion resistant materials of plastic or glass are used. Solid connections, slip joints, or couplings may be used on the trap inlet, trap outlet, or within the trap seal. (See Section 7.4.6.)

5.3.2 Trap Seals

Each fixture trap shall have a liquid seal of not less than two inches and not more than four inches

EXCEPTIONS:

(1) Interceptors in Chapter 6.

(2) Special conditions such as accessible fixtures, a deeper seal may be required by the Authority Having Jurisdiction.

5.3.3 Trap Setting and Protection

Traps shall be set level with respect to their water seals and, where necessary, shall be protected from freezing.

Table 5.2 MINIMUM SIZE OF NON-INTEGRAL TRAPS	
Plumbing Fixture	**Trap Size in inches**
Bathtub (with or without overhead shower)	1 ½
Bidet	1 ¼
Clothes washing machine standpipe	2
Combination sink and wash (laundry) sink with food waste grinder unit	1 ½ (1)
Combination kitchen sink, domestic dishwasher, and food waste grinder	1 ½
Dental unit or cuspidor	1 ¼
Dental lavatory	1 ¼
Drinking fountain	1 ¼
Dishwasher, commercial	2
Dishwasher, domestic (non-integral trap)	1 ½
Floor drain	2
Food waste grinder, commercial use	2
Food waste grinder, domestic use	1 ½
Kitchen sink, domestic, with food waste grinder unit	1 ½
Kitchen sink, domestic	1 ½
Lavatory, common	1 ¼
Lavatory (barber shop, beauty parlor or surgeon's)	1 ½
Lavatory, multiple type (wash fountain or wash sink)	1 ½
Laundry tray (1 or 2 compartments)	1 ½
Shower stall or shower drain (single shower head)	1 ½
Shower stall or shower drain (multiple shower heads)	2
Sink (surgeon's)	1 ½
Sink (flushing rim type, flush valve supplied)	3
Sink (service type with floor outlet trap standard)	3
Sink (service type with P trap)	2
Sink, commercial (pot, scullery, or similar type)	2
Sink, commercial (with food grinder unit)	2

(1) Separate trap required for wash tray and separate trap required for sink compartment with food waste grinder.

5.3.4 Building Traps

Building traps shall not be installed except where required by the Authority Having Jurisdiction. Each building trap when installed shall be provided with a cleanout and with a relieving vent or fresh air intake on the inlet side of the trap that shall be at least 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.

5.3.5 Prohibited Traps

a. The following types of traps shall be prohibited:
   1. Traps that depend upon moving parts to maintain their seal.
   2. Bell traps.

3. Crown vented traps.
4. Separate fixture traps that depend on interior partitions for their seal, except if made from plastic, glass or other corrosion resistant materials.
5. “S” traps, of uniform internal dimension.
6. Drum traps.

b. Hair interceptors, precious metal interceptors and similar appurtenances shall be permitted as required.

5.3.6 Trap Seal Maintenance

a. Traps that could lose their seal due to evaporation because of infrequent use shall be equipped with a readily accessible means to replenish the trap seal or a trap primer conforming to ASSE 1018 or ASSE 1044

b. In addition to the priming requirement above, the installation of a sealing component on the fixture drain outlet to reduce trap seal loss shall be permitted. Sealing devices shall be properly sized for the drain outlet on which they are installed. They shall permit the fixture to drain completely and shall not leave standing water or waste on or around the device.

5.4 DRAINAGE PIPE CLEANOUTS

5.4.1 Cleanout Spacing

a. Cleanouts in horizontal drainage lines shall be spaced at intervals not exceeding the following values:

4" pipe size or less: 75 feet
5" size and larger: 100 feet

b. The distance referred to in Sections 5.4.1a shall include the developed length of the cleanout pipe.

5.4.2 Building Sewer

Cleanouts, when installed on an underground building sewer, shall be extended vertically to or above the finished grade level.

5.4.3 Change of Direction

a. Cleanouts shall be installed at changes of direction in drainage piping made with 60°, 70° and 90° fittings.

EXCEPTION: Where there are multiple changes of direction, not more than one cleanout shall be required in 40 feet of run.

b. Cleanouts shall not be required where changes of direction are made with one or more 22 1/2° or 45° fittings.

5.4.4 Cleanouts for Concealed Piping

Cleanouts for concealed piping shall be extended through and terminate flush with the finished wall or floor; or pits or chases may be left in the wall or floor, provided they are of sufficient size to permit removal of the cleanout plug and proper cleaning of the system.

5.4.5 Base of Stacks

a. A cleanout shall be provided near the base of each vertical waste or soil stack and located 6 inches above the flood level rim of the lowest fixture on the lowest floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack.

b. For buildings with a floor slab, a crawl space of less than 18 inches, or where a stack cleanout is not accessible, the cleanout shall be installed in the building drain or building sewer, not more than five feet outside the building wall.

c. Rain leaders and conductors connected to a building storm sewer shall have a cleanout installed at the base of the outside leader or inside conductor before it connects to the horizontal drain.

5.4.6 Building Drain and Building Sewer Junctions and the Property Line

a. There shall be a cleanout near the junction of a building drain and building sewer either inside or outside the building wall.

b. A cleanout shall be placed in the building sanitary sewer and building storm sewer at the property line and brought to the surface per the requirements of the Authority Having Jurisdiction.

5.4.7 Direction of Flow

Cleanouts shall be installed so that the cleanout opens in the direction of the flow of the drainage line or at right angles thereto.

5.4.8 Connections to Cleanouts Prohibited

a. Cleanout plug openings in other than drainage pattern fittings shall not be used for the installation of new fixtures or floor drains.

b. If a cleanout fitting or cleanout plug opening is removed from a drainage pattern fitting in order to extend the drain, another cleanout of equal access and capacity shall be provided in the same location.

5.4.9 Cleanout Size

Cleanout size shall conform with Table 5.4.9.

Table 5.4.9
SIZE OF CLEANOUTS

Nominal Piping Size (inches)	Nominal Size of Cleanout (inches)
$1^1/_4$	$1^1/_4$
$1^1/_2$	$1^1/_2$
2	2
3	3
4&6	4
8&10	6
12&15	8

(1) See Section 5.4.10 for sizes 12" or larger for building sewers.
(2) See Section 5.4.13 for cleanout equivalents.

5.4.10 Manholes for Large Pipes

a. Manholes shall be provided as cleanouts for building sewers 12" size and larger. Manholes shall be provided at every change of size, alignment, direction, grade, or elevation. The distance between manholes shall not exceed 300 feet.

b. Manholes may be provided in lieu of cleanouts in underground building sewers, building drains, and branches thereof, 8" size and larger.

c. Such manholes shall comply with the requirements of Section 5.4.10a.

d. If manholes are installed indoors, they shall have a bolted, gas-tight cover.

e. Manhole construction shall comply with the standards of the Authority Having Jurisdiction.

5.4.11 Cleanout Clearances

Cleanouts on 3" or larger pipes shall be so installed that there is a clearance of not less than 18" for the purpose of rodding. Cleanouts smaller than 3 inches shall be so installed that there is a 12" clearance for rodding.

5.4.12 Cleanouts to be Kept Uncovered

Cleanout plugs shall not be covered with cement, plaster, or any other permanent finishing material. Where it is necessary to conceal a cleanout plug, a covering plate or access door shall be provided that will permit ready access to the plug.

5.4.13 Cleanout Equivalent

Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent, provided the opening to be used as a cleanout opening is the size required by Table 5.4.9.
EXCEPTIONS:
(1) The trap arm of a floor drain with a removable strainer.
(2) Fixtures with readily removable traps not more than one pipe size smaller than the drain served shall be permitted.

5.4.14 Cleanouts for Floor Drains

A cleanout shall be provided immediately downstream from a floor drain whose strainer is not readily removable.

5.5 BACKWATER VALVES

5.5.1 Where Required

a. Fixtures and/or drain inlets subject to backflow and flooding from blocked or restricted public sewers shall be protected by a backwater valve.
b. Such situations include those where fixtures and/or drains are located above the crown level of the public sewer at the point of connection thereto, but are below the level of the curb at the point where the building sewer crosses under the curb at the property line.
c. Backwater valves shall be installed in branches of the drainage system that receive flow only from fixtures and/or drains subject to backflow from the public sewer.
d. Other portions of the drainage system not subject to such backflow shall drain directly to the public sewer.

5.5.2 Material Standard and Accessibility

Backwater valves shall conform to ASME A112.14.1 and be installed so that their internal working parts are accessible for periodic cleaning, repair or replacement.

5.5.3 Notice of the Installation of Backwater Valves

When backwater valves are installed in building sanitary drainage systems, a notice shall be posted at the building water service shutoff valve(s) describing where backwater valves are located.

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Chapter 6

Liquid Waste Treatment Equipment

6.1 GENERAL

6.1.1 Where Required

Interceptors, separators, neutralizers, dilution tanks, or other means shall be provided where required to prevent liquid wastes containing fats, oils, greases, flammable liquids, sand, solids, acid or alkaline waste, chemicals, or other harmful substances from entering a building drainage system, a public or private sewer, or sewage treatment plant or process.

6.1.2 Design

The size and type of liquid waste treatment equipment shall be based on the maximum volume and rate of discharge of the plumbing fixtures and equipment being drained. See Appendix J.

6.1.3 Exclusion of Other Liquid Wastes

Only wastes from fixtures and equipment requiring treatment or separation shall be discharged into treatment equipment.

6.1.4 Approval

6.1.4.1 General

The type, size, capacity, design, arrangement, construction, and installation of liquid waste treatment devices shall be as approved by the Authority Having Jurisdiction.

6.1.4.2 Grease Interceptors and Grease Recovery Devices

Grease interceptors rated for up to 100 gallons per minute shall be certified according to PDI Standard G101 or ASME A112.14.3. Grease recovery devices rated for up to 100 gallons per minute shall be certified according to ASME A112.14.4.

6.1.4.3 Mechanical Equipment

Each installation of a manufactured liquid waste treatment device employing pumps, filters, drums, collection plates, or other mechanical means of operation shall be certified by the manufacturer to provide effluent meeting the environmental requirements of the sewer or other approved point to which it discharges.

6.1.5 Venting

Liquid waste treatment equipment shall be so designed that they will not become air-bound if tight covers are used. Equipment shall be properly vented if loss of its trap seal is possible.

6.1.6 Accessibility

a. Liquid waste treatment equipment shall be so installed that it is accessible for the removal of covers and the performance of necessary cleaning, servicing and maintenance.

b. The need to use ladders or move bulky objects in order to service interceptors and other liquid waste treatment equipment shall constitute a violation of accessibility.

6.1.7 Point of Discharge

Connections to sewers or other points of discharge for the effluent from liquid waste treatment equipment shall be as approved by the Authority Having Jurisdiction.

6.2 GREASE INTERCEPTORS AND GREASE RECOVERY DEVICES (GRD)

6.2.1 Sizes Up to 100 GPM

a. Manufactured grease interceptors rated up to 100 gallons per minute shall comply with ASME A112.14.3 and be sized and installed in accordance with the recommendations of PDI Standard G101 - Appendix A and the manufacturer's instructions. They shall have a grease retention capacity not less than two pounds for each gpm of rated flow. A flow control device shall be provided to prevent the waste flow (gpm) through the interceptor from exceeding its rated flow capacity. An air intake shall be provided for the flow control as recommended by the manufacturer or PDI Standard G101 - Appendix A.

b. Grease interceptors that include automatic grease recovery (GRD) shall comply with Section 6.2.1.a and ASME A112.14.4.

6.2.2 Fixture Traps

a. Fixtures that discharge into a grease interceptor shall be individually trapped and vented between the fixture and the interceptor.

b. When individually trapped and vented fixtures discharge into a grease interceptor, the required vented flow control device shall be installed between the vented fixture traps and the interceptor.

EXCEPTION: A grease interceptor with the required flow control device shall be permitted to serve as a trap for an individual fixture if the developed length of the drain between the fixture and the interceptor does not exceed four feet horizontally and 30 inches vertically.

6.2.3 Food Waste Grinders

Where food waste grinders discharge through a grease interceptor, a solids interceptor shall be installed upstream of the grease interceptor to prevent food particles from entering the grease interceptor.

6.2.4 Commercial Dishwashers

Commercial dishwashers shall be permitted to discharge through a grease interceptor.

6.2.5 Location

Grease interceptors shall be permitted to be installed within buildings unless otherwise prohibited by the Authority Having Jurisdiction. Where interceptors or holding tanks are remote from the fixtures served, the drain piping between the fixtures and the interceptor or holding tank shall be as direct as possible and shall include provisions for periodic cleaning.

6.2.6 Prohibited Interceptors

The installation of water-cooled grease interceptors shall be prohibited.

6.2.7 Chemicals Prohibited

The use of enzymes, emulsifiers, or similar chemicals in grease interceptors shall be prohibited.

6.2.8 Individual Dwelling Units

Grease interceptors shall not be required in individual dwelling units or any private living quarters.

6.3 OIL/WATER SEPARATORS

6.3.1 Where Required and Approved Point of Discharge

a. Liquid waste containing grease, oil, solvents, or flammable liquids shall not be directly discharged into any sanitary sewer, storm sewer, or other point of disposal. Such contaminants shall be removed by an appropriate separator.

b. Sand interceptors and oil separators shall be provided wherever floors, pits or surface areas subject to accumulation of grease or oil from service or repair operations are drained or washed into a drainage system. Such locations include, but are not limited to, car or truck washing facilities, engine cleaning facilities, and similar operations. The drainage or effluent from such locations shall be connected to the sanitary sewer.

c. Drains shall not be required in service or repair garages that employ dry absorbent cleaning methods; however, if any drains are located in such areas, they shall discharge to the sanitary sewer through a sand interceptor and oil interceptor.

d. Drains shall not be required in parking garages unless the garage, or portions thereof, has provisions for either washing vehicles or rinsing the floor. Where such cleaning facilities are provided, the area subject to waste drainage shall be provided with one or more floor drains, complete with sand interceptor and oil interceptor, and the effluent from the oil separator shall be connected to the sanitary sewer. Any storm water shall be drained separately and directly to the storm sewer.

e. Where parking garages without provisions for vehicle washing or floor rinsing require storm water drainage, drains shall be permitted to connect to the storm sewer without a sand interceptor and oil separator. Such drainage, including melting snow, ice or rainwater runoff from vehicles, shall not be connected to the sanitary sewer.

f. Where oil separators include a waste holding tank, it shall not be used to store or contain any other waste oil (e.g., motor oil) or hazardous fluid.

6.3.2 Design of Oil Separators

a. Where oil separators are required in garages and service stations, they shall have a minimum volume of six cubic feet for the first 100 square feet of area drained, plus one cubic foot for each additional 100 square feet of area drained. Oil separators in other applications shall be sized according to the manufacturers rated flow.

b. Field-fabricated oil separators shall have a depth of not less than two feet below the invert of the discharge outlet. The outlet opening shall have a water seal depth of not less than 18 inches.

c. Manufactured oil separators shall be sized according to gallons per minute of rated flow. They shall include a flow control device and adjustable oil draw-off.

d. Oil separators shall have a 3-inch minimum discharge line and a 2-inch minimum vent to atmosphere. The discharge line shall have a full-size cleanout extended to grade or otherwise be accessible.

e. The oil draw-off or overflow piping from oil separators shall be connected to an approved waste oil tank that is installed and permitted according to the environmental requirements of the Authority Having Jurisdiction. The waste oil from the separator shall flow by gravity or may be pumped to a higher elevation by an automatic pump. Pumps shall be adequately sized, explosion-proof, and accessible. Waste oil tanks shall have a 2-inch minimum pump-out connection and a 1-1/2 inch minimum vent to atmosphere.

f. Where oil separators are subject to backflow from a sewer or other point of disposal, their discharge line shall include a backwater valve, installed in accordance with Section 5.5.

g. Where oil separators are installed in parking garages and other areas where the waste flow will include sand, dirt or similar soilds, a sand interceptor shall be provided upstream from the oil separator. Sand interceptors shall comply with Section 6.4.

h. Oil interceptors, waste oil tanks, oil pump-out connections, backwater valves and atmospheric vent piping shall be permanently identified by suitable labels or markings.

6.3.3 Vapor Venting

The atmospheric vents from oil separators and their waste holding tanks shall be separate from other plumbing system vents and shall be extended to an approved location at least 12 feet above grade or the surrounding area.

6.3.4 Combination Oil Separator and Sand Separator

A combination oil separator and sand separator meeting the functional requirements of Sections 6.3 and 6.4 shall be permitted to be installed.

6.4 SAND INTERCEPTORS

6.4.1 Where Required

a. A sand interceptor shall be installed upstream from an oil separator if required in Section 6.3.2.g.

b. A sand interceptor shall be provided downstream from any drain whose discharge may contain sand, sediment, or similar matter on a continuing basis that would tend to settle and obstruct the piping in the drainage system. Multiple floor drains shall be permitted to discharge through one sand interceptor.

6.4.2 Construction and Size

a. Sand interceptors shall be constructed of concrete, brick, fabricated coated steel, or other watertight material, and shall be internally baffled to provide an inlet section for the accumulation of sediment and a separate outlet section.

b. The outlet pipe of a sand interceptor shall be the same size as the drain served.

EXCEPTION: If serving an oil separator, the outlet from the sand interceptor shall be the same size as the inlet to the oil separator.

c. The inlet baffle shall have two top skimming openings, each the same size as the outlet pipe and at the same invert as the outlet opening. The openings in the baffle shall be offset to prevent straight-line flow through the interceptor from any of its inlets to its outlet.

d. The inlet to the interceptor shall be at the same elevation as, or higher than, the outlet. The bottom of the inlet section shall be at least 24 inches below the invert of the outlet pipe.

e. The bottom of the inlet section shall be at least two feet wide and two feet long for flow rates up to 20 gallons per minute. The bottom of the inlet section shall be increased by one square foot for each 5 gpm of flow or fraction thereof over 20 gpm. The bottom of the outlet section shall be not less than 50% of the area of the bottom of the inlet section.

f. A solid removable cover shall cover the outlet section. An open grating suitable for the traffic in the area in which it is located shall cover the inlet section. Covers shall be set flush with the finished floor.

6.4.3 Water Seal

When a sand interceptor is used separately without also discharging through an oil separator, its outlet pipe shall be turned down inside the separator below the water level to provide a six-inch minimum water seal. A cleanout shall be provided for the outlet line.

6.4.4 Alternate Design

Alternate designs for construction of, or baffling in, sand interceptors shall comply with the intent of this Code and be submitted to the Authority Having Jurisdiction for approval.

6.5 SOLIDS INTERCEPTORS

a. Solids interceptors shall be provided where necessary to prevent harmful solid materials from entering the drainage system on a continuing basis. Such harmful materials include, but are not limited to, aquarium gravel, barium, ceramic chips, clay, cotton, denture grindings, dental silver, fish scales, gauze, glass particles, hair, jewels, lint, metal grindings, plaster, plastic grindings, precious metal chips, sediment, small stones, and solid food particles.

b. Solids interceptors shall separate solids by gravity, trapping them in a removable bucket or strainer.

c. Solids interceptors shall be sized according to their drain pipe size or by the required flow rate.

6.6 NEUTRALIZING AND DILUTION TANKS

a. Neutralizing or dilution tanks shall be provided where necessary to prevent acidic or alkaline waste from entering the building drainage system. Such waste shall be neutralized or diluted to levels that are safe for the piping in the drainage and sewer systems.

b. Vents for neutralizing or dilution tanks shall be constructed of acid-resistant piping and shall be independent from sanitary system vents.

6.7 SPECIAL APPLICATIONS

6.7.1 Laundries

Commercial laundries shall be equipped with one or more lint interceptors having wire baskets or similar devices, removable for cleaning, that will prevent passage into the drainage system of solids 1/2 inch or larger in size, strings, rags, buttons, lint, and other materials that would be detrimental to the drainage system.

6.7.2 Bottling Establishments

Bottling plants shall discharge their process wastes into a solids separator that will retain broken glass and other solids, before discharging liquid wastes into the drainage system.

6.7.3 Slaughter Houses

Drains in slaughtering rooms and dressing rooms shall be equipped with separators or interceptors, approved by the Authority Having Jurisdiction, that will prevent the discharge into the drainage system of feathers, entrails, and other waste materials that are likely to clog the drainage system.

6.7.4 Barber Shops and Beauty Parlors

Shampoo sinks in barbershops, beauty parlors, and other grooming facilities shall have hair interceptors installed in lieu of regular traps.

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Chapter 7

Plumbing Fixtures, Fixture Fittings and Plumbing Appliances

7.1 FIXTURE STANDARDS

Plumbing fixtures, plumbing fixture trim, and plumbing appliances shall comply with the standards listed in Table 3.1.3.

7.2 FIXTURES FOR ACCESSIBLE USE

Plumbing fixtures for accessible use and their installation shall confirm to the requirements of the Authority Having Jurisdiction.

7.3 INSTALLATION

7.3.1 General

Plumbing fixtures, fixture trim, and plumbing appliances shall be installed in accordance with the requirements of this Code and the manufacturer's instructions and recommendations.

7.3.2 Minimum Clearances

For other than accessible applications, minimum clearances between plumbing fixtures and from fixtures to adjacent walls shall be in accordance with Figure 7.3.2.

7.3.3 Access for Cleaning

Plumbing fixtures shall be so installed as to provide access for cleaning the fixture and the surrounding area.

7.3.4 Securing Floor-Mounted Fixtures

Floor-mounted fixtures shall be securely supported by the floor or floor/wall structure. No strain shall be transmitted to the connecting piping. Fastening screws or bolts shall be corrosion-resisting.

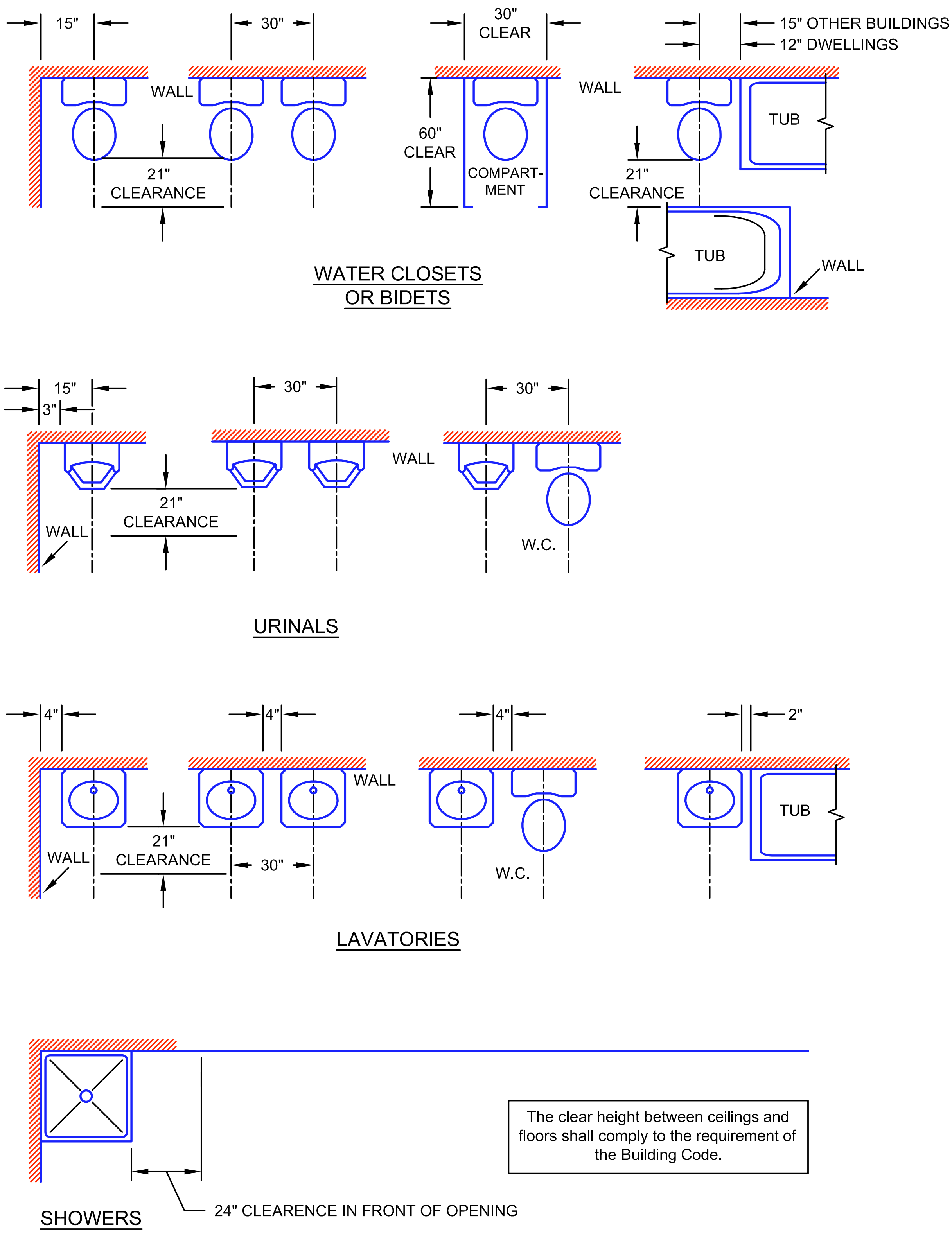

Figure 7.3.2
MINIMUM FIXTURE CLEARANCES

7.3.5 Supporting Wall-Hung Fixtures

a. Wall-hung water closets shall be supported by concealed metal carriers that transmit the entire weight of the fixture to the floor and place no strain on the wall or connecting piping. Supports of this design shall comply with ASME A112.6.1.

b. Free-standing lavatories, wall-hung urinals, water closets with or without concealed tanks and other wall-mounted fixtures shall be supported by a concealed or exposed finished wall hanger plate or equivalent that transmits the weight of the fixture to the wall structure, if adequate, or to the floor without placing strain on the piping. Such supports shall comply with ASME A112.6.2 or ASME A112.19.12. In addition to the wall support brackets, pedestals or legs may provide additional support for pedestal lavatories.

7.3.6 Orientation and Operation of Faucets

Where fixtures are supplied with both hot and cold water, the faucet(s) and supply piping shall be installed so that the hot water is controlled from the left side of the fixture or faucet when facing the controls during fixture use.
EXCEPTION: Single handle and single control valves for showers and tub/shower combinations where the hot and cold temperature orientation is marked on the fitting surface.

7.3.7 Access to Concealed Connections

Where fixtures have drains with concealed slip joint connections or incorporate a cleanout plug, a means of access shall be provided for inspection and repair. Such access is not required for connections that are soldered, threaded, solvent cemented, or equivalently secured.

7.3.8 Joints with Walls and Floors

Joints where fixtures contact walls and floors shall be caulked or otherwise made water-tight.

7.4 WATER CLOSETS

7.4.1 Compliance

Vitreous china water closets shall comply with ASME A112.19.2M. Plastic water closets shall comply with ANSI Z124.4.

7.4.2 Water Conservation

Water closets, whether operated by flush tank, flushometer tank, or flushometer valve, shall comply with ASME A112.19.2M and shall be the low-consumption type having an average consumption of not more than 1.6 gallons per flush when tested in accordance with ASME A112.19.6.
EXCEPTION: Blow-out water closets and clinical sinks.

7.4.3 Contour of Bowls

Water closets shall have elongated bowls with open-front seats.
EXCEPTIONS:

(1) Water closets having closed-front seats and either round or elongated bowls shall be permitted in dwelling units.

(2) Water closets having closed-front seats that are protected by automated seat cover protection.

(3) A water closet in a private office toilet room, intended for the exclusive use of one individual.

(4) Water closets intended for use in pre-school and kindergarten facilities.

7.4.4 Bowl Height

The height of water closet bowls shall be a minimum of 13½ inches from the floor to the top of the rim.
EXCEPTIONS:
(1) Bowls intended for children's use (5 years and younger) are permitted to be 9-1/2" to 10-1/2" high to the rim and juvenile use (6-12 years) are permitted to be 10-1/2" to 13-1/2" high to the rim.
(2) The height of bowls intended specifically for children's accessible use (12 years and younger) shall be such that the top of the seat is 11" to 17" above the floor and comply with Section 7.2.
(3) The height of bowls intended specifically for adult accessible use (13 years and older) shall be such that the top of the seat is 17" to 19" above the floor and comply with Section 7.2.

7.4.5 Water Closet Seats

Seats for water closets shall be of smooth, non-absorbent materials, be properly sized to fit the water closet bowl, and comply with ANSI Z124.5
EXCEPTION: Water closet seats in dwelling units are not required to comply with ANSI Z124.5.

7.4.6 Hotels, Motels, Dormitories, and Boarding Houses

Water closets in hotels, motels, dormitories, boarding houses and similar occupancies shall be the elongated type complying with ASME A112.19.2 or ANSI Z124.4, and ASME A112.19.6 and with open-front seats complying with ANSI Z124.5
EXCEPTIONS:
(1) Closed-front seats shall be permitted in hotel and motel guest rooms.
(2) Closed-front seats that are provided with automatic seat cover protection.

7.4.7 Prohibited Water Closets

Water closets not having a visible trap seal or having either unventilated spaces or walls that are not washed at each discharge shall be prohibited.

7.4.8 Macerating Toilet Systems

Macerating toilet systems and related components shall comply with ASME A112.3.4 or CSA B45.9.

7.5 URINALS

7.5.1 Compliance

a. Urinals with a non-visible water trap seal and/or strainer shall be equipped with an automatic flushing device.
b. Vitreous china urinals shall comply with ASME A112.19.2.
c. Plastic urinals, including female urinals, urinals for the physically impaired, and waterless male urinals, shall comply with ANSI Z124.9.

7.5.2 Water Conservation

Water-fed urinals shall be the low-consumption type having an average water consumption of not more than 1.0 gallon per flush when tested in accordance with ASME A112.9.6.

7.5.3 Surrounding Surfaces

Urinals shall not be installed where wall and floor surfaces are not waterproof and do not have a smooth, readily cleanable, non-absorbent surface extending not less than four feet above the floor and one foot to each side of the urinal, and one foot in front of the lip of the urinal.

7.5.4 Prohibited Urinals

Trough urinals and urinals having walls that are not washed at each discharge shall be prohibited.
EXCEPTION: Waterless urinals complying with ANSI Z124.9.

7.6 LAVATORIES

7.6.1 Compliance

a. Lavatories shall comply with the following standards:
1. Ceramic, non-vitreous; ASME A112.19.9M
2. Enameled cast-iron; ASME A112.19.1M
3. Enameled steel; ASME A112.19.4M
4. Plastic; ANSI Z124.3
5. Stainless steel; ASME A112.19.3M
6. Vitreous china; ASME A112. 19.2M

7.6.2 Water Conservation

a. Except as required under Section 7.6.2.c, lavatory faucets shall be designed and manufactured so that they will not exceed a water flow rate of 2.2 gallons per minute when tested in accordance with ASME A112.18.1.

b. Public lavatory faucets, other than the metering type, shall be designed and manufactured according to ASME A112.18.1.

c. Self-closing or self-closing/metering faucets shall be installed on lavatories intended to serve the transient public, such as those in, but not limited to, service stations, train stations, airport terminals, restaurants, and convention halls. Metering faucets shall deliver not more than 0.25 gallon of water per use when tested in accordance with ASME A112.18.1. Self-closing faucets shall be designed and manufactured so that they will not exceed a water flow rate of 0.5 gallon per minute when tested in accordance with ASME A112.18.1.

7.6.3 Waste Outlet

The waste outlet pipe on individual lavatories shall be not less than 1-1/4" nominal size. A strainer, pop-up stopper, crossbar grid, or other device shall be provided to protect the waste outlet.

7.6.4 Integral Overflow

Where lavatories include an integral overflow drain, the waste fitting shall be designed and installed so that standing water in the bowl of the fixture cannot rise in the overflow channel when the drain is closed, nor shall any water remain in the overflow channel when the bowl is empty. The overflow shall drain to the inlet side of the fixture trap.

7.6.5 Lavatory Equivalent

Where group-type wash fountains or wash sinks are used to satisfy the number of lavatories required by 7.21.1, each 18-inch usable length of rim having an available water spray shall be considered as one lavatory.

7.7 BIDETS

7.7.1 Compliance

Vitreous china bidets shall comply with ASME A112.19.2M. Bidet faucets shall comply to ASME A112.18.1.

7.7.2 Backflow Prevention

Bidets having integral flushing rims shall have a vacuum breaker assembly on the mixed water supply to the fixture. Bidets without flushing rims shall have an over-the-rim supply fitting providing the air gap required by Chapter 10.

7.7.3 Integral Overflow

Where bidets include an integral overflow drain, the waste fitting shall be designed and installed so that standing water in the bowl of the fixture cannot rise in the overflow channel when the drain is closed, nor shall any water remain in the overflow channel when the bowl is empty. The overflow shall drain to the inlet side of the fixture trap.

7.8 BATHTUBS

7.8.1 Compliance

a. Bathtubs shall comply with the following standards:
   1. Plastic, cultured marble and other synthetic products or finishes; ANSI Z124.1
   2. Enameled cast-iron; ASME A112.19.1
   3. Enameled steel; ASME A112.19.4
   4. Bathtubs with pressure sealed doors; ASME A112.19.15

7.8.2 Waste and Overflow

Bathtubs shall have waste outlet and overflow pipes not less than 1-1/2" nominal size. Waste outlets shall be equipped with a pop-up waste, chain and stopper, or other type of drain plug.

7.8.3 Combination Bath/Showers

Shower heads, including the hand-held type, shall be designed and manufactured so that they will not exceed a water supply flow rate of 2.5 gallons per minute when tested in accordance with ASME A112.18.1. The control of mixed water temperatures to bath/shower combinations shall comply with Section 10.15.6. Surrounding wall construction shall be in accordance with Section 7.10.5.e. Riser pipes to shower heads shall be secured in accordance with Section 7.10.7.

7.8.4 Backflow Prevention

Unless equipped with an atmospheric backflow preventer in accordance with ASSE 1001 or ASME A112.18.7, the bathtub filler shall be equipped with an air gap between the end of the over-rim tub filler spout and the overflow rim of the tub that complies with Section 10.5.

7.9 WHIRLPOOL BATHS

7.9.1 General

The requirements of Section 7.8 for bathtubs shall also apply to whirlpool baths. The provisions for wet venting in Section 12.10 shall also apply to whirlpool baths.

7.9.2 Compliance

Whirlpool bathtubs shall comply with ASME A112.19.7M.

7.9.3 Drainage

The arrangements of circulating piping and pumps shall not be altered in any way that would prevent the pump and associated piping from draining after each use of the fixture.

7.9.4 Access

One or more removable panels shall be provided where required for access to pumps, heaters, and controls, as recommended by the fixture manufacturer.

7.10 SHOWERS

7.10.1 Compliance

Plastic shower receptors and stalls shall comply with ANSI Z124.2.

7.10.2 Water Conservation

Shower heads shall be designed and manufactured so that they will not exceed the flow rate for shower head specified in ASME A112.18.1M.
EXCEPTION: Emergency safety showers.

7.10.3 Control of Mixed Water Temperature

The control of mixed water temperatures shall comply with Section 10.15.6.

7.10.4 Shower Waste Outlet

a. For a shower with a single shower head, the waste outlet connection shall be not less than 1-1/2" inches nominal size and for a shower with multiple shower heads shall be not less than 2 inches nominal size and have a removable strainer not less than 3 inches in diameter with ¼" minimum openings.
EXCEPTIONS:

(1) Bathubs with overhead showers.

(2) Waste outlets shall be securely connected to the drainage system.

(3) In group showers where each shower space is not provided with an individual waste outlet, the waste outlet(s) shall be so located and the floor so pitched that waste water from one outlet does not flow over the floor area serving another outlet.

7.10.5 Shower Compartments

a. The minimum outside rough-in dimension for shower bases and prefabricated shower compartments shall be 32 inches,

b. The minimum rough-in depth for prefabricated tub/shower combinations shall be 30 inches.

c. Where shower compartments have glass enclosures or field-constructed tile walls, the compartment shall provide clearance for a 30 inch diameter circle with the door closed.

d. The minimum rough-in depth for shower compartments that replace existing bathtubs shall be no less than the rough-in depth of the bathtub that they replace. Such enclosures shall provide not less than 900 square inches of inside clear floor area,

e. The walls in shower compartments and above built-in bathtubs having installed shower heads shall be constructed of smooth. non-corrosive. non-absorbent waterproof materials that extend to a height of not less than 68 inches above the fixture drain.

f. The joints between walls and with bathtubs and shower compartment floors shall be water-tight.

7.10.6 Shower Floors or Receptors

a. Floors or receptors for shower compartments shall be laid on or be supported by a smooth and structurally sound base.

b. Shower pans shall be provided under the floors of shower compartments.

EXCEPTION: Shower pans shall not be required when prefabricated shower receptors are used.

c. Shower pans shall form a watertight lining beneath the shower floor.

d. Shower pans shall turn up at least 2 inches above the finished threshold level on all sides.

e. Shower pans shall be securely fastened to the shower waste outlet at the seepage entrance, making a watertight joint between the pan and the waste outlet.

f. Finished shower floor surfaces shall be smooth, non-corrosive, non-absorbent, and waterproof.

7.10.7 Water Supply Riser

Whether exposed or concealed, the water supply riser pipe from the shower control valve(s) to the shower head outlet shall be secured to the wall structure.

7.11 SINKS

7.11.1 Compliance

a. Sinks shall comply with the following standards:

1. Enameled cast-iron; ASME A112.19.1M
2. Enameled steel; ASME A112.19.4M
3. Stainless steel; ASME A112.19.3M
4. Plastic; ANSI Z124.6.

7.11.2 Kitchen Sinks and Bar Sinks

a. Each compartment in a kitchen sink or bar sink shall have an outlet suitable for either a domestic food waste grinder or a basket strainer. The waste outlet pipe for each compartment shall be 1-1/2" nominal size. Outlet fittings shall have crossbars or other provisions for protecting the drain outlet and shall include a means of closing the drain outlet.

b. Faucets for kitchen sinks and bar sinks shall be designed and manufactured so that they will not exceed a water flow rate of 2.2 gallons per minute when tested in accordance with ASME A112.18.1M.

7.11.3 Laundry Sinks

a. Sinks for laundry use shall be not less than 12 inches deep with a strainer and waste outlet connection not less than 1-1/2" nominal size.

b. Utility faucets for laundry sinks shall comply with ASME A112.18.1.

7.11.4 Service Sinks and Mop Receptors

a. Service sinks and mop receptors shall have removable strainers and waste outlet connections not less than 2" nominal size.

b. Service sinks and mop receptors shall not be installed where walls and floors are not waterproof and do not have a smooth, readily cleanable surface at least one foot in front of the sink or receptor, at least one foot on each side, and up to a point one foot above the faucet height.

7.11.5 Sink Faucets

a. Sink faucets having a hose thread or other means of attaching a hose to the outlet shall be protected from back-siphonage by either an integral vacuum breaker, an atmospheric vacuum breaker attached to the outlet, or pressure-type vacuum breakers on the fixture supply lines.

b. Faucets for kitchen sinks shall be designed and manufactured so that they will not exceed the flow rate for kitchen faucet specified in ASME A112.18.1M.

7.12 DRINKING FOUNTAINS AND WATER COOLERS

7.12.1 Compliance

Refrigerated drinking fountains and water coolers shall comply with ARI 1010 and UL 399.

7.12.2 Prohibited Locations

Drinking fountains or water coolers shall not be located in public toilet rooms.
EXCEPTION: Convertible lavatory faucets and fixture fittings that provide a discharge stream similar to a drinking fountain shall be permitted in bathrooms in dwelling units.

7.13 AUTOMATIC CLOTHES WASHERS

7.13.1 Compliance

Automatic clothes washers shall comply with AHAM HLW-2PR or ASSE 1007, and shall have an air gap incorporated in the internal tub fill line.

7.14 FOOD-WASTE-GRINDER UNITS

7.14.1 Compliance

Domestic food-waste-grinder units shall comply with UL 430 and either AHAM FWD-1 or ASSE 1008.

7.14.2 Domestic Units

Domestic food-waste-grinder units shall have not less than a 1-1/2" nominal waste connection to the drainage system. Such units may connect to a kitchen sink drain outlet, as permitted under Section 7.11.2.a.

7.14.3 Commercial Units

Commercial food-waste-grinder units shall be connected to the drainage system and be separately trapped from any sink compartment or other fixture. The waste pipe size for such fixtures shall be of sufficient size to serve the fixture but shall be not less than 2-inch nominal size.

7.14.4 Water Supply

An adequate supply of water shall be provided for proper operation of food-waste-grinders.

7.15 DISHWASHING MACHINES

7.15.1 Compliance

Domestic dishwashing machines shall comply with UL 749 and either AHAM DW-2PR or ASSE 1006. Commercial dishwashing machines shall comply with UL 921 and ASSE 1004. The water supply to dishwashing machines shall be protected from back-siphonage by an integral air gap or other internal means.

7.15.2 Residential Sink and Dishwasher

The discharge from a residential kitchen sink and dishwasher may discharge through a single 1-1/2" trap. The discharge line from the dishwasher shall be not less than the size recommended by the dishwasher manufacturer. It shall either be looped up and securely fastened to the underside of the counter or be connected to a deck-mounted dishwasher air gap fitting. The discharge shall then be connected to a branch inlet wye fitting between the sink waste outlet and the trap inlet.

7.15.3 Residential Sink, Dishwasher, and Food-Waste-Grinder

The discharge from a residential kitchen sink, dishwasher, and food-waste-grinder may discharge through a single 1-1/2" trap. The discharge line from the dishwasher shall be not less than the size recommended by the dishwasher manufacturer. It shall either be looped up and securely fastened to the underside of the counter or be connected to a deck-mounted dishwasher air gap fitting. The discharge shall then be connected either to the chamber of the food-waste-grinder or to a branch inlet wye fitting between the food-waste-grinder outlet and the trap inlet.

7.15.4 Commercial Dishwashing Machine

a. Commercial dishwashing machines shall be indirectly connected to the drainage system through either an air gap or an air break. When the machine is within 5 feet developed length of a trapped and vented floor drain, an indirect waste pipe from the dishwasher may be connected to the inlet side of the floor drain trap.

b. Commercial dishwashers shall be permitted to discharge through a grease interceptor in accordance with Section 6.4.2.

7.16 FLOOR AND TRENCH DRAINS

7.16.1 Compliance

Floor and trench drains shall comply with ASME A112.6.3 or ASME A112.3.1.

7.16.2 Trap Seal and Strainer

a. Floor drains shall have a water seal of not less than 2 inches and shall be fitted with a removable strainer. The free open area of strainers shall be at least 2/3 of the cross-sectional area of the nominal drain outlet size.

b. Where infrequently used floor drains are subject to evaporation of their trap seals, they shall either 1) be provided with a 4-inch trap seal, 2) be fed from an automatic trap priming device, or 3) be arranged as otherwise approved by the Authority Having Jurisdiction.

7.16.3 Size of Floor Drains

a. Floor drains and their branch piping shall be sized on the basis of their normal, expected flow rate. Floor drains shall be not less than 2" nominal size.

b. If provided for emergency showers and eyewash stations, floor drains and their fixture drain branches shall be sized for the GPM discharge capacity of the shower or eyewash, but the drainage fixture unit (DFU) loading on the sanitary drainage system shall be zero (0.0 DFU).

7.16.4 Required Locations for Floor Drains

a. Floor drains shall be installed in the following areas:

1. Toilet rooms containing either two or more water closets or wall hung urinals or a combination of one or more water closets and wall hung urinals, except in a dwelling unit.
2. Commercial kitchens.
3. Common laundry rooms in commercial buildings and buildings having more than two dwelling units.

7.16.5 Walk-in Coolers and Freezers

Floor drains located in walk-in coolers and walk-in freezers where food or other products for human consumption are stored shall be indirectly connected to the drainage system in accordance with Section 9.1.6.

7.16.6 Floor Slope

Floors shall be sloped to floor drains where drainage occurs on a regular or frequent basis, or as otherwise required by the Authority Having Jurisdiction.

7.17 GARBAGE CAN WASHERS

Garbage can washers shall include a removable basket or strainer to prevent large particles of garbage from entering the drainage system. The water supply connection shall be protected from back-siphonage in accordance with Chapter 10. Garbage can washers shall be trapped and vented as required for floor drains.

7.18 SPECIAL INSTALLATIONS

7.18.1 Protection of Water Supply

The water supply to special installations shall be protected from backflow in accordance with Chapter 10. Examples of such special installations include decorative fountains, ornamental pools, waterfalls, swimming and wading pools, baptisteries, and similar custom-built equipment.

7.18.2 Approval

Special installations requiring water supply and/or drainage shall be submitted to the Authority Having Jurisdiction for approval.

7.19 FLUSHING DEVICES FOR WATER CLOSETS AND URINALS

7.19.1 General

Appropriate flushing devices shall be provided for water closets, urinals, clinical sinks, and other fixtures that depend on trap siphonage to discharge the contents of the fixture.

7.19.2 Separate Devices

A separate flushing device shall be provided for each fixture.
EXCEPTION: A single device may be used to automatically flush two or more urinals.

7.19.3 Flush Tanks: Gravity, Pump Assisted, Vacuum Assisted.

a. Flush tanks shall have ballcocks or other means to refill the tank after each discharge and to shutoff the water supply when the tank reaches the proper operating level. Ballcocks shall be the anti-siphon type and comply with ASSE 1002.

b. Except in approved water closet and flush tank designs, the seat of the tank flush valve shall be at least 1 inch above the flood level rim of the fixture bowl.

c. The flush valve shall be designed so that it will close tightly if the tank is flushed when the fixture drain is clogged or partly restricted, so that water will not spill continuously over the rim of the bowl or backflow from the bowl to the flush tank.

d. Flush tanks shall include a means of overflow into the fixture served having sufficient capacity to prevent the tanks from overflowing with normal flow through the fill valve.

7.19.4 Flushometer Tanks (Pressure Assisted)

Flushometer tanks (pressure assisted) shall comply with ASSE 1037 and shall include built-in pressure regulation and backflow prevention devices.

7.19.5 Flushometer Valves

Flushometer valves shall comply with ASSE 1037 and include a vacuum breaker assembly and means of flow adjustment. Flushometer valves shall be accessible for maintenance and repair.

7.19.6 Required Water Pressure

The available water supply pressure shall be adequate for proper operation of the particular flushing devices used, as recommended by the manufacturer.
NOTE: Some one-piece tank-type water closets require 30 psig flowing pressure and 1/2" supplies for proper operation.

7.20 FIXTURES FOR DETENTION AND CORRECTIONAL INSTITUTIONS

Special design fixtures for use in detention and correctional institutions shall comply with the requirements of this Code except that fixtures may be fabricated from welded seamless stainless steel and be equipped with necessary security devices. Water closets shall be the elongated type with integral or separate seats. Urinals shall have a continuous flushing rim that washes all four walls of the fixture.

7.21 MINIMUM NUMBER OF REQUIRED FIXTURES

7.21.1 Number of Fixtures

Plumbing fixtures shall be provided for the type of building occupancy and in the numbers not less than those shown in Tables 7.21.1.

7.21.2 Occupant Load

a. The minimum number of plumbing fixtures shall be based on the number of persons to be served by the fixtures, as determined by the person responsible for the design of the plumbing system.

b. Where the occupant load is not established and is based on the egress requirements of a building code, the number of occupants for plumbing purposes shall be permitted to be reduced to two-thirds of that for fire or life safety purposes.

c. Wherever both sexes are present in approximately equal numbers, the total occupant load shall be multiplied by 50 percent to determine the number of persons of each sex to be provided for, unless specific information concerning the percentage of male and female occupants is available.

d. Plans for plumbing systems, where required, shall indicate the maximum number of persons to be served by the facilities.

e. In occupancies having established seating, such as auditoriums and restaurants, the number of occupants for plumbing purposes shall not be less than the number of seats.

7.21.3 Access to Fixtures

a. In multi-story buildings, accessibility to the required fixtures shall not exceed one vertical story.

b. Fixtures accessible only to private offices shall not be counted to determine compliance with this section.

c. The lavatories required by Tables 7.21.1 for employee and public toilet facilities shall be located within the same toilet facility as their associated water closets and urinals.

7.21.4 Separate Facilities

a. Separate toilet facilities shall be provided for each sex.

EXCEPTIONS:

(1). Residential installations.

(2). In occupancies serving 15 or fewer people, one toilet facility, designed for use by no more than one person at a time, shall be permitted for use by both sexes.

(3). In business occupancies with a total floor area of 1500 square feet or less, one toilet facility, designed for use by no more than one person at a time, shall satisfy the requirements for serving customers and employees of both sexes.

(4). In mercantile occupancies with a net occupiable floor area of 1500 square feet or less that is accessible to customers, one toilet facility designed for use by no more than one person at a time, shall satisfy the requirements for serving customers and employees of both sexes.

7.21.5 Substitution and Omission of Fixtures

a. Urinals: Not more than 50% of the required number of water closets may be substituted with urinals.

b. Drinking Water Facilities: A kitchen or bar sink shall be considered as meeting the requirements for drinking water facilities for employees.

c. Laundry Trays: Multiple dwelling units or boarding houses without public laundry rooms shall not require laundry trays.

d. Service Sinks: Service sinks may be omitted when the Authority Having Jurisdiction determines that they are not necessary for proper cleaning of the facility.

7.21.6 Fixture Requirements for Special Occupancies

a. Additional fixtures may be required when unusual environmental conditions or special activities are encountered.

b. In food preparation areas of commercial food establishments, fixture requirements may be dictated by the health and/or sanitary codes. Fixtures, fixture compartments and appliances used for rinsing or sanitizing equipment or utensils, processing or preparing food for sale or serving, shall be installed in accordance with Section 9.1.1 to ensure the required protection from backflow and flooding.

c. Types of occupancy not shown in Tables 7.21.1 shall be considered individually by the Authority Having Jurisdiction.

d. Where swimming pools operated by an apartment building, condominium, or similar multi-family dwelling unit are restricted to the use of residents and guests of residents of dwelling units in the immediate vicinity of the pool, the minimum required toilet facilities for bathers within the pool compound shall be one (1) male toilet room and one (1) female toilet room, each consisting of a water closet and lavatory as a minimum.

e. Hand washing facilities shall be provided in each examination room in a doctor's office or medical office.

7.21.7 Facilities in Mercantile and Business Occupancies Serving Customers

a. Requirements for customers and employees shall be permitted to be met with a single set of restrooms accessible to both groups. The required number of fixtures shall be the greater of the required number for employees or the required number for customers.

b. Fixtures for customer use shall be permitted to be met by providing a centrally located facility accessible to several stores. The maximum distance of entry from any store to this facility shall not exceed 500 feet.

c. In stores with a floor area of 150 square feet or less, the requirement to provide facilities for employees shall be permitted to be met by providing a centrally located facility accessible to several stores. The maximum distance of entry from any store to this facility shall not exceed 300 feet.

d. Drinking water facilities are not required for customers where normal occupancy is short term.

e. For establishments less than 1500 square feet in total floor area, one water closet and one lavatory in a restroom with a lockable door shall be permitted to provide the requirements for serving the customers and employees.

7.21.8 Food Service Establishments

a. Food service establishments with an occupant load of 101 or more customers shall be provided with separate toilet facilities for employees and customers. Customer and employee toilet facilities may be combined for customer loads of 100 or less. For employees of 15 or less, one toilet facility, designed for use by no more than one person at a time, shall be permitted for use by both sexes.

b. Drinking water facilities are not required in restaurants or other food service establishments if drinking water service is provided.

7.22 WATER TREATMENT SYSTEMS

Water softeners, reverse osmosis water treatment units, and other drinking water treatment systems shall meet the requirements of the appropriate standards listed in Table 3.1.3. Waste discharge from such equipment shall enter the drainage system through an air gap.

7.23 SAFETY FEATURES FOR SPAS AND HOT TUBS

7.23.1 Spas and Hot Tubs

Spas and hot tubs shall comply with the requirements of subsections 7.23.2, 7.23.3, and 7.23.4.

7.23.2 Entrapment Avoidance

There shall be nothing in the spa or hot tub that can cause the user to become entrapped underwater. Types of entrapment can include, but not be limited to, rigid, non-giving protrusions, wedge-shaped openings, and any arrangement of components that could pinch and entrap the user.

7.23.3 Outlets Per Pump

There shall be a minimum of two (2) suction outlets for each pump in the suction outlet system, separated by at least 3 feet or located on two (2) different planes, such as one on the bottom and one on a vertical wall, or one on each of two vertical walls. The suction outlets shall be piped so that water is drawn through the outlets simultaneously by a common suction line to the pump. Blocking one suction outlet shall not create excessive suction at other suction outlets.

7.23.4 Obstructions and Entrapment Avoidance

Where vacuum cleaning fittings are provided, they shall be located outside of the spa or hot tub and shall not be accessible to the spa or hot tub user.

7.24 EMERGENCY EQUIPMENT

Emergency showers and eyewash stations shall comply with ANSI Z358.1

Table 7.21.1
MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES - Page 1

No.	Classification	Use Group	Description	No. Of Persons of Each Sex	Water Closets (Urinals) Male	Water Closets (Urinals) Female	Lavatories Male	Lavatories Female	Drinking Water Facilities	Bath or Shower	Other
1	Assembly	A-1	Theatres and other buildings for the performing arts and motion pictures usually with fixed seats	1 - 50	1	1	1	2	1 per 1000 people		1 service sink per floor
				51 - 100	add 1	add 1	add 0	add 1			
				101 - 200	add 1	add 2	add 1	add 1			
				201 - 300	add 1	add 1	add 0	add 1			
			See Notes: 4, 6, 9, 12, 16	ea. add'l. 300 over 300	add 1	add 2	add 1	add 2			
		A-2	Dance halls, nightclubs and for similar purposes.	1 - 25	1	1	1	2	1 per 200 people		1 service sink per floor
				26 - 50	add 1	add 1	add 1	add 1			
				51 - 100	add 1	add 2	add 1	add 0			
			See Notes: 2, 3, 4, 6, 9, 12, 13, 16	ea. add'l. 200 over 100	add 1	add 2	add 1	add 2			
		A-3	a) Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, restaurants other than nightclubs, food courts.	1 - 50	1	1	1	1	1 per 1000 people		1 service sink per floor
				51 - 100	add 1	add 1	add 0	add 1			
				101 - 200	add 1	add 2	add 1	add 1			
				201 - 300	add 1	add 1	add 0	add 1			
			b) Places of worship and other religious services. Churches without assembly halls See Notes: 4, 6, 9, 12, 16	ea. add'l. 300 over 300	add 1	add 2	add 1	add 2			
		A-4 and A-5	a) Arenas, convention halls, outdoor assembly including grandstands, bleachers, coliseums, stadiums, amusement park structures, fair and carnival structures, passenger terminals.	1 - 100	2	2	1	2	1 per 1000 people		1 service sink per floor
				101 - 200	add 2	add 3	add 1	add 2			
				201 - 400	add 2	add 5	add 0	add 1			
				ea. add'l. 200 up to 2,600	add 1	add 2	add 2	add 2			
			See Notes: 2, 3, 4, 6, 9, 12, 13, 16	ea. add'l. 300 over 2,600	add 1	add 2	add 2	add 2			
			b) Recreational facilities: includes health spas, golf courses, public swimming pools and similar uses.	1 - 40	1	2	1	2	1 per 75 people	1 shower per 15 people over 150 add 1 per 30 people	1 service sink per floor
			See Notes: 2, 3, 4, 6, 9, 12, 16	ea. add'l. 40 over 40	add 1	add 2	add 1	add 2			

Table 7.21.1
MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES - Page 2

No.	Classification	Use Group	Description	No. Of Persons of Each Sex	Water Closet (Urinals) Male	Water Closet (Urinals) Female	Lavatories Male	Lavatories Female	Drinking Water Facilities	Bath or Shower	Other
2	Business	B	Buildings for the transaction of business, professional services, other services involving merchandise, office buildings, banks, light industrial and similar uses.	1 - 15	1	1	1	1	1 per 100 people		1 service sink per floor
				16 - 40	add 1	add 1	add 0	add 1			
				41 - 75	add 1	add 1	add 1	add 1			
			See Notes: 2, 4, 6, 7, 12, 15, 16	ea. add'l. 60 over 75	add 1	add 2	add 1	add 2			
3	Education	E	a) Educational facilities: Preschool, Day Care, Kindergarten	1 - 15	1	1	1	1	1 per 100 people		1 service sink per floor
				16 - 30	add 1	add 1	add 1	add 1			
				31 - 45	add 1	add 1	add 1	add 1			
				46 - 60	add 1	add 1	add 1	add 1			
				61 - 75	add 1	add 1	add 1	add 1			
				76 - 90	add 1	add 1	add 1	add 1			
			See Notes: 4, 6, 9, 16	ea. add'l. 30 over 90	add 1	add 1	add 1	add 2			
			b) Elementary Grades 1 – 5	1 - 25	1	1	1	2	1 per 100 people		1 service sink per floor
				26 - 50	add 1	add 1	add 1	add 1			
				51 - 75	add 1	add 1	add 1	add 1			
				76 - 100	add 1	add 1	add 1	add 1			
			See Notes: 4, 6, 9, 16	ea. add'l. 50 over 100	add 1	add 1	add 1	add 2			
			c) Secondary Grades 6 – 12 and higher education facilities	1 - 30	1	1	1	2	1 per 100 people		1 service sink per floor
				31 - 60	add 1	add 1	add 1	add 1			
				61 - 90	add 1	add 1	add 1	add 1			
				91 - 120	add 1	add 1	add 1	add 1			
			See Notes: 4, 6, 9, 16, 17	ea. add'l. 60 over 120	add 1	add 2	add 1	add 2			
4	Factory and Industrial	F-1 and F-2	Structures in which occupants are engaged in work fabricating, assembling or processing products or materials.	1 - 10	1	1	1	1	1 per 75 people	1 emergency shower per 10 people when exposed to skin contamination	1 service sink per floor 1 emerg. shower and eye wash
				11 - 25	add 1	add 1	add 0	add 1			
				26 - 50	add 1	add 1	add 1	add 1			
				51 - 75	add 1	add 1	add 0	add 1			
				76 - 100	add 1	add 1	add 1	add 2			
			See Notes: 4, 6, 9, 12, 16	ea. add'l. 50 over 100	add 2	add 2	add 2	add 2			

Table 7.21.1
MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES - Page 3

No.	Classification	Use Group	Description	No. Of Persons of Each Sex	Water Closets (Urinals)		Lavatories		Drinking Water Facilities	Bath or Shower	Other
					Male	Female	Male	Female			
5	Institutional	I-1	Six or more individuals in a supervised environment. Group homes. Alcohol and drug centers, convalescent facilities, hospital wards. See Notes: 4, 16	1 - 8 patients	1	1	½ of required water closets		1 per 100 people	1 per 20 people	1 service sink per floor
				ea. add'l. 8 over 8	add 1	add 1					
		I-2	a) Buildings, with six or more individuals, used for medical, surgical, psychiatric, nursing or custodial care. b) Hospital rooms: private or semi-private.		1 water closet per patient room		1 per patient room			1 per patient room	1 service sink per floor
		I-3	Buildings, with six or more persons under some restraint or security: a) Detention centers (short term). See Notes: 4, 14,16		1 per cell or 1 per 4 inmates		1 per cell or 1 per 4 inmates			1 per 6 inmates	1 service sink per floor
			b) Prisons, jails and reformatories (long term). See Notes: 4, 14, 16		1 per cell or 1 per 8 inmates		1 per cell or 1 per 8 inmates			1 per 15 inmates	1 service sink per floor
6	Mercantile	M	Buildings occupied for display and sales purposes. Retail stores, service stations, shops, salesrooms, markets and shopping centers. See Notes: 2, 4, 6, 7, 12, 15, 16	1 – 50	1	1	1	1	1 per 1000 people		1 service sink per floor
				51 – 150	add 1	add 1	add 0	add 1			
				151 – 300	add 0	add 1	add 0	add 2			
				ea. add'l. 300 over 300	add 1	add 2	add 1	add 2			

Table 7.21.1
MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES - Page 4

No.	Classification	Use Group	Description	No. Of Persons of Each Sex	Water Closets (Urinals)		Lavatories		Drinking Water Facilities	Bath or Shower	Other
					Male	Female	Male	Female			
7	Residential	R-1	a) Hotels, motels.		1 water closet per guest room		1 per guest room			1 per guest room	1 service sink per floor
			b) Dormitories and boarding houses.	1 – 20	2	2	1	2	1 per 100 or 1 per floor	2 ea. add'l. 20 add 1	1 service sink per floor 1 laundry tray per 100
			See Notes: 4, 6, 9, 10, 16	ea. add'l. 20 over 20	add 1	add 2	add 1	add 2			
		R-2	Multi-family dwellings. See Note: 4, 10		1 water closet per unit		1 per unit			1 per unit	1 kitchen sink per unit 1 laundry tray per 100
		R-3 R-4	One and two-family dwellings, Detached one and two-family dwellings		1 water closet per unit		1 per unit			1 per unit	1 kitchen sink
8	Storage	S-1	Structures for the storage of goods, warehouses, storehouses and freight depots. Moderate hazard.		1 water closet per unit		1 per unit			1 per unit	1 service sink per unit
		S-2	Structures for the storage of goods, warehouses, storehouses and freight depots. Low hazard. See Notes: 1, 4, 6, 18, 19								
9	Utility and Miscellaneous	U-1	Accessory buildings: Barns, carports, stables, sheds, greenhouses.	No fixtures are required							
		U-2	Construction workers	ANSI Z4.3 if non-sewered waste disposal equipment is used							

Notes for Table 7.21.1:

1. This table shall be used unless superseded by the Building Code. For handicap requirements see local, state or national codes. Additional fixtures may be required where environmental conditions or special activities may be encountered.

2. Drinking fountains are not required in restaurants or other food service establishments if drinking water service is available. Drinking water is not required for customers where normal occupancy is short term. A kitchen or bar sink may be used for employee water drinking facilities.

3. In food preparation areas, fixture requirements may be dictated by local Health Codes.

4. Wherever both sexes are present in approximately equal numbers, multiple the total census by 50% to determine the number of persons of each sex to be provided for. This regulation only applies when specific information, that would otherwise affect the fixture count is not provided.

5. Not more than 50% of the required number of water closets may be urinals.

6. In buildings with multiple floors, accessibility to the fixtures shall not exceed one vertical story.

7. Fixtures for public use as required by this section may be met by providing a centrally located facility accessible to several stores. The maximum distance from entry to any store to this facility shall not exceed 500 feet.

8. In stores with floor areas of 150 sq. ft. or less, the requirements to provide facilities for use by employees may be met by providing central facilities located accessible to several stores. The maximum distance from entry to any store from this facility shall not exceed 300 feet.

9. Fixtures accessible only to private offices shall not be counted to determine compliance with this section.

10. Multiple dwellings or boarding houses without public laundry rooms shall not require laundry trays.

11. (Reserved)

12. Requirements for employees and customers may be met with a single set of restrooms.

13. If the design number of customers in food handling establishments exceeds 100, separate facilities for employees and customers are required.

14. Water closet and lavatory may be a combination fixture. All showers and lavatories shall have thermostatic control and timing devices.

15. See Section 7.21.4 and Section 7.21.7 for toilet facilities for occupancies with a total floor area of 1,500 square feet or less.

16. In determining the number of required fixtures for numbers of persons that fall in the "each additional (xx) over (xx)" listings, the requirement applies to fractions of the listed group.

17. Laboratories in higher education facilities shall have safety showers.

18. Warehouse storage area requirements shall be permitted to be met by providing a facility centrally located within the storage area. The maximum travel distance to the facility shall not exceed 500 feet.

19. Multiple individual self storage areas shall be permitted to be met by fixtures located in the facilities administration building. The administration office must be accessible during normal business hours.

Chapter 8

Hangers and Supports

8.1 GENERAL

a. Hangers and anchors shall be securely attached to the building construction at sufficiently close intervals to support the piping and its contents.

b. Fixtures, appliances and equipment shall be connected to support the weight of the device and any additional probable loads that may impact on the device.

c. Fixtures shall be rigidly supported so that no strain is transmitted in the piping connections.

8.2 VERTICAL PIPING

a. Vertical pipe of the following materials shall be supported according to manufacturer's recommendations, but no less than the distances listed below:

1. Cast-iron soil pipe—at base and at each story height.
2. Steel threaded pipe—at every other story height.
3. Copper tube—at each story height but not more than 10-foot intervals.
4. Lead pipe—four-foot intervals.
5. Plastic pipe—see Section 8.7.
6. Flexible plastic tubing—each story height and at mid-story.
7. Stainless steel drainage pipe—at each story height.

8.3 HORIZONTAL PIPING

a. Horizontal pipe of the following materials shall be supported according to manufacturer's recommendations, but not less than the distances listed below:

1. Cast-iron soil pipe—minimum of one hanger per pipe length located within 18 inches of each joint (up to 10-foot maximum pipe length), at changes in direction, and at branch connections. Where pipe is suspended by non-rigid hangers more than 18 inches long, provide lateral support at 25-foot maximum spacing. Lateral support shall consist of either 1) a sway brace or 2) either a change in direction or a branch connection that provides the required lateral support.
2. Steel threaded pipe—3/4-inch size and smaller—10-foot intervals. One-inch size and larger—12-foot intervals.
3. Copper tube (1-1/4 inch size and smaller)—6-foot intervals.
4. Copper tube (1-1/2 inch size and larger)—10-foot intervals.
5. Lead pipe—on continuous metal or wood strips for its entire length.
6. Plastic pipe—see Section 8.7.
7. Flexible plastic tubing—32 inches.
8. Stainless steel drainage pipe—10 foot intervals, changes of direction and branch connections.

8.4 MATERIAL

a. Hangers, anchors, and supports shall be of metal or other material of sufficient strength to support the piping and its contents.

b. Piers shall be of concrete, brick, or other masonry construction.

8.5 STRAIN AND STRESSES IN PIPE

Piping in the plumbing system shall be installed so as to prevent strains and stresses that will exceed the structural strength of the pipe. Provision shall be made for expansion and contraction of the piping. (See Sections 4.1.3 and 4.2.16.)

8.6 BASE OF STACKS

Bases of cast-iron stacks shall be supported on concrete, brick laid in cement mortar, metal brackets attached to the building construction, or by other methods approved by the Authority Having Jurisdiction. Other piping material shall be so anchored as to support the stack at the base.

8.7 SUPPORT OF PLASTIC PIPE

Hangers and straps shall not compress, distort, cut or abrade the piping and shall allow free movement of the pipe. Restraining joints and expansion joints shall be installed as required. Pipe shall be supported at intervals of not more than four feet, at end of branches, and at a change of direction or elevation. Supports shall allow free movement. Vertical piping shall be maintained in straight alignment. Trap arms in excess of three feet shall be supported as close as possible to the trap. Installation shall be in accordance with appropriate standards and manufacturer's instructions.

8.8 UNDERGROUND INSTALLATION

See Section 2.6.

8.9 SEISMIC SUPPORTS FOR PIPING

Where earthquake loads are applicable in accordance with the adopted building code, plumbing piping supports shall be designed and installed for the seismic forces in accordance with the adopted building code.

Chapter 9

Indirect Waste Piping and Special Wastes

9.1 INDIRECT WASTES

9.1.1 General

Drains from fixtures, fixture compartments, equipment, appliances, appurtenances, and other devices requiring protection against contamination from backflow or flooding from the drainage system or other source shall not be directly connected to any soil, waste, or vent pipe. Such drains shall discharge separately through an air gap or, where permitted, an air break.

9.1.2 Air Gaps

The clear air gap between a drain outlet or indirect waste pipe and the flood level rim of an indirect waste receptor or other point of disposal shall be not less than twice the diameter of the effective opening of the drain served, but not less than one inch.

9.1.3 Air Breaks

Where air breaks are permitted, the waste pipe shall be permitted to terminate below the flood level rim of the receptor but shall maintain an air space above the top of the receptor's trap seal. Such indirect waste pipes shall be permitted to connect to the inlet side of the receptor's trap.

9.1.4 Where Indirect Wastes Are Required

Indirect wastes shall be provided for food-handling or food-storage equipment, medical or other sterile equipment, clear-water wastes or discharges, and other drains as required herein.

9.1.5 Food Handling Areas

a. Fixtures and appliances used for the storage, processing, preparation, serving, dispensing, or sale of food shall be drained indirectly. Examples of such fixtures include refrigerated cases, steam kettles, steam tables, potato peelers, egg boilers, coffee urns and brewers, culinary sinks used for soaking or washing food, ice machines, ice storage bins, drink dispensers, and similar equipment or appliances. A separate indirect waste pipe shall be provided for each fixture drain and each shall discharge separately through an air gap or air break into a trapped and vented receptor.

b. Where bar sinks, glass-washing sinks, or other counter sinks cannot be vented according to the requirements of Chapter 12, they shall be permitted to each discharge separately to a trapped and vented receptor through indirect waste pipes providing either an air break or air gap.

EXCEPTIONS:
(1) Indirect drains shall not be required for domestic kitchen sinks or domestic dishwashers.
(2) The rinsing and sanitizing compartments of three-compartment commercial sinks shall be drained indirectly, in accordance with Section 9.1.1, but the pot washing compartment shall discharge to the drainage system through a grease interceptor in accordance with Section 6.1.1.
(3) If a properly vented floor drain is installed immediately adjacent to a sink used for dishwashing, a properly trapped and vented sink or sink compartment shall be permitted to connect directly to the drainage system, on the sewer side of the floor drain trap.

9.1.6 Walk-in Coolers and Freezers

a. If floor drains are located in walk-in coolers or walk-in freezers used for the storage of food or other products for human consumption, they shall be indirectly connected to the sanitary drainage system.
b. Separate indirect waste pipes shall be provided for the floor drains from each cooler or freezer, and each shall discharge separately through an air gap or air break into a trapped and vented receptor.
c. Traps shall be provided in the indirect waste pipe when required under Section 9.2.3.
d. Indirectly connected floor drains may be located in freezers or other spaces where freezing temperatures are maintained, provided that traps are not required under Section 9.2.3. Otherwise, the floor of the freezer shall be sloped to a floor drain located outside the storage compartment.
e. The above requirements do not apply to refrigerated food preparation areas or work rooms.

9.1.7 Medical and Other Sterile Equipment

Stills, sterilizers, and other sterile equipment requiring drainage shall each discharge separately through an air gap into a trapped and vented receptor.

9.1.8 Potable Clear-Water Wastes

Discharges of potable water from the water distribution system, water storage or pressure tanks, water heaters, water pumps, water treatment equipment, boilers, relief valves, backflow prevention devices, and other potable water sources shall be indirect through an air gap.
EXCEPTION: An air break shall be permitted where the potable water supply to boilers, water-cooled equipment, heating and air-conditioning systems, and similar cross-connections is protected by a backflow prevention device in accordance with Section 10.5.

9.1.9 Drinking Fountains and Water Coolers

Drinking fountains and water coolers shall be permitted to discharge indirectly through an air break or air gap. Where such fixtures are connected to a dedicated drainage stack, the fixtures may connect directly to the stack and the stack shall terminate with an air break or air gap.

9.1.10 Air Conditioning Equipment

Where condensate or other drainage from air conditioning or cooling equipment discharges to a drainage system, it shall discharge indirectly to a trapped and vented receptor through an air break or air gap.
EXCEPTION: An air break shall not be permitted where the drain connects to a point in the air conditioning equipment that operates at a pressure below atmospheric.

9.1.11 Swimming Pools

Drainage from swimming pools or wading pools, including pool drains, filter backwash, overflows, and pool deck drains, shall discharge indirectly through an air gap to a trapped and vented receptor.

9.1.12 Relief Valve Discharge Piping

Discharge piping from relief valves and any associated indirect waste piping shall be in accordance with Section 10.16.6.

9.2 INDIRECT WASTE PIPING

9.2.1 Materials and Installation

Indirect waste piping shall be of materials approved for sanitary drainage under Section 3.5.

9.2.2 Pipe Size

Indirect waste piping shall be not less than the nominal size of the drain outlet on the fixture or equipment served.

9.2.3 Fixture Traps

Traps shall be provided at fixtures and equipment connections where the developed length of indirect waste piping exceeds ten feet.
EXCEPTION: Drain lines used for clear-water wastes.

9.2.4 Provisions for Cleaning

Indirect waste piping shall be installed in a manner to permit ready access for flushing and cleaning. Where necessary, cleanouts shall be provided in accordance with Section 5.4.

9.3 INDIRECT WASTE RECEPTORS

9.3.1 General

a. Receptors for indirect wastes shall be properly trapped and vented floor drains, floor sinks, standpipes, open-hub drains, air gap fittings, or other approved fixtures.

b. Receptors shall be of such size, shape, and capacity as required to prevent splashing or flooding by the discharge from any and all indirect waste pipes served by the receptor.

c. Plumbing fixtures that are used for domestic or culinary purposes shall not be used as receptors for indirect wastes, except as follows:

EXCEPTIONS:

(1) In a dwelling unit, a kitchen sink trap, or food waste grinder, shall be permitted to receive the discharge from a dishwasher.

(2) In a dwelling unit, a laundry sink, provided that an air gap is maintained for any potable clear-water waste, shall be an acceptable receptor for:

a. Air conditioning condensate.
b. Automatic clothes washer.
c. Water treatment unit.
d. Water heater relief valve discharge.

(3) A service sink or mop basin shall be an acceptable receptor for air conditioning condensate and any infrequent potable clear-water waste if the required air gap is provided for potable clear-water wastes.

9.3.2 Strainers or Baskets

Floor sinks and floor drains that handle other than clear-water wastes shall include an internal or a readily removable metal basket to retain solids.

9.3.3 Prohibited Locations

Receptors for indirect wastes shall not be located in a toilet room or in any confined, concealed, inaccessible, or unventilated space.
EXCEPTION: Air conditioning condensate in dwellings shall be permitted to drain to a tub waste and overflow or lavatory tailpiece in accordance with Section 9.4.3.c.5.

9.3.4 Standpipes

A standpipe, 2-inch minimum pipe size and extending not more than 48 inches nor less than 18 inches above its trap, shall be permitted to serve as a receptor for a domestic clothes washer. In a dwelling, a laundry sink shall be permitted to drain into the standpipe.

9.3.5 Open-hub Drains

A trapped and vented open-end drain pipe extending not less than 2 inches above the surrounding floor shall be permitted to serve as a receptor for clear-water wastes.

9.3.6 Minimum Receptor Pipe Size

a. The minimum drain pipe size for an indirect waste receptor shall be at least one pipe size larger than the indirect waste pipe that it serves.
EXCEPTION: A laundry sink receiving the discharge from an automatic clothes washer under Section 9.3.1.b.2.
b. Where a receptor receives indirect drainage from two or more fixtures, the cross-sectional area of the receptor drain shall be not less than the aggregate cross-sectional area of all indirect waste pipes served by the receptor. For the purposes of this requirement, 1-1/4" pipe = 1.2 in^2, 1-1/2" pipe = 1.8 in^2, 2" pipe = 3.1 in^2, 2-1/2" pipe = 4.9 in^2, 3" pipe = 7.1 in^2, 4" pipe = 12.6 in^2, 5" pipe = 19.6 in^2, and 6" pipe = 28.3 in^2.

9.3.7 Drainage Fixture Unit (DFU) Values

The drainage fixture unit values used to combine the loading of indirect waste receptors with other fixtures shall be the sum of the DFU values for all fixtures that are indirectly drained into the receptor.

9.4 SPECIAL WASTES

9.4.1 Treatment of Corrosive Wastes

Corrosive liquids, spent acids, or other harmful chemicals that may damage a drain, sewer, soil or waste pipe, create noxious or toxic fumes, or interfere with sewage treatment processes shall not be discharged into the plumbing system without being thoroughly neutralized or treated by passing through a properly constructed and approved neutralizing device. Such devices shall be provided automatically with a sufficient supply of neutralizing medium, so as to make its contents non-injurious before discharge into the drainage system. The nature of the corrosive or harmful waste and proposed method of its treatment shall be submitted to and approved by the Authority Having Jurisdiction prior to installation.

9.4.2 High Temperature Wastes

No waste at temperatures above 140°F shall be discharged directly into any part of a drainage system. Such wastes shall be discharged to an indirect waste receptor and a means of cooling shall be provided where necessary.

9.4.3 Air Conditioning Condensate

a. Indirect waste piping from air conditioning units shall be sized according to the condensate-generating capacity of the units served. Branches from individual units shall be no smaller than the drain opening or drain connection on the unit. Traps shall be provided at each air conditioning unit or cooling coil to maintain atmospheric pressure in the waste piping.

b. Condensate waste piping shall be sloped not less than 1/8" per foot. Drainage fittings shall be used in sizes 1-1/4" and larger. Minimum pipe sizing shall be as follows:

- 3/4" pipe size through 3-ton cooling capacity
- 1" pipe size through 20-ton cooling capacity
- 1-1/4" pipe size through 100-ton cooling capacity
- 1-1/2" pipe size through 300-ton cooling capacity
- 2" size pipe through 600-ton cooling capacity

c. Discharge of air conditioning condensate shall not be permitted to create a nuisance such as by flowing across the ground or paved surfaces. Unless expressly prohibited by the Authority Having Jurisdiction, the point of indirect discharge for air conditioning condensate shall be one of the following:

1. The building sanitary drainage system.
2. The building storm drainage system.
3. A sump pump.
4. A subsurface absorption pit or trench.
5. Within dwellings, a tub waste and overflow or lavatory tailpiece within the same dwelling.

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Chapter 10

Water Supply and Distribution

10.1 QUALITY OF WATER SUPPLY

Only potable water shall be supplied to plumbing fixtures used for drinking, bathing, culinary use or the processing of food, medical or pharmaceutical products.

10.2 IDENTIFICATION OF POTABLE AND NON-POTABLE WATER

In buildings where dual water distribution systems are installed, one potable water and the other non-potable water, each system shall be identified either by color marking or metal tags, or other appropriate methods such as may be approved by the Authority Having Jurisdiction. Each outlet on the non-potable water line that may be used for drinking or domestic purposes shall be posted: **DANGER-UNSAFE WATER.**

10.3 WATER REQUIRED

10.3.1 Buildings

Plumbing fixtures shall be provided with a potable supply of water in the amounts and at the pressures specified in this Chapter.

10.4 PROTECTION OF POTABLE WATER SUPPLY

10.4.1 General

A potable water supply shall be designed, installed and maintained to prevent contamination from non-potable liquids, solids or gases by cross connections.

10.4.2 Interconnections

Interconnections between two or more public water supplies shall be permitted only with the approval of the Authority Having Jurisdiction.

10.4.3 Cross Connection Control

Potable water supplies shall be protected in accordance with the cross connection control program of the Authority Having Jurisdiction and the provisions of this Code. Cross connection control shall be provided at individual outlets, and where required, by containment of the premises. Each potential cross connection within the premises shall be protected. Where containment is required, the potable water supply shall be protected by a backflow protection device installed immediately downstream of the meter or between the service shutoff valve and the first outlet or branch connection.

10.4.4 Private Supplies

a. Private potable water supplies (i.e., wells, cisterns, lakes, streams) shall require the same backflow protection that is required for a public potable water supply.

b. Cross connection between a private potable water supply and a public potable water supply shall not be made unless specifically approved by the Authority Having Jurisdiction.

10.4.5 Toxic Materials

a. Piping conveying potable water shall be constructed of non-toxic material.

b. The interior surface of a potable water tank shall not be lined, painted, or repaired with any material that will affect either the taste, odor, color or potability of the water supply when the tank is placed in or returned to service.

10.4.6 Reserved

10.4.7 Reserved

10.4.8 Used Materials

Materials that have been used for any purpose other than conveying potable water shall not be used for conveying potable water.

10.4.9 Water As a Heat-Transfer Fluid

Potable water may be used as a heat-transfer fluid provided the system design is approved by the Authority Having Jurisdiction.

10.5 BACKFLOW PREVENTION

10.5.1 Plumbing Fixtures, Appliances, Water Supply Outlets

The water supply shall be protected from back-siphonage by a fixed air gap between the potable water outlet and the overflow level of the fixture or receptor.

10.5.2 Requirements for Air Gaps

a. How Measured: The air gap shall be measured vertically from the lowest end of a potable water outlet to the flood rim or line of the fixture or receptor into which it discharges.

b. Minimum Size (distance): The minimum required air gap shall be twice the effective opening of a potable water outlet unless the outlet is a distance less than 3 times the effective opening away from a wall or similar vertical surface in which case the minimum required air gap shall be 3 times the effective opening of the outlet. In no case shall the minimum required air gap be less than that shown in Table 10.5.2.

Table 10.5.2

MINIMUM AIR GAPS FOR PLUMBING FIXTURES

Fixture	Minimum Air Gap: When not Affected By Near Wall[1] (Inches)	Minimum Air Gap: When Affected By Near Wall[2] (Inches)
Lavatories with effective opening not greater than 1/2 inch diameter	1	1-1/2
Sink, laundry trays, goose-neck bath faucets and other fixtures with effective openings not greater than 3/4" diameter	1-1/2	2-1/4
Over rim bath fillers and other fixtures with effective openings not greater than 1 inch diameter	2	3
Drinking water fountains-single orifice not greater than 7/16 (0.437) in. diameter or multiple orifices having total area of 0.150 square inches (area of circle 7/16 in. diameter)	1	1-1/2
Effective openings greater than one inch	2X diameter of effective opening	3X diameter of effective opening

1. Side walls, ribs or similar obstructions do not affect air gaps when spaced from inside edge of the spout opening a distance greater than three times the diameter of the effective opening for a single wall, or a distance greater than four times the diameter of 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 require a greater air gap when spaced closer to the nearest inside edge of the spout opening than specified in 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.

10.5.3 Required Backflow Prevention Devices

The following requirements shall apply:

A. Backsiphonage, Non-Continuous Pressure, Non-Health Hazard

1. Atmospheric vacuum breaker - ASSE 1001 (AVB)
2. Hose connection vacuum breaker - ASSE 1011
3. Any backflow protection device approved for protection against backsiphonage with non-continuous or continuous pressure and a non-health hazard or health hazard.

B.Backsiphonage, Continuous Pressure, Non-Health Hazard

1. Pressure vacuum breaker - ASSE 1020 (PVB)
2. Spill-resistant vacuum breaker - ASSE 1056 (SVB)
3. Backflow preventer with intermediate atmospheric port - ASSE 1012
4. Double check valve assembly ASSE 1015 (DC and DCVA)
5. Any backflow protection device approved for protection against backsiphonage with continuous pressure and a non-health hazard or health hazard.

C. Backsiphonage, Non-Continuous Pressure, Health Hazard

1. Atmospheric vacuum breaker - ASSE 1001 (AVB)
2. Hose connection backflow preventer - ASSE 1052
3. Any backflow protection device approved for protection against backsiphonage with non-continuous or continuous pressure and a health hazard.

D. Backsiphonage, Continuous Pressure, Health Hazard

1. Pressure vacuum breaker - ASSE 1020 (PVB)
2. Spill-resistant vacuum breaker - ASSE 1056 (SVB)

3. Reduced pressure backflow preventer assembly - ASSE 1013 (RP, RPZ, and RPBA)

4. Any backflow protection device approved for protection against backsiphonage with continuous pressure and a health hazard.

E. Back Pressure, Non-Health Hazard

1. Dual check backflow preventer - ASSE -1024 (DuCh)
2. Double check valve assembly - ASSE 1015 (DC)(DCVA)
3. Reduced pressure backflow preventer assembly - ASSE 1013 (RP)(RPZ)(RPBA)

F. Back Pressure, Health Hazard

1. Reduced pressure backflow preventer assembly - ASSE 1013 (RP)(RPZ)(RPBA)

10.5.4 Approval of Devices

Backflow prevention devices shall be listed or certified by a recognized certification body as complying with the appropriate standards in Table 3.1.3 - Part IX.

10.5.5 Installation of Backflow Preventers

a. Devices of All Types: All backflow prevention devices shall be accessible. Backflow prevention devices having atmospheric vents shall not be installed in pits, vaults, or similar potentially submerged locations. Vacuum breakers and other devices with vents to atmosphere shall not be located within fume hoods.

b. Atmospheric Vacuum Breakers: Pipe applied atmospheric vacuum breakers shall be installed with the critical level at least six inches above the flood level rim or highest point of discharge of the fixture being served. Approved deck-mounted and pipe-applied vacuum breakers and vacuum breakers within equipment, machinery and fixtures where the critical level is a specified distance above the source of contanination shall be installed in accordance with manufacturer's instructions with the critical level not less than one inch above the flood level rim. Such devices shall be installed on the discharge side of the last control valve to the fixture and no shut-off valve or faucet shall be installed downstream of the vacuum breaker. Vacuum breakers on urinals shall be installed with the critical level six inches above the flood level rim.

c. Pressure Type Vacuum Breakers: Pressure type vacuum breakers shall be installed with the critical level at a height of at least 12 inches above the flood level rim for ASSE 1020 devices and with the critical level at least six inches above the flood level rim or highest point of discharge of the fixture being served for ASSE 1056 devices. Deck-mounted and pipe-applied pressure type (ASSE 1056) vacuum breakers within equipment, machinery and fixtures where the critical level is a specified distance above the source of contamination shall be installed in accordance with manufacturer's instructions with the critical level not less than one inch above the flood level rim.

d. Double Check Valves and Reduced Pressure Principle Valves: Such devices shall be installed at not less than 12 inches above the floor or permanent platform with the maximum of 60 inches above floor or permanent platform.

e. Spill-resistane Vacuum Breakers: Approved deck mounted and pipe-applied spill-resistant vacuum breakers within equipment, machinery and fixtures where the critical level is a specified distance above the source of contamination shall be installed in accordance with manufacturer's instructions with the critical level not less than one inch above the flood level rim.

10.5.6 Maintenance and Testing of Backflow Prevention Devices

a. Devices installed in a building potable water supply distribution system for protection against backflow shall be maintained in good working condition by the person or persons responsible for the maintenance of the system.

b. Devices that are designed to be field tested shall be tested prior to final inspection of the initial installation and once each year thereafter, using field test procedures conforming to ASSE 5010 Series Professional Qualifications Standards or equivalent.

NOTE: Testable devices are those backflow prevention devices having test cocks and include, but are not limited, to the following:

1. Pressure vacuum breakers
2. Spill-resistant vacuum breakers
3. Double check valve assemblies
4. Double check detector assemblies
5. Reduced pressure backflow preventer assemblies
6. Reduced pressure detector assemblies

c. Where tests indicate that the device is not functioning properly, it shall be serviced or repaired in accordance with the manufacturer's instructions and be retested.

d. Testing and repair of devices shall be performed by certified individuals approved by an agency acceptable to the Authority Having Jurisdiction. Certification for testing shall be in accordance with ASSE 5000 or equivalent. Certification for repair shall be in accordance with ASSE 5030 or equivalent. Certification shall include not less than 32 hours of combined classroom and practice training and successful completion of a written and practical examination.

e. Copies of test reports for the initial installation shall be sent to the Authority Having Jurisdiction and the water supplier. Copies of annual test reports shall be sent to the water supplier.

f. Where a continuous water supply is critical and cannot be interrupted for the periodic testing of a backflow prevention device, multiple backflow prevention devices or other means of maintaining a continuous supply shall be provided that does not create a potential cross connection.

10.5.7 Tanks and Vats—Below Rim Supply

a. Where a potable water outlet terminates below the rim of a tank or vat and the tank, or vat has an overflow of a diameter not less than given in Table 10.8.3, the overflow pipe shall be provided with an air gap as close to the tank as possible.

b. The potable water outlet to the tank or vat shall terminate a distance not less than 1-1/2 times the height to which water can rise in the tank above the top of the overflow. This level shall be established at the maximum flow rate of the supply to the tank or vat and with all outlets closed except the air-gapped overflow outlet.

c. The distance from the outlet to the high water level shall be measured from the critical point of the potable water supply outlet.

10.5.8 Connections to Carbonated Beverage Dispensers

The water supply to a carbonated beverage dispenser shall be protected against backflow with an integral backflow preventer conforming to ASSE 1032 or an air gap. Carbonated beverage dispensers and carbonated beverage dispensing systems without an integral backflow preventer conforming to ASSE 1032 or an air gap shall have the water supply protected with a double check valve with atmospheric vent conforming to ASSE 1032.

10.5.9 Protection from Fire Systems

a. Potable water supplies to water-based fire protection systems, including but not limited to standpipes and automatic sprinkler systems, shall be protected from back-pressure and back-siphonage by one of the following testable devices:

1. double check fire protection backflow protection assembly - ASSE 1015 (DCF)
2. double check detector fire protection backflow protection assembly - ASSE 1048 (DCDF)
3. reduced pressure principle fire protection backflow prevention assembly - ASSE 1013 (RPF)
4. reduced pressure detector fire protection backflow prevention assembly - ASSE 1047 (RPDF)

EXCEPTIONS

(1) ASSE 1024 dual check valves in residential sprinkler systems
(2) ASSE 1024 dual check valves in limited area sprinkler systems
(3) Where fire protection systems include a fire department connection, double check valve assembles shall not be permitted.
(4) Where fire protection systems are filled with solutions that are considered to be health hazards as defined in Section 1.2, double check valve assemblies shall not be permitted.

b. Whenever a backflow protection device is installed in a potable water supply to a fire protection system, the hydraulic design of the fire protection system shall account for the pressure drop through the backflow protection device.

c. If backflow protection devices are retrofitted for an existing fire protection system, the hydraulics of the fire protection system shall be checked to verify that there is sufficient water pressure available for satisfactory operation of the fire protection system.

10.5.10 Protection from Lawn Sprinklers and Irrigation Systems

a. 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
2. Pressure vacuum breaker (PVB)
3. Spill-resistant vacuum breaker (SVB)
4. Reduced pressure backflow preventer assembly

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

1. Reduced pressure backflow preventer assembly

c. 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
2. Pressure vacuum breaker (PVB)
3. Spill-resistant vacuum breaker (SVB)
4. Reduced pressure backflow preventer assembly

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

1. Reduced pressure backflow preventer assembly

10.5.11 Domestic Water Heat Exchangers

a. 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, in accordance with either subparagraph b or c below.

b. Single-wall heat exchangers shall be permitted if they satisfy all of the following requirements:

1. The heat transfer medium is either potable water or contains only substances that are recognized as safe by the U.S. Food and Drug Administration.
2. The pressure of the heat transfer medium is maintained less than the normal minimum operating pressure of the potable water system.

EXCEPTION: Steam complying with subparagraph b.1.

3. The equipment is permanently labeled to indicate that only additives recognized as safe by the FDA shall be used in the heat transfer medium.

c. Double-wall heat exchangers shall separate the potable water from the heat transfer medium by providing a space between the two walls that is vented to the atmosphere.

10.5.12 Hose Connections

A pressure-type or atmospheric-type vacuum breaker or a permanently attached hose connection vacuum breaker shall protect hose bibbs, sill-cocks. wall hydrants and other openings with a hose connection.

EXCEPTIONS:

(1) Water heater and boiler drain valves that are provided with hose connection threads and that are intended only for tank or vessel draining shall not be required to be equipped with a backflow preventer.

(2) This section shall not apply to water supply valves intended for connection to clothes washing machines where backflow prevention is otherwise provided or is integral with the machine.

10.5.13 Protection for Special Equipment

The water supply for any equipment or device that creates a cross-connection with the potable water supply shall be protected against backflow as required in Section 10.5. Such equipment and devices includes, but is not limited to, chemical dispensers, portable cleaning equipment, sewer and drain cleaning equipment, and dental pump equipment.

a. Chemical Dispensing Systems

Chemical dispensing systems with connections to the potable water distribution system shall protect the water distribution system from backflow in accordance with ASSE 1055.

b. Portable Cleaning Equipment

Where the water distribution system connects to portable cleaning equipment, the water supply system shall be protected against backflow in accordance with Section 10.5, which allows for an atmospheric vacuum breaker, pressure vacuum breaker, double check valve, or a reduced pressure principle assembly.

EXCEPTION: Atmospheric vacuum breakers shall not be used where there are shutoff valves or other shutoff devices downstream or where they are subject to continuous flowing pressure for more than 12 hours at a time.

c. Dental Pump Equipment

Where the water distribution system connects to dental pumping equipment, the water supply system shall be protected against backflow in accordance with Section 10.5, which allows for an atmospheric vacuum breaker, pressure vacuum breaker, double check valve, or a reduced pressure principle assembly.

EXCEPTION: Atmospheric vacuum breakers shall not be used where there are shutoff valves or other shutoff devices downstream or where they are subject to continuous flowing pressure for more than 12 hours at a time.

10.6 WATER SERVICE

10.6.1 Separation of Water Service and Building Sewer

The water service pipe and building drain or building sewer shall not have less than one foot horizontal distance between the piping.

10.6.2 Water Service Near Sources of Pollution

Potable water service piping shall not be located in, under, or above cesspools, septic tanks, septic tank drainage fields, or drainage pits. A separation of ten feet shall be maintained from such systems. When a water line parallels or crosses over or under a sewer, a minimum clearance of 12 inches in all directions shall be maintained.

10.6.3 Stop-and-Waste Valves Prohibited

Combination stop-and-waste valves or cocks shall not be installed underground in water service piping.

10.6.4 Water Service Pipe Sleeves

Pipe sleeves shall be provided where water service pipes penetrate foundation walls or floor slabs to protect against corrosion of the pipe and allow clearance for expansion, contraction and settlement. The sleeve shall form a watertight bond with the wall or floor slab. The annular space between the pipe and the sleeve shall be resiliently sealed watertight. Where water service piping is plastic, the wall sleeve shall be not less than five feet long extended outside beyond the wall.

10.6.5 Water Service Sizing

The water service pipe shall be of sufficient size to furnish water to the building in the quantities and at the pressures required elsewhere in this Code. The pipe size shall not be less than 3/4 inch nominal.

10.7 WATER PUMPING AND STORAGE EQUIPMENT

10.7.1 Pumps and Other Appliances

Water pumps, filters, softeners, tanks and other appliances and devices used to handle or treat potable water shall be protected against contamination as per Section 10.5.

10.7.2 Prohibited Location of Potable Supply Tanks

Potable water gravity tanks or manholes of potable water pressure tanks shall not be located directly under any soil or waste piping.

10.8 WATER PRESSURE BOOSTER SYSTEMS

10.8.1 Water Pressure Booster Systems Required

a. When the water pressure in the public water main or individual water supply system is insufficient to supply the potable peak demand flow to plumbing fixtures and other water needs freely and continuously with the minimum pressure and quantities specified in Section 10.14.3, or elsewhere in this Code, and in accordance with good practice, the rate of supply shall be supplemented by one of the following methods:

1. An elevated water tank.
2. A hydro-pneumatic pressure booster system.
3. A water pressure booster pump.

10.8.2 Reserved

10.8.3 Overflows for Water Supply Tanks

Gravity or suction water supply tanks shall be provided with an overflow having a diameter not less than that shown in Table 10.8.3. The overflow outlet shall discharge above and within not less than 6 inches of a roof or roof drain, floor or floor drain, or over an open water-supplied fixture. The overflow outlet shall be covered by a corrosion-resistant screen of not less than 16 x 20 mesh to the inch and by 1/4 inch hardware cloth, or it shall terminate in a horizontally installed 45^0 angle-seat check valve. Drainage from overflow pipes shall be directed so as not to freeze on roof walkways.

10.8.4 Covers

All water supply tanks shall be covered to keep out unauthorized persons, dirt, and vermin. The covers of gravity tanks shall be vented with a return bend vent pipe having an area not less than the area of the down feed riser pipe and the vent shall be screened with corrosion resistant screen having not less than 14 and not more than 20 openings per linear inch.

Table 10.8.3
SIZES[1] OF OVERFLOW PIPES FOR WATER SUPPLY TANKS

Maximum Capacity of Water Supply Line to Tank	Diameter of Overflow Pipe (Inches ID)	Maximum Capacity of Water Supply Line to Tank	Diameter Overflow Pipe (Inches ID)
0-13 gpm	1-1/2	356-640 gpm	5
14-55 gpm	2	641-1040 gpm	6
56-100 gpm	2-1/2	over 1040 gpm	8
101-165 gpm	3		
166-355 gpm	4		

[1] Computed by the method of NBS Mono. 31, for vertical pipes flowing not greater than 1/2 full at terminal velocity. (1/3 full for 1-1/2 in. pipe).

10.8.5 Potable Water Inlet Control and Location

Potable water inlets to gravity tanks shall be controlled by a ball cock or other automatic supply valve so installed as to prevent the tank from overflowing. The inlet shall be terminated so as to provide an accepted air gap but in no case less than 4 inches above the overflow.

10.8.6 Tank Drain Pipes

Each tank shall be provided at its lowest point with a valved pipe to permit emptying the tank.

10.8.7 Low Pressure Cut-Off Required on Booster Pumps

Booster pumps shall be protected by a low pressure cut-off switch to shut-off the pump(s) if the suction pressure drops to an unsafe value.

10.8.8 Pressure Tanks—Vacuum Relief

All water pressure tanks shall be provided with a vacuum relief valve at the top of the tank that will operate up to a maximum water pressure of 200 psi and to maximum water temperatures of 200^0F. The minimum size of such vacuum relief valves shall be 1/2 inch.

10.8.9 Pressure Tanks—Pressure Relief

All water pressure tanks shall be provided with approved pressure relief valves set at a pressure not in excess of the tank working pressure.

10.9 FLUSHING AND DISINFECTING POTABLE WATER SYSTEMS

10.9.1 Flushing

The water service piping and distribution piping to all fixtures and outlets shall be flushed until the water runs clear and free of debris or particles. Faucet aerators or screens shall be removed during flushing operations.

10.9.2 Disinfecting

a. Where required by the Authority Having Jurisdiction, the water service piping and the hot and cold water distribution piping in new or renovated potable water systems shall be disinfected after flushing and prior to use. The procedure used shall be as follows or an approved equivalent:

1. All water outlets shall be posted to warn against use during disinfecting operations.

2. Disinfecting shall be performed by persons experienced in such work.

3. The water supply to the piping system or parts thereof being disinfected shall be valved-off from the normal water source to prevent the introduction of disinfecting agents into a public water supply or portions of a system that are not being disinfected.

4. The piping shall be disinfected with a water-chlorine solution. During the injection of the disinfecting agent into the piping, each outlet shall be fully opened several times until a concentration of not less than 50 parts per million chlorine is present at every outlet. The solution shall be allowed to stand in the piping for at least 24 hours.

5. An acceptable alternate to the 50 ppm/24-hour procedure described in Section 10.9.2.d shall be to maintain a level of not less than 200 parts per million chlorine for not less than three hours. If this alternate procedure is used, the heavily concentrated chlorine shall not be allowed to stand in the piping system for more than 6 hours. Also, special procedures shall be used to dispose of the heavily concentrated chlorine in an environmentally acceptable and approved manner.

6. At the end of the required retention time, the residual level of chlorine at every outlet shall be not less than five parts per million. If the residual is less than five parts per million, the disinfecting procedure shall be repeated until the required minimum chlorine residual is obtained at every outlet.

7. After the required residual chlorine level is obtained at every outlet, the system shall be flushed to remove the disinfecting agent. Flushing shall continue until the chlorine level at every outlet is reduced to that of the incoming water supply.

8. Any faucet aerators or screens that were removed under Section 10.9.1 shall be replaced.

9. A certification of performance and laboratory test report showing the absence of coliform organisms shall be submitted to the Authority Having Jurisdiction upon satisfactory completion of the disinfecting operations.

10.10 WATER SUPPLY SYSTEM MATERIALS

See Section 3.4.3.

10.11 ALLOWANCE FOR CHARACTER OF SOIL AND WATER

When selecting the material and size for water service supply pipe, tube, or fittings, due consideration shall be given to the action of the water on the interior of the pipe and of the soil, fill or other material on the exterior of the pipe. (Appendix B gives recommendations concerning allowances to be made in sizing water piping because of the properties of the water.)

10.12 WATER SUPPLY CONTROL VALVES

10.12.1 Curb Valve

On the water service from the street main to the building, an approved gate valve or ground key stopcock or ball valve shall be installed near the curb line between the property line and the curb. This valve or stopcock shall be provided with an approved curb valve box.

10.12.2 Building Valve

The building water service shall be provided with a readily accessible gate valve with bleed or other full-way valve with bleed located inside the building near the point where the water service enters. When the building water service enters a crawl space, the building valve shall be readily accessible. Where there are two or more water services serving one building, a check valve shall be installed on each service in addition to the above valves.

10.12.3 Water Supply Tank Valve

A shutoff valve shall be provided at the outlet of any tank serving as a water supply source, either by gravity or pressure.

10.12.4 Valves in Dwelling Units

a. Except as defined in 10.12.4.b, c and d, individual fixture shutoff or stop valves shall be provided for water closets, lavatories, kitchen sinks, laundry trays, bar sinks, bidets, clothes washing machines, sill cocks, wall hydrants, appliances and equipment connected to the water supply system. Valves for fixtures, appliances and equipment shall be accessible without having to move the appliance or equipment.
EXCEPTION: Valves for ice makers
b. Shutoff valves shall be provided for each powder room or bathroom group unless all fixtures within the room or group have individual fixture shutoff or stop valves.
c. In a single dwelling unit, two bathrooms or powder rooms installed back-to-back or one directly above the other may be considered as a single group and shall be permitted to have one set of shutoff valves. If two such rooms are not piped as a single group, separate shutoff valves shall be provided for each room or group.
d. In multi-dwelling 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 the water supply to fixtures in other dwelling units. These valves shall be accessible in the dwelling unit that they control.
e. Self-piercing and needle-type saddle valves shall be prohibited.

10.12.5 Riser Valves

Shutoff valves(s) shall be provided for isolating each water supply riser serving fixtures on two or more floors.
EXCEPTION: Risers within individual dwelling units.

10.12.6 Individual Fixture Valves

In a building used or intended to be used for other than dwelling purposes, the water distribution pipe to each fixture or other piece of equipment shall be provided with a valve or fixture stop to shut off the water to the fixture or to the room in which it is located. These valves shall be accessible. Sill cocks and wall hydrants shall be separately controlled by a valve inside the building.

10.12.7 Water Heating Equipment Valve

A shutoff valve shall be provided in the cold water supply to each water heater. If a shutoff valve is also provided in the hot water supply from the heater, it shall not isolate any safety devices from the heater or storage tank. Shutoff valves for water heaters shall be the gate, ball, plug, or butterfly type.

10.12.8 Meter Valve

A gate valve or other full-way valve shall be installed in the line on the discharge side of each water meter. The valve shall not be less in size than the building water service pipe.

10.12.9 Valve Accessibility

Water supply control valves shall be placed so as to be accessible for service and maintenance.

10.13 FLEXIBLE WATER CONNECTORS

Flexible water connectors exposed to continuous pressure shall conform to ASME A112.18.6. Access shall be provided to all flexible water connectors.

10.14 MINIMUM REQUIREMENTS FOR WATER DISTRIBUTION SYSTEMS

10.14.1 Maximum Velocity (See Appendix B.6)

Water distribution piping within buildings shall be sized for a maximum velocity of 8 feet per second at the design flow rate unless the pipe manufacturer's sizing recommendations call for the maximum velocity to be less than 8 feet per second.

10.14.2 Size of Individual Fixture Supply Branches

a. Individual fixture supply branch pipe sizes shall be based on the minimum available flowing water pressure at the point of connection to the water distribution system, any elevation difference between that connection and the fixture, and the allowable pressure loss in the fixture supply branch. The minimum fixture supply branch pipe sizes shall be as indicated in Table 10.14.2A. For design purposes, the required pressure at each fixture inlet shall be 15 psig minimum with flow for all fixtures, except 20 psig flowing for flushometer valves on siphon jet water closets and 25 psig flowing for flushometer valves on blowout water closets and blowout urinals. Flushometer tank (pressure assisted) water closets require a minimum of 25 psig static pressure. The following water flow rates shall be used for the purpose of sizing individual fixture supply branch pipes:

5.0 gpm for hose bibbs and wall hydrants;
4.0 gpm for bath faucets and clothes washers;
0.75 gpm for drinking fountains and water coolers;
2.5 gpm for sink faucets;
2.5 gpm for showers;
1.5 gpm for lavatory faucets;
3.0 gpm for water closets other than the flushometer valve type;
12.0 gpm for flushometer valve urinals;
30.0 gpm for flushometer valve water closets

b. Fixture supply branches shall extend from the distribution system to within 30 inches of the point of connection to the fixture or device served and be within the same area and physical space as the point of connection to the fixture or device. Fixture supply tubes and flexible water connectors shall be not less than the size recommended by the manufacturer of the fixture, faucet, appliance or device served.

10.14.3 Sizing Water Distribution Piping

a. The supply demand in gallons per minute in the building hot and cold water distribution system shall be determined on the basis of the load in terms of water supply fixture units (WSFU) as shown in Table 10.14.2A and the relationship between the load in WSFU and the supply demand in gallons per minute (gpm) as shown in Table 10.14.2B. For fixtures having both hot water and cold water connections, the separate hot water and cold water loads shall be taken as 75% of the listed fixture unit value.

Table 10.14.2A
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES

TYPE OF FIXTURES	MINIMUM BRANCH PIPE SIZE	INDIVIDUAL DWELLING UNITS	SERVING 3 OR MORE DWELLING UNITS	OTHER THAN DWELLING UNITS	HEAVY-USE ASSEMBLY
BATHROOM GROUPS HAVING 1.6 GPF WATER CLOSETS OTHER THAN THE FLUSHOMETER VALVE TYPE					
Half-bath or Powder Room		3.5	2.5		
1 Bathroom Group		5.0	3.5		
1 1/2 Bathrooms		6.0			
2 Bathrooms		7.0			
2 1/2 Bathrooms		8.0			
3 Bathrooms		9.0			
Each Additional 1/2 Bath		0.5			
Each Additional Bathroom Group		1.0			
BATHROOM GROUPS HAVING 3.5 GPF GRAVITY-TANK WATER CLOSETS					
Half-bath or Powder Room		4.0	3.0		
1 Bathroom Group		6.0	5.0		
1 1/2 Bathrooms		8.0			
2 Bathrooms		10.0			
2 1/2 Bathrooms		11.0			
3 Bathrooms		12.0			
Each Additional 1/2 Bath		0.5			
Each Additional Bathroom Group		1.0			
BATH GROUP (1.6 GPF Flushometer Valve)		6.0	4.0		
BATH GROUP (3.5 GPF Flushometer Valve)		8.0	6.0		
KITCHEN GROUP (Sink and Dishwasher)		2.0	1.5		
LAUNDRY GROUP (Sink and Clothes Washer)		5.0	3.0		

Table 10.14.2A (Continued)
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES

TYPE OF FIXTURES	MINIMUM BRANCH PIPE SIZE	INDIVIDUAL DWELLING UNITS	SERVING 3 OR MORE DWELLING UNITS	OTHER THAN DWELLING UNITS	HEAVY-USE ASSEMBLY
INDIVIDUAL FIXTURES					
Bathtub or Combination Bath/Shower	1/2"	4.0	3.5		
Bidet	1/2"	1.0	0.5		
Clothes Washer, Domestic	1/2"	4.0	2.5	4.0	
Dishwasher, Domestic	1/2"	1.5	1.0	1.5	
Drinking Fountain or Watercooler	3/8"			0.5	0.75
Hose Bibb	1/2"	2.5	2.5	2.5	
Hose Bibb, Each Additional	1/2"	1.0	1.0	1.0	
Kitchen Sink, Domestic	1/2"	1.5	1.0	1.5	
Laundry Sink	1/2"	2.0	1.0	2.0	
Lavatory	3/8"	1.0	0.5	1.0	1.0
Service Sink or Mop Basin	1/2"			3.0	
Shower	1/2"	2.0	2.0	2.0	
Shower, Continuous Use	1/2"			5.0	
Urinal, 1.0 GPF	3/4"			4.0	5.0
Urinal, Greater Than 1.0 GPF	3/4"			5.0	6.0
Water Closet, 1.6 GPF Gravity Tank	1/2"	2.5	2.5	2.5	4.0
Water Closet, 1.6 GPF Flushometer Tank	1/2"	2.5	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	1	5.0	5.0	5.0	8.0
Water Closet, 3.5 GPF Gravity Tank	1/2"	3.0	3.0	5.5	7.0
Water Closet, 3.5 GPF Flushometer Valve	1	7.0	7.0	8.0	10.0
Whirlpool Bath or Combination Bath/Shower	1/2"	4.0	4.0		

NOTES:

1. A Bathroom Group, for the purposes of this Table, consists of not more than one water closet, up to two lavatories, and either one bathtub, one bath/shower combination, or one shower stall. Other fixtures within the bathing facility shall be counted separately to determine the total water supply fixture unit load.
2. A Half-Bath or Powder Room, for the purposes of this Table, consists of one water closet and one lavatory.
3. For unlisted fixtures, refer to a listed fixture having a similar flow and frequency of use.
4. The listed fixture unit values for Bathroom Groups and Individual Fixtures represent their load on the cold water service. The separate cold water and hot water fixture unit values for fixtures having both cold and hot water connections shall each be taken as 3/4 of the listed total value for the individual fixture..
5. When WSFU values are added to determine the demand on the water distribution system or portions thereof, round the sum to the nearest whole number before referring to Table 10.14.2B for the corresponding gallons per minute (gpm) flow. WSFU values of 0.5 or more should be rounded up to the next higher whole number (9.5 = 10 WSFU). Values of 0.4 or less should be rounded down to the next lower whole number (9.4 = 9 WSFU).
6. The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size in inches.
7. "Other Than Dwelling Units" applies to business, commercial, industrial, and assembly occupancies other than those defined under "Heavy-Use Assembly." Included are the public and common areas in hotels, motels, and multi-dwelling buildings.
8. "Heavy-Use Assembly" applies to toilet facilities in occupancies that place heavy, but intermittent, time-based demands on the water supply system, such as' schools, auditoriums, stadiums, race courses, transportation terminals, theaters, and similar occupancies where queuing is likely to occur during periods of peak use.
9. For fixtures or supply connections likely to impose continuous flow demands, determine their required flow in gallons per minute (gpm) and add it separately to the demand (in gpm) for the distribution system or portion thereof.

Table 10.14.2B
TABLE FOR CONVERTING DEMAND IN WSFU TO GPM[1]

WSFU	GPM Flush Tanks[2]	GPM Flush Valves[3]	WSFU	GPM Flush Tanks[2]	GPM Flush Valves[3]
3	3		120	49	74
4	4		140	53	78
5	4.5	22	160	57	83
6	5	23	180	61	87
7	6	24	200	65	91
8	7	25	225	70	95
9	7.5	26	250	75	100
10	8	27	300	85	110
11	8.5	28	400	105	125
12	9	29	500	125	140
13	10	29.5	750	170	175
14	10.5	30	1000	210	210
15	11	31	1250	240	240
16	12	32	1500	270	270
17	12.5	33	1750	300	300
18	13	33.5	2000	325	325
19	13.5	34	2500	380	380
20	14	35	3000	435	435
25	17	38	4000	525	525
30	20	41	5000	600	600
40	25	47	6000	650	650
50	29	51	7000	700	700
60	33	55	8000	730	730
80	39	62	9000	760	760
100	44	68	10,000	790	790

NOTES:
1. This table converts water supply demands in water supply fixture units (WSFU) to required water flow in gallons per minute (GPM) for the purpose of pipe sizing.
2. This column applies to portions of piping systems where the water closets are the flush tank type (gravity or pressure) or there are no water closets, and to hot water piping.
3. This column applies to portions of piping systems where the water closets are the flush valve type.

b. Main risers and branches of the water distribution system shall be sized based on the minimum available water pressure at the source, any elevation differences between the source and the fixtures, pressure losses in the distribution system, and the pressure (with flow) required at each connection of the fixture supply branches.

10.14.4 Inadequate Water Pressure

Whenever water pressure from the street main or other sources of supply is insufficient to provide flow pressures at fixture outlets as required under Section 10.14.3, a booster pump and pressure tank or other approved means shall be installed on the building water supply system.

10.14.5 Variable Street Pressures

Where street water main pressures fluctuate, the building water distribution system shall be designed for the minimum pressure available.

10.14.6 Excessive Pressures

a. Approved pressure reducing valves complying with ASSE 1003 shall be provided if required to limit the water supply pressure at any fixture appliance, appurtenance, or outlet to not more than 80 psi under no-flow conditions.

b. The requirement of Section 10.14.6.a above shall not prohibit supply pressures higher than 80 psi to water pressure booster systems under Section 10.14.4 or in high pressure distribution systems, provided that the pressure at the fixtures served is subsequently reduced to 80 psi maximum. Where operating water pressures exceed 80 psi, the working pressure rating of materials and equipment shall be suitable for the maximum pressure that may be encountered, including temporary increases or surges.

c. Where pressure reducing valves are installed and the downstream piping is not rated for the maximum upstream pressure, a pressure relief valve shall be installed downstream from the pressure reducing valve. The relief valve shall be set not higher than the working pressure rating of the downstream piping and sized for not less than the flow capacity of the pressure reducing valve. Relief valves shall discharge in accordance with Sections 10.16.6a, b, c, and d.

10.14.7 Water Hammer

a. Approved water hammer arresters, complying with ANSI/ASSE 1010, shall be installed on water distribution piping in which quick closing valves are installed.

EXCEPTION: Single lever faucets, domestic clothes washers, and domestic dishwashers.

b. Water hammer arresters shall be placed as close as possible to the quick acting valve, at the end of long piping runs, or near batteries of fixtures.

c. Arresters shall be accessible for replacement.

10.15 HOT WATER

10.15.1 Hot Water Supply System

In residences and buildings intended for human occupancy, hot water shall be supplied to all plumbing fixtures and equipment used for bathing, washing, culinary purposes, cleansing, laundry or building maintenance. With the approval of the Authority Having Jurisdiction, tempered water supply systems may be installed in lieu of hot and cold water systems in buildings other than dwelling units.

10.15.2 Temperature Maintenance Where Required

a. Heated water distribution systems in buildings where developed length of heated water piping from the source of the heated water to the farthest fixture exceeds 100 feet shall maintain heated water temperature in all supply piping to within 25 feet of any heated water outlet.

b. An approved electric heat tracing system shall be permitted to be used to satisfy the requirements of Section 10.15.2a.

10.15.3 Minimum Requirements for Hot Water Storage Tanks

a. Hot water storage tanks shall be adequate in size, when combined with the B.T.U.H. input of the water heating equipment to provide the rise in temperature necessary.

b. Water heaters and storage tanks shall be sized to provide sufficient hot water to provide both daily requirements and hourly peak loads of the occupants of the building.

c. Storage tanks shall be protected against excessive temperatures and pressure conditions as specified in this Code. (See Sections 3.3.8 and 3.3.10)

10.15.4 Drainage of Hot Water Storage Tanks

Hot water storage tanks shall be equipped with a valve capable of draining the tank completely.

10.15.5 Pressure Marking of Hot Water Storage Tanks

Hot water storage tanks shall be permanently marked in an accessible place with the maximum allowable working pressure, in accordance with the applicable standard as listed in Table 3.1.3.

10.15.6 Mixed Water Temperature Control

a. Showers and Bath/Shower Combinations: All showers and bath/shower combinations shall be provided with individual balanced pressure, thermostatic, or combination automatic compensating valves that comply with ASSE 1016 or ASME A112.18.1/CSA B125.1. These valves shall include a means to limit the maximum discharge temperature of the water and shall be installed and field-adjusted in accordance with the manufacturer's instructions to a maximum of 120ºF. No further mixing of water shall be permitted downstream of the automatic compensating valve.

EXCEPTION: Where multiple showers are supplied by a one-pipe tempered water distribution system, the tempered water distribution system shall be controlled by an automatic temperature control mixing valve complying with ASSE 1069. These valves shall include a means to limit the maximum discharge temperature of the water and shall be installed and field-adjusted in accordance with the manufacturer's instructions to a maximum of 120ºF. No further mixing of water shall be permitted downstream of the automatic temperature controlled mixing valve.

b. Bathtubs and Whirlpool Baths: The water discharged into bathtubs and whirlpool baths, with or without deck-mounted hand sprays, shall be controlled to a maximum temperature of 120ºF by a device complying with CSA B125.3, ASSE 1070, ASME B112.18.1/CSA B125.1 or ASSE 1016.

c. Public-Use Hand Washing Facilities: Water discharged from public-use hand washing facilities shall be limited to a maximum temperature of 110°F using a water temperature limiting device complying with ASSE 1070.

d. Commercial Hair/Shampoo Sink Sprays: The temperature of water discharged from commercial hair/shampoo sink sprays shall be limited to a maximum of 110°F by a water temperature-limiting device complying with ASSE 1070, ASME A112.18.1/CSA B125.1, or CSA B125.3.

e. Temperature Actuated Flow Reduction (TAFR) Devices: Where temperature actuated flow reduction (TAFR) devices are installed to limit the maximum discharge temperature to 120°F for individual fixture fittings, such devices shall comply with ASSE 1062. These devices alone shall not supersede the other requirements of Section 10.15.6.

f. In-Line Pressure Balancing Valves: Where in-line pressure balancing valves are installed to compensate for water pressure fluctuations to stabilize the temperature discharges from their individual faucet or fixture fitting, such devices shall comply with ASSE 1066. These devices shall be installed in an accessible location and alone shall not supersede the other requirements of Section 10.15.6

g. Temperature-Actuated Mixing Valves: Where temperature-actuated mixing valves are installed to control the in-line hot water supply temperature in the water distribution system. they shall comply with ASSE 1017. Such devices shall be installed at the hot water source and alone shall not supersede the other requirements of Section 10.15.6 for mixed water temperature control.

h. The temperature control devices for water heaters and other hot water supply sources shall not be permitted to be used to meet this Section's requirements for mixed water temperature control.

i. Alternative Methods: The use of a combination of water temperature control or limiting devices that comply with the standards listed in Table 3.1.3 and satisfy the performance requirements of Section 10.15.6 shall be subject to the approval of the Authority Having Jurisdiction.

10.15.7 Thermal Expansion Control

Where a backflow prevention device, check valve or water pressure regulator is installed serving water heating equipment such that a closed system is created, a device for controlling thermal expansion shall be installed.

EXCEPTION: Instantaneous water heaters.

10.15.8 Plastic Piping

a. Plastic piping used for hot water distribution shall conform to the requirements of Section 3.4 and Table 3.4. Piping shall be water pressure rated for not less than 100 psi at 180ºF and 160 psi at 73º.

NOTE: The working pressure rating for certain approved plastic piping materials varies depending on material composition, pipe size, wall thickness and method of joining. See Table 3.4.3.

b. Plastic pipe or tube shall not be used downstream from instantaneous water heaters, immersion water heaters or other heaters not having approved temperature safety devices.

c. Piping within six inches of flue or vent connectors shall be approved metallic pipe or tube.

d. The normal operating pressure in water distribution piping systems utilizing approved plastic pipe or tube for hot water distribution shall be not more than 80 psi. Where necessary, one or more pressure reducing valves shall be provided to regulate the hot and cold water supply pressure to not more than 80 psi.

e. The pressure in the hot water distribution piping shall be limited by a pressure relief valve set no higher than listed in Table 10.15.8 for the particular plastic piping material. When the water heater is protected by a pressure relief valve or combination pressure-temperature relief valve having a pressure setting higher than listed in Table 10.15.8, a separate pressure relief valve shall be provided to protect the piping. The relief valve for the piping shall comply with Section 10.16.2 except that it shall be set no higher than listed in Table 10.15.8. Thermal expansion shall be controlled as required under Section 10.15.7.

10.15.9 Drip Pans

10.15.9.1 Where Required

Where water heaters or hot water storage tanks are installed in locations where leakage will cause damage to the building structure, the tank or water heater shall be installed in a drip pan in accordance with Section 10.15.9.b.

Table 10.15.8 MAXIMUM PRESSURE RELIEF VALVE SETTINGS FOR PLASTIC HOT WATER DISTRIBUTION PIPING	
HW DISTRIBUTION PIPING MATERIAL	**MAX. RELIEF VALVE SETTING**
CPVC (ASTM D2846)	100 psig
CPVC (ASTM F441)	100 psig
CPVC (ASTM F442)	100 psig
PEX (ASTM F876)	100 psig
PEX (ASTM F877)	100 psig
PE-AL-PE (ASTM D 1282)	100 psig
PEX-AL-PEX (ASTM F1281)	125 psig
Composite High Temperature PE-AL-PE (ASTM D1335)	150 psig
Composite High Temperature PEX-AL-PE (ASTM D1335)	150 psig

10.15.9.2 Construction

a. Drip pans shall be watertight and constructed of corrosion-resistant materials. Metallic pans shall be 24 gage minimum. Non-metallic pans shall be .0625-inch minimum thickness. Pans shall be not less than 1-½" deep and shall be of sufficient size to hold the heater without interfering with drain valves, burners, controls, and any required access.

b. High impact plastic pans shall be permitted under gas-fired water heaters where the heater is listed for zero clearance for combustible floors and the application is recommended by the pan manufacturer.

10.15.9.3 Drainage

a. Drip pans shall have drain outlets not less than ¾" size, with indirect drain pipes extending to an approved point of discharge, a suitably located indirect waste receptor, or floor drain, or extend to within 2 to 6 inches above the adjacent floor.

b. Discharge from a relief valve into a water heater pan shall be prohibited.

10.15.10 Water Heaters Used for Space Heating

a. Water heaters used for space heating shall be listed for such use.

b. Piping and components connected to a water heater for space heating application shall be suitable for use with potable water.

c. Where required, a water temperature control valve shall be installed in every combination water heating-space heating system application to limit domestic hot water temperature to 140°F. The temperature control device shall be an ASSE 1017 listed device.

10.16 SAFETY DEVICES FOR PRESSURE VESSELS

10.16.1 Tank Protection

a. Pressure vessels used for heating water or storing water at pressures above atmospheric shall be protected by approved safety devices in accordance with one of the following methods:

1. A separate pressure relief valve and a separate temperature relief valve; or
2. A combination pressure and temperature relief valve; or
3. Either "a" or "b" above and an energy cut-off device.
4. Tank construction conforming to a standard that does not require a temperature or pressure safety or relief valve.

10.16.2 Pressure Relief Valves

a. Pressure relief valves shall comply with the applicable codes, standards, and ratings of ASME, ANSI, and AGA.

b. The valves shall have a relief rating adequate to meet the pressure conditions in the equipment served, and shall be installed either directly in a top tank tapping or in the hot or cold water piping close to the tank.

c. There shall be no shutoff valve between the pressure relief valve and the tank.

d. The pressure relief valve shall be set to open at not less than 25 p.s.i. above the street main pressure or not less than 25 p.s.i. above the setting of any house water pressure regulating valve.

e. The setting pressure relief valve shall not exceed the rated working pressure of the tank being protected.

10.16.3 Temperature Relief Valves

a. Temperature relief valves shall be of adequate relief rating, expressed in BTU/HR, for the equipment served.

b. The valves shall be installed so that the temperature sensing element is immersed in the hottest water within the top 6 inches of the tank.

c. The valves shall be set to open when the stored water temperature reaches a maximum of 210°F. (See Section 3.3.10.)

d. The valves shall conform to an approved standard and shall be sized so that when the valve opens, the water temperature cannot exceed 210°F with the water heating equipment operating at maximum input.

10.16.4 Combination Pressure-Temperature Relief Valves

Combination pressure-temperature relief valves shall comply with all the requirements of the separate pressure and temperature relief valves. (See Section 3.3.10.)

10.16.5 Tankless Water Heaters

a. Tankless instantaneous water heaters shall have a safety thermal cutout to shutoff the unit in the event of unsafe high temperature. The pressure and temperature tank protection required by Section 10.16.1 shall not be necessary unless required by the manufacturer's installation instructions.

b. The outlet temperature control device for tankless water heaters shall be set to supply no more than 140ºF hot water.

10.16.6 Relief Valve Discharge Piping

a. Piping from the outlet of a relief valve to the point of disposal shall be of a material suitable for potable water (see Section 3.4). Discharge pipes from temperature relief valves and combination pressure-temperature relief valves shall be listed in Table 3.4 for hot water distribution, and shall be suitable for conveying water at 210°F to an open discharge. The pressure rating of the pipe at 210 deg F is not required to equal or exceed the pressure setting of the relief valve.

b. There shall be no shut-off valve, check valve or other restricting device between a relief valve and the pressure vessel or piping system being protected.

c. The discharge pipe shall be no smaller than the outlet size of its relief valve and shall extend to a point of disposal without valves, traps or rises that would prevent the relief valve from draining by gravity. Discharge end of the pipe shall not be threaded.

d. An air gap shall be provided where relief valves discharge into an indirect waste pipe, floor drain, trench drain, service sink, mop basin, laundry sink, standpipe or other approved receptor. The minimum size of fixture drains or waste pipes that receive the discharge from relief valves shall be as indicated in Table 10.16.6.

e. Where relief valves discharge to the floor, the discharge pipe shall terminate not more than 6 inches nor less than 2 inches above the floor.

f. If the point of disposal is outside the room or space in which the relief valve is located, an indirect gravity drain shall be provided from the room or space to the point of disposal. Indirect waste pipes shall be sized according to Table 10.16.6 and shall be of a material approved for potable water, sanitary drainage or storm drainage (see Tables 3.4, 3.5, and 3.7). A visible air gap shall be provided in the room or space in which the relief valve is located.

EXCEPTION: Where water heaters are located above ceilings, the relief valve discharge pipe shall extend to a point of disposal or indirect waste that is readily observable in an area below the heater.

g. Where two or more relief valves serving independent systems are located in the same area, each shall be discharged separately. Where such relief valves for independent systems are discharged into a common gravity drain or indirect waste pipe, the drain or waste pipe shall be sized according to the largest discharge pipe served.

Table 10.16.6
SIZE OF DRAINS OR WASTE PIPES RECEIVING RELIEF VALVE DISCHARGE

Discharge Pipe Size	Minimum Drain or Indirect Waste Size
3/4"	2"*
1"	3"
1-1/2"	4"
2"	4"
2-1/2"	6"

*EXCEPTION: A laundry sink with 1-1/2" waste pipe.

10.16.7 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.

10.16.8 Replacement of Relief Valves

a. Relief valves shall be maintained in proper working order and shall be replaced when necessary.

b. Whenever a water heater is replaced, its temperature relief valve and pressure relief valve, or combination temperature-pressure relief valve shall also be replaced and shall not be reused.

10.17 MANIFOLD-TYPE PARALLEL WATER DISTRIBUTION SYSTEMS

10.17.1 General

a. Parallel water distribution systems shall provide individual hot and cold water lines from a manifold to each fixture served.

b. Manifolds shall be specifically designed and manufactured for parallel water distribution.

c. Manufacturer's of such systems shall provide complete sizing and installation instructions, including any limitations or restrictions on use.

d. Piping materials shall include coiled plastic or copper tube approved for hot and cold water distribution.

10.17.2 Sizing

See Appendix B for sizing manifolds and distribution lines. Distribution line sizes shall be as recommended by the system manufacturer to provide the fixture water flow rates listed in Section 10.14.2a. The minimum line size shall be 3/8” nominal.

10.17.3 Valving

a. Each manifold outlet shall be equipped with a shut-off valve that identifies the fixture being supplied. Additional shut-off or stop valves at the fixtures shall be provided as required per Section 10.12.4.
EXCEPTION: Additional shut-off or stop valves at the fixtures shall not be required if the manifold is located within the same room or adjacent closet as the fixtures.

b. Manifolds shall be readily accessible.

10.17.4 Support

a. Tube bundles for manifold systems shall be supported in accordance with Chapter 8 of this Code.

b. Supports at changes in direction shall be in accordance with the manufacturer’s recommendations.

10.18 DRINKING WATER TREATMENT UNITS

10.18.1 Compliance with Standards

Drinking water treatment units shall comply with the standards listed in Table 3.1.3.

10.18.2 Air Gap Discharge

Discharge from all drinking water treatment units shall be installed with an air gap.
EXCEPTION: Reject water connections from reverse osmosis drinking water treatment units shall be through an air gap or alternate air gap device in accordance with the requirements of NSF 58.

10.18.3 Connection Tubing

The tubing to and from the drinking water treatment unit shall be of a size and material as recommended by the manufacturer. The tubing shall comply with NSF 14, NSF 58 or NSF 61.

10.19 SIZING OF RESIDENTIAL WATER SOFTENERS

Residential-use water softeners shall be sized per Table 10.19.

Table 10.19
SIZING OF RESIDENTIAL WATER SOFTENERS

Required Size of Softener Connection (in.)	Number of Bathroom Groups Served[1]
3/4	Up to 2[2]
1	Up to 4[3]

[1] Installation with a kitchen sink and dishwasher, laundry tray and automatic clothes washer.
[2] An additional water closet and lavatory shall be permitted without an increase in sizing.
[3] Over four Bathroom Groups, the softener shall be engineered for the specific installation.

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Chapter 11

Sanitary Drainage Systems

11.1 MATERIALS

See Section 3.1.

11.2 BUILDING SEWERS

11.2.1 Sewer or Drain in Filled Ground

Building sewers or building drains that are installed in filled or unstable ground shall be installed in accordance with Section 2.6.

11.2.2 Existing Building Sewers and Drains

Existing building sewers and drains may be used in connection with new building sewer and drainage systems only when found by examination to conform to the new system in quality of material prescribed by this Code.

11.2.3 Building Sewer and Building Drain Size

The size of the building sewer and the size of the building drain shall be determined by fixture unit loads connected in accordance with Table 11.5.1A.

11.3 DRAINAGE PIPING INSTALLATION

11.3.1 Slope of Horizontal Drainage Piping

a. Horizontal drainage piping shall be installed in uniform alignment at uniform slopes not less than 1/4 inch per foot for 2-inch size and smaller, and not less than 1/8 inch per foot for 3-inch size and larger.

b. Where conditions do not permit building drains and sewers to be laid with slope as great as that specified, a lesser slope may be permitted by the Authority Having Jurisdiction.

11.4 FIXTURE UNITS

11.4.1 Load on Drainage Piping

The load on drainage system piping shall be computed in terms of drainage fixture unit values in accordance with Table 11.4.1 and Section 11.4.2.

11.4.2 Conversion of Flow in GPM to DFU

Where the discharge rate of fixtures or equipment is expressed in gallons per minute (GPM), two (2) drainage fixture units (DFU) shall be allowed for each gallon per minute (GPM) of flow.

Table 11.4.1
DRAINAGE FIXTURE UNIT (DFU) VALUES

TYPE OF FIXTURES	INDIVIDUAL DWELLING UNITS	SERVING 3 OR MORE DWELLING UNITS	OTHER THAN DWELLING UNITS	HEAVY-USE ASSEMBLY
BATHROOM GROUPS HAVING 1.6 GPF GRAVITY-TANK WATER CLOSETS				
Half-bath or Powder Room	3.0	2.0		
1 Bathroom Group	5.0	3.0		
1 1/2 Bathrooms	6.0			
2 Bathrooms	7.0			
2 1/2 Bathrooms	8.0			
3 Bathrooms	9.0			
Each Additional 1/2 Bath	0.5			
Each Additional Bathroom Group	1.0			
BATHROOM GROUPS HAVING 1.6 GPF PRESSURE-TANK WATER CLOSETS				
Half-bath or Powder Room	3.5	2.5		
1 Bathroom Group	5.5	3.5		
1 1/2 Bathrooms	6.5			
2 Bathrooms	7.5			
2 1/2 Bathrooms	8.5			
3 Bathrooms	9.5			
Each Additional 1/2 Bath	0.5			
Each Additional Bathroom Group	1.0			
BATHROOM GROUPS HAVING 3.5 GPF TANK-TYPE WATER CLOSETS				
Half-bath or Powder Room	3.0	2.0		
1 Bathroom Group	6.0	4.0		
1 1/2 Bathrooms	8.0			
2 Bathrooms	10.0			
2 1/2 Bathrooms	11.0			
3 Bathrooms	12.0			
Each Additional 1/2 Bath	0.5			
Each Additional Bathroom Group	1.0			
BATH GROUP (1.6 GPF Flushometer Valve)	5.0	3.0		
BATH GROUP (3.5 GPF Flushometer Valve)	6.0	4.0		

Table11.4.1 (Continued)
DRAINAGE FIXTURE UNIT (DFU) VALUES

TYPE OF FIXTURES	INDIVIDUAL DWELLING UNITS	SERVING 3 OR MORE DWELLING UNITS	OTHER THAN DWELLING UNITS	HEAVY-USE ASSEMBLY
INDIVIDUAL FIXTURES				
Bathtub or Combination Bath/Shower, 1 1/2" Trap	2.0	2.0		
Bidet, 1 1/4" Trap	1.0	1.0		
Clothes Washer, Domestic, 2" Standpipe	3.0	3.0	3.0	
Dishwasher, Domestic, with Independent Drain	2.0	2.0	2.0	
Drinking Fountain or Watercooler			0.5	
Food-Waste-Grinder, Commercial, 2" Min Trap			3.0	
Floor Drain, Auxiliary			0.0	
Kitchen Sink, Domestic, with One 1 1/2" Trap	2.0	2.0	2.0	
Kitchen Sink, Domestic, with Food-Waste-Grinder	2.0	2.0	2.0	
Kitchen Sink, Domestic, with Dishwasher	3.0	3.0	3.0	
Kitchen Sink, Domestic, with Grinder and Dishwasher	3.0	3.0	3.0	
Laundry Sink, One or Two Compartments, 1 1/2" Waste	2.0	2.0	2.0	
Laundry Sink, with Discharge from Clothes Washer	2.0	2.0	2.0	
Lavatory, 1 1/4" Waste	1.0	1.0	1.0	1.0
Mop Basin, 3" Trap			3.0	
Service Sink, 3" Trap			3.0	
Shower Stall, 2" Trap	2.0	2.0	2.0	
Showers, Group, per Head (Continuous Use)			5.0	
Sink, 1 1/2" Trap	2.0	2.0	2.0	
Sink, 2" Trap	3.0	3.0	3.0	
Sink, 3" Trap			5.0	
Trap Size, 1 1/4" (Other)	1.0	1.0	1.0	
Trap Size, 1 1/2" (Other)	2.0	2.0	2.0	
Trap Size, 2" (Other)	3.0	3.0	3.0	
Trap Size, 3" (Other)			5.0	
Trap Size, 4" (Other)			6.0	
Urinal, 1.0 GPF			4.0	5.0
Urinal, Greater Than 1.0 GPF			5.0	6.0
Wash Fountain, 1 1/2" Trap			2.0	
Wash Fountain, 2" Trap			3.0	
Wash Sink, Each Set of Faucets			2.0	

Table 11.4.1 (Continued)
DRAINAGE FIXTURE UNIT (DFU) VALUES

TYPE OF FIXTURES	INDIVIDUAL DWELLING UNITS	SERVING 3 OR MORE DWELLING UNITS	OTHER THAN DWELLING UNITS	HEAVY-USE ASSEMBLY
Water Closet, 1.6 GPF Gravity or Pressure Tank	3.0	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Valve	3.0	3.0	4.0	6.0
Water Closet, 3.5 GPF Gravity Tank	4.0	4.0	6.0	8.0
Water Closet, 3.5 GPF Flushometer Valve	4.0	4.0	6.0	8.0
Whirlpool Bath or Combination Bath/Shower, 1 1/2" Trap	2.0	2.0		

NOTES: (Table 11.4.1):

1. A Bathroom Group, for the purposes of this Table, consists of not more than one water closet, up to two lavatories, and either one bathtub, one bath/shower combination, or one shower stall. Other fixtures within the bathing facility shall be counted separately to determine the total drainage fixture unit load.
2. A Half-Bath or Powder Room, for the purposes of this Table, consists of one water closet and one lavatory.
3. For unlisted fixtures, refer to a listed fixture having a similar flow and frequency of use.
4. When drainage fixture unit (DFU) values are added to determine the load on the drainage system or portions thereof, round the sum to the nearest whole number before referring to Tables 11.5.1A, 11.5.1B, or 12.16.6A for sizing the drainage and vent piping. Values of 0.5 or more should be rounded up to the next higher whole number (9.5 = 10 DFU). Values of 0.4 or less should be rounded down to the next lower whole number (9.4 = 9 DFU).
5. "Other Than Dwelling Units" applies to business, commercial, industrial, and assembly occupancies other than those defined under "Heavy-Use Assembly." Included are the public and common areas in hotels, motels, and multi-dwelling buildings.
6. "Heavy-Use Assembly" applies to toilet facilities in occupancies that place heavy, but intermittent, time-based loads on the drainage system, such as; schools, auditoriums, stadiums, race courses, transportation terminals, theaters, and similar occupancies where queuing is likely to occur during periods of peak use.
7. Where other than water-supplied fixtures discharge into the drainage system, allow 2 DFU for each gallon per minute (gpm) of flow. (See Section 11.4.2.)

11.4.3 Diversity Factors

In certain structures such as hospitals, laboratory buildings, and other special use or occupancy buildings where the ratio of plumbing fixtures to occupants is proportionally more than required by building occupancy and in excess of 1,000 fixture units, the Authority Having Jurisdiction may permit the use of a diversity factor for sizing branches, stacks and building sewers.

11.5 DETERMINING DRAINAGE PIPE SIZES

11.5.1 Selecting the Size of Drainage Piping

Pipe sizes shall be determined from Table 11.5.1A and 11.5.1B on the basis of the drainage fixture unit load (DFU) computed from Table 11.4.1 and Section 11.4.1. Sanitary drainage pipe sizes shall not be reduced in the direction of flow.
EXCEPTION: Drain pipe sizes for individual fixtures shall be not less than the minimum trap size required in Section 5.2.

11.5.2 Minimum Size of Soil and Waste Stacks

Soil and waste stacks shall be sized according to Table 11.5.1B. based on the number of branch intervals and drainage fixture unit load.
EXCEPTION: Sections of stacks shall not be smaller than their largest branch connection. except that stack sizes shall not be reduced in the direction of flow.

11.5.3 Horizontal Fixture Branches and Branches of the Building Drain:

Horizontal fixture branches shall be sized according to Table 11.5.1B to the point where they connect to the building drain or a branch of the building drain. Building drain piping that serves two or more horizontal fixture branches are branches of the building drain and may be sized according to Table 11.5.1A.

11.5.4 Provision for Future Fixtures

When provision is made for the future installation of fixtures, those provided for shall be considered in determining the required sizes of drain and vent pipes. Construction to provide for such future installation shall be terminated with a plugged fitting or fittings.

11.5.5 Minimum Size of Underground Drainage Piping

No portion of the drainage system installed underground shall be less than two inch pipe size.
EXCEPTION: Condensate waste, tub and shower traps and trap arms, and piping that receives the discharge from relief valves after an air gap.

11.5.6 Restrictions on the Number of Water Closets on 3" Drains

a. 3" Horizontal Fixture Branches

No more than four water closets or bathroom groups shall be installed on a 3" horizontal fixture branch.
EXCEPTION: Where the water closets are rated 3.5 gallons or more per flush, no more than two water closets or bathroom groups shall be permitted.

b. 3" Stacks

No more than four water closets or bathroom groups shall be installed within any branch interval of a 3" stack, and no more than a total of twelve on the stack.
EXCEPTION: Where the water closets are rated 3.5 gallons or more per flush, no more than two water closets or bathroom groups shall be permitted in any branch interval, and no more than a total of six on the stack.

c. 3" Building Drains and Sewers

1. In single dwelling units, no more than six water closets or bathroom groups shall be installed on a 3" building drain or building sewer, or branches thereof.

EXCEPTION: Where the water closets are rated 3.5 gallons or more per flush, no more than three water closets or bathroom groups shall be permitted.

2. In other than single dwelling units, no more than four water closets or bathroom groups shall be installed on a 3" building drain or building sewer, or branches thereof.

Table 11.5.1A
BUILDING DRAINS AND SEWERS[1]

Maximum Number of Drainage Fixture Units (DFU) That May Be Connected to Any Portion of the Building Drain or the Building Sewer.

Pipe Size- Inches	Slope Per Foot 1/16-Inch	1/8-Inch	1/4-Inch	1/2-Inch
2			21	26
3			42[2]	50[2]
4		180	216	250
5		390	480	575
6		700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

1. On-site sewers that serve more than one building may be sized according to the current standards and specifications of the Authority Having Jurisdiction for the public sewers.
2. See Sections 11.5.6.d, 11.5.6.e, and 11.5.6.f.

Table 11.5.1B
HORIZONTAL FIXTURE BRANCHES AND STACKS

Maximum Number of Drainage Fixture Units (DFU) That May Be Connected To:

Pipe Size- Inches	Any Horizontal Fixture Branch[1]	One Stack of Three Branch Intervals or Less	Stacks with More Than Three Branch Intervals: Total for Stack	Stacks with More Than Three Branch Intervals: Total at One Branch Intervals
$1^1/_4$	1	1	1	1
$1^1/_2$	3	4	8	2
2	6	10	24	6
3	20[2]	48[3]	72[3]	20[3]
4	160	240	500	90
5	360	540	1,100	200
6	620	960	1,900	350
8	1,400	2,200	3,600	600
10	2,500	3,800	5,600	1,000
12	3,900	6,000	8,400	1,500
15	7,000			

1. Does not include branches of the building drain.
2. See Section 11.5.6.b.
3. See Section 11.5.6.c.

EXCEPTION: Where the water closets are rated 3.5 gallons or more per flush, no more than two water closets or bathroom groups shall be permitted.

d. Mixed Water Closets on 3" Drains

Where 3" drainage piping serves a mixture of 1.6 GPF water closets and 3.5 (or higher) GPF water closets, the 3.5 (or higher) GPF water closets shall be counted as two water closets for the purpose of determining the total number of water closets on the 3" drainage piping. The drainage fixture unit (DFU) load for each 3.5 (or higher) GPF water closet shall be as indicated in Table 11.4.1

11.5.7 Stack Size Reduction

a. Stacks shall be sized according to the total accumulated drainage fixture unit load (DFU) at each story or branch interval.

b. The stack size shall be permitted to be reduced as the DFU load decreases on the upper portion of the stack.

EXCEPTION: No portion of a stack shall be less than one-half of the required size at the base of the stack.

11.6 SIZING OF OFFSETS IN DRAINAGE PIPING

11.6.1 Vertical Offsets

An offset in a stack that is 45 degrees or more from horizontal shall be sized as a straight vertical stack in accordance with Table 11.5.1B.

11.6.2 Reserved

11.6.3 Offsets Above the Highest Branch

An offset in a stack above the highest horizontal branch drain connection shall not affect the size of the stack, only the developed length of the stack vent.

11.6.4 Reserved

11.6.5 Horizontal Offsets

a. A stack with an offset of less than 45 degrees from the horizontal shall be sized as follows:

1: The portion of the stack above the offset shall be sized as a regular stack based on the total number of fixture units above the offset.

2. The offset shall be sized as a uilding drain (See Table 11.5.1A).

3. The portion of the stack below the offset shall be sized as the offset or based on the total number of fixture units on the entire stack, whichever is the larger.

4. A relief vent shall be provided for the offset is required by Section 12.3.3.

11.7 SUMPS AND EJECTORS

11.7.1 Building Subdrains

a. Building sanitary drains that cannot be discharged by gravity shall be discharged into a sump pit from which the contents shall be lifted and discharged into the building gravity drainage system by automatic pumping equipment or by an equally efficient method approved by the Authority Having Jurisdiction.

b. Only drains that must be lifted for gravity discharge shall be connected to such sump pits. All other drains shall discharge by gravity.

EXCEPTION: Existing buildings.

c. Sump pits shall be a minimum of 15 inches in diameter and 18 inches deep, and be accessible, tightly covered, and vented.

11.7.2 Reserved

11.7.3 Reserved

11.7.4 Venting

Building subdrain systems shall be vented according to Chapter 12 of this Code.

11.7.5 Reserved

11.7.6 Grinder Pump Ejector

a. Grinder pumps shall be permitted to be used when approved by the Authority Having Jurisdiction and installed according to the manufacturer's recommendations.

b. The rated flow velocity for grinder pump discharge piping shall be not less than 2 feet per second.

c. The size of grinder pump discharge piping shall be:

1. 1-1/4" size for up to 25 gallons per minute.
2. 1-1/2" size for up to 35 gallons per minute.
3. 2" size for up to 65 gallons per minute.

11.7.7 Pneumatic Ejectors

Vents from pneumatic ejectors shall be carried separately to the open air as a vent terminal in accordance with Section 12.14.2.

11.7.8 Sewage Ejectors or Sewage Pumps

a. A sewage ejector or sewage pump receiving the discharge from a water closet or urinal shall have a minimum capacity of 20 gallons per minute.

b. The discharge piping from a sewage ejector and sewage pump shall include a backwater valve and a full-way shutoff valve.

c. Ejectors or pumps in single dwelling units shall be capable of passing a 1-1/2 inch diameter solid.
EXCEPTION: Grinder pumps.

d.In other than single dwelling units, ejectors and pumps shall be capable of passing a 2 inch diameter solid.
EXCEPTION: Grinder pumps.

11.7.9 Individual Fixture Ejector or Pump

a. Individual fixtures other than water closets, urinals, and similar fixtures, may discharge directly into an approved fixture-mounted ejector or pump, or into receptors having ejectors or pumps.

b. The discharge piping from a sewage ejector or sewage pump for an individual fixture shall be sized on a hydraulic basis and include a backwater valve and full-way shutoff valve.

c. Direct-mounted equipment may be manually or automatically operated.

d. The installation of manually or automatically operated equipment shall not be subject to the venting requirements of this Code, but shall be vented only as required for proper operation of the equipment.

e. A vent on the fixture side of the trap may terminate locally in the area served.

f. If the equipment provides a proper water seal, additional traps are not required.

11.7.10 Macerating Toilet Systems

a. The sump for macerating toilets shall be vented with a 1-1/4" vent.

b. The discharge line from the sump shall be not less than 3/4" size and include a check valve and full-way shutoff valve.

c. The distance from a macerating toilet system to a gravity drain shall not exceed the recommendations of the manufacturer of the macerating toilet system

11.7.11 High Water Alarms

All sewage ejector or sewage pump systems shall be provided with an audible, visual, or combination high water alarm device.
EXCEPTION: Sewage ejectors and sewage pumps serving individual fixtures.

11.8 RESERVED

11.9 BRANCH CONNECTIONS NEAR THE BASE OF STACKS

a. Horizontal branch drain connections shall not be made within 10 pipe diameters downstream from the base of a stack.

b. A relief vent shall be provided for stacks of five or more branch intervals, either above the base of the stack or within 10 pipe diameters downstream from the base of the stack.

c. Branch drains shall not connect between the base of a stack and its relief vent.

11.10 BRANCH CONNECTIONS TO OFFSETS IN STACKS

a. Branch drains shall be permitted to connect to a horizontal stack offset, provided that the connection is not less than 10 pipe diameters downstream from the upper portion of the stack

b. Where stacks have five or more branch intervals above a horizontal offset, there shall be no branch connections to the stack within 2 feet above or below the offset.

c. Where stacks having five or more branch intervals above a vertical offset have branch connections to the stack within 2 feet above or below the offset, the offset shall be vented as required for a horizontal offset.

11.11 SUDS PRESSURE ZONES

11.11.1 General

Where suds-producing fixtures on upper floors discharge into a soil or waste stack, suds pressure zones shall exist as described in Section 11.11.2. Fixture or branch drain connections shall not be made to such stacks in the suds pressure zones except where relief vents complying with Section 12.15 are provided. Suds-producing fixtures include kitchen sinks, laundry sinks, automatic clothes washers, dishwashers, and other fixtures that could discharge sudsy detergents.

11.11.2 Locations in Stacks Serving Suds-Producing Fixtures

a. Zone 1 - at offsets greater than 45 degrees from vertical. A suds pressure zone shall extend 40 pipe diameters up the stack above the offset, 10 pipe diameters downstream from the base of the upper portion of the stack, and in the horizontal offset, 40 pipe diameters upstream from the top of the lower portion of the stack.

b. Zone 2 - at the base of a soil or waste stack. A suds pressure zone shall extend 40 pipe diameters up the stack above its base.

c. Zone 3 - in the horizontal drain beyond the base of a soil or waste stack. A suds pressure zone shall extend 10 pipe diameters from the base of the stack. Also, if a turn greater than 45 degrees occurs in the horizontal drain less than 50 feet from the base of the stack, suds pressure zones shall exist 40 pipe diameters upstream and 10 pipe diameters downstream from the horizontal turn.

d. Zone 4 - in a vent stack at the base of a soil or waste stack. Where a vent stack connects above or beyond the base of a soil or waste stack, a suds pressure zone shall extend up the vent stack to a level equal to the level of the suds pressure zone in the soil or waste stack.

11.11.3 Separate Stacks

Where soil or waste stacks serving suds-producing fixtures extend six or more floors above the base of the stack or above a horizontal offset in the stack, the lowest four floors above the base or horizontal offset shall be drained by a separate stack. In the case of a horizontal offset, the separate stack for the four floors above the offset may be reconnected to the main stack below the offset, provided that the point of connection is not a suds pressure zone in either stack.

11.11.4 Exceptions

The requirements of Sections 11.11 and 12.15 shall not apply to the following:

a. Stacks that are less than three stories in height.
b. Stacks in individual dwellings having their own building sewer.

Chapter 12

Vents and Venting

12.1 MATERIALS

See Section 3.6.

12.2 PROTECTION OF TRAP SEALS

12.2.1 Protection Required

a. The protection of trap seals from siphonage, aspiration, or back-pressure shall be accomplished by the appropriate use of soil or waste stacks with adequate venting in accordance with the requirements of this Code.

b. Venting systems shall be designed and installed so that at no time shall trap seals be subjected to a pneumatic pressure differential of more than one inch of water pressure under design load conditions.

c. If a trap seal is subject to loss by evaporation, means shall be provided to prevent the escape of sewer gas. (See Section 5.3.6.)

12.3 VENTING OF DRAINAGE STACKS

12.3.1 Stack Vents and Vent Stacks

a. A vent stack shall be provided for drainage stacks having five or more branch intervals.

b. Where drainage stacks have five or more branch intervals, the vent stack shall connect to the drainage stack as a relief vent, either:

1. To the drainage stack at or below the lowest fixture branch or,
2. To the building drain within 10 pipe diameters downstream from the base of the stack.

c. Vent stacks shall also be permitted to be provided for drainage stacks having less than five branch intervals.

12.3.2 Relief Vents for Stacks Having Ten or More Branch Intervals

a. Where drainage stacks have ten or more branch intervals, a relief vent shall be provided for each ten intervals, starting at the top of the stack.

b. The lower end of each relief vent shall connect to the drainage stack as a yoke vent below its tenth branch interval.

c. The upper end of the relief vent shall connect to the vent stack at an elevation not less than 3 feet above the floor level served by the branch interval.

12.3.3 Horizontal Offsets

a. Horizontal offsets in stacks having five or more branch intervals discharging above the offset shall be vented either:

1. by considering the stack as two separate stacks, one above and one below the offset, and venting each separately.

2. by providing a yoke vent from the drainage stack below the offset to the vent stack required by Section 12.3.1 not less than 3 feet above the offset. This relief vent may be a stack vent for the lower portion of the drainage stack.

12.3.4 Vertical Offsets

Where vertical offsets in drainage stacks having five or more branch intervals above the offset have branch connections within 2 feet above or below the offset, a relief vent shall be provided for the lower portion of the stack below the offset.

12.3.5 Vent Headers

Vents may be connected into a common header at the top of one or more stacks and then be extended to the open air at one point.

12.3.6 Other Use Prohibited

The plumbing vent system shall not be used for purposes other than venting of the plumbing system.

12.4 VENT TERMINALS

12.4.1 Extension Above Roofs

Vent pipes shall terminate not less than 6 inches above the roof, measured from the highest point where the vent intersects the roof.
EXCEPTION: Where a roof is used for any purpose other than weather protection, vents shall extend at least 7 feet above the roof and shall be properly supported.

12.4.2 Waterproof Flashings

Vent terminals shall be made watertight with the roof by proper flashing.

12.4.3 Flag Poling Prohibited

Vent terminals shall not be used for the purpose of flag poling, TV aerials, or similar purposes.

12.4.4 Location of Vent Terminal

a. Vent terminals shall not be located where vapors can enter the building.

b. No vent terminal shall be located directly beneath any door, window, or other ventilating opening of a building or of another building, nor shall any such vent terminal be within 10 feet horizontally of such opening unless it is at least 2 feet above the top of such opening.

c. Where a vent terminal is within 10 feet horizontally and less than 2 feet above a ventilation opening described in Section 12.4.4b and the line-of-sight from the vent terminal to the ventilation opening is interrupted by the continuous ridge of a roof, the ridge shall be at least 2 feet above the top of the opening. Otherwise, the vent terminal shall comply with Section 12.4.4b.

d. Where a vent terminal is within 10 feet horizontally and less than 2 feet above a ventilation opening described in Section 12.4.4b and the line of sight from the vent terminal to such ventilation opening is interrupted by a solid wall or solid barrier, the top of the wall or barrier shall be at least 2 feet above the top of the ventilation opening and the shortest travel distance around the wall or barrier from the vent terminal to the nearest edge of the ventilation opening shall be at least 10 feet. Otherwise, the vent terminal shall comply with Section 12.4.4b.

12.4.5 Sidewall Venting

Vent terminals shall be permitted to extend through a wall on an existing building. They shall be at least 10 feet horizontally from any lot line, 10 feet above existing grade, and terminate with a corrosion-resistant bird screen. Vent terminals shall not terminate under an overhang of a building. They shall be located in accordance with Section 12.4.4.

12.4.6 Extensions Outside Building

No soil, waste, or vent pipe extension shall be installed on the outside of a wall of any new building, but shall be carried up inside the building
EXCEPTION: In those localities where the outdoor temperature does not drop below 32^0F, the Authority Having Jurisdiction may approve the installation outside the building.

12.4.7 Flashing Roof Vent Terminals

a. Vent terminals through the roof shall be made watertight to the roof by sealing the flashing to either the exterior or interior of the vent terminal.
b. Vent terminals that are externally sealed shall employ manufactured vent stack flashing sleeves, roof couplings, or no-caulk roof vent flashings.
c. Where vent terminals are sealed by counter-flashing over the top of the vent terminal, the counter flashing shall not decrease the interior free area of the minimum required vent terminal size. Vent terminals shall be increased at least one pipe size when counter-flashed. Interior counter flashing shall be sealed gas-tight to prevent the entrance of sewer gas into the building through the flashing.

12.5 FROST CLOSURE

Where the Authority Having Jurisdiction requires protection against frost closure, vent terminals less than 3" pipe size shall be increased at least one pipe size to not less than 2" size. Where an increase is necessary, the increase in size shall be made inside the building at least one foot below a roof or ceiling that is thermally insulated and in an area not subject to freezing temperatures.

12.6 VENT SLOPES AND CONNECTIONS

12.6.1 Vent Slope

Vent and branch vent pipes shall be free from drops and sags and be sloped and connected as to drain by gravity to the drainage system.

12.6.2 Vertical Rise

Every vent shall rise vertically to a minimum of 6 inches above the flood level of the rim of the fixture being served before connecting to another vent.
EXCEPTIONS:
(1) Horizontal portions of a vent below the flood level rim of the fixture served that are installed in accordance with Sections 12.6.2.1, 12.6.2.2, and 12.6.2.3.
(2) Island sink vents in accordance with Section 12.18.

12.6.2.1

Where a vent pipe connects to a horizontal fixture drain branch, and conditions require a horizontal offset in the vent below the flood level rim of the fixture served, the vent shall be taken off so that the invert of the horizontal portion of the vent pipe is at or above the centerline of the horizontal soil or waste pipe.

12.6.2.2

The portion of the horizontal vent installed below the flood level rim as permitted in Section 12.6.2.1 shall be installed with the required slope to drain by gravity to the drainage system.

12.6.2.3

Cleanouts shall be provided in the vent piping so that any blockages in the vent piping below the flood level rim of the fixture served can be cleared into the drainage system.

12.6.3 Vent Connection Height Above Fixtures

Connections between any horizontal vent pipe, including individual vents, branch vents, relief vents, circuit vents or loop vents, and a vent stack or stack vent shall be made at least 6 inches above the flood level rim of the highest fixture on the floor level.

12.6.4 Side-Inlet Closet Bends

a. Side-inlet closet bends shall be permitted only in cases where the fixture connection thereto is vented.
b. In no case shall the side-inlet be used to vent a bathroom group without being washed by a fixture.
EXCEPTION: As allowed in Sections 12.10 and 12.11.

12.7 ADJACENT FIXTURES

Two fixtures set adjacent within the distance allowed between a trap and its vent, may be served with one common vent, provided that each fixture connects separately into an approved double fitting having inlet openings at the same level. (See Section 12.9.2 for inlet openings at different levels.)

12.8 FIXTURE VENTS

12.8.1 Venting of Fixture Drains

Fixture drains shall have a vent so located that the vent connects above the top weir of the trap and the developed length of the trap arm is within the limits set forth in Table 12.8.1.
EXCEPTIONS:
(1) Water closets and similar siphonic fixtures.
(2) Combination waste and vent systems. (see Section 12.17)
(3) Vents may be connected below the top weir of the fixture trap if the following conditions are met:
a) The vertical section of the drain pipe shall be at least one pipe size larger than the trap inlet size.
b) The horizontal pipe connected to the trap outlet shall be at least two pipe diameters long.
c) The developed length of the trap arm shall not exceed the values in Table 12.8.1.

Table 12.8.1
MAXIMUM LENGTH OF TRAP ARM

Diameter of Trap Arm (Inches)	Length—Trap to Vent	Slope—Inches per Foot
1 1/4	3'6"	1/4
1 1/2	5'	1/4
2	8'	1/4
3	10'	1/4
4	12'	1/8

NOTE: This table has been expanded in the "length" requirements to reflect expanded application of the wet venting principles. Slope shall not exceed 1/4" per foot.

12.8.2 Provision for Venting Future Fixtures

On new construction of residential dwelling units with basements, a 2" minimum size vent shall be installed between the basement and attic or tied into an existing, properly sized vent and capped for future use.

12.8.3 Crown Venting Limitation

A vent shall not be installed within two pipe diameters of the trap weir.

12.8.4 Water Closets and Other Siphonic Fixtures

For water closets and other fixtures that operate by siphonic action, the distance between the outlet of the fixture and its vent connection shall not exceed 3 feet vertically and 9 feet horizontally.

12.9 COMMON VENTS

12.9.1 Individual Vent as Common Vent

An individual vent, installed vertically, may be used as a common vent for two fixture traps when both fixture drains connect with a vertical drain at the same level.

12.9.2 Fixtures Drains Connected at Different Levels

A common vent may be used for two fixtures installed on the same floor but connecting to a vertical drain at different levels, provided that the vertical drain is one pipe size larger than the upper fixture drain but in no case smaller than the lower fixture drain.

12.10 WET VENTING

12.10.1 Single Bathroom Groups

a. An individually vented lavatory in a single bathroom group shall be permitted to serve as a wet vent for either the water closet, the bathtub or shower stall, the water closet and bathtub/shower if all of the following conditions are met.

1. The wet vent is 1-1/2" minimum pipe size if the water closet bend is 3" size or it shall be 2" minimum pipe size if the water closet bend is 4" pipe size**.**
2. A horizontal branch drain serving both the lavatory and the bathtub or shower stall is 2" minimum pipe size.
3. The length of the trap arm for the bathtub or shower stall is within the limits of Table 12.8.1. If not, the bathtub or shower stall shall be individually vented.
4. The distance from the outlet of the water closet to the connection of the wet vent is within the limits established by Section 12.8.4. Otherwise, the water closet shall be individually vented.
5. A horizontal branch serving the lavatory and the bathtub or shower stall shall connect to the stack at the same level as the water closet, or it may connect to the water closet bend, or the lavatory and bathtub or shower stall may individually connect to the water closet bend.
6. When the bathroom group is the topmost load on a stack, a horizontal branch serving the lavatory and the bathtub or shower stall may connect to the stack below the water closet bend, or the lavatory and the bathtub or shower stall may individually connect to the stack below the water closet bend.

12.10.2 Double Bathtubs and Lavatories

Two lavatories and two bathtubs or showers back-to-back may be installed on the same horizontal branch with a common vent for the lavatories and with no back vent for the bathtubs or shower stalls provided the wet vent is 2" in size and the lengths of the tub/shower drains conform to Table 12.8.1.

12.10.3 Multi-Story Bathroom Groups

a. On the lower floors of a stack, the waste pipe from one or two lavatories may be used as a wet vent for one or two bathtubs or showers as provided in Section 12.10.2.

b. Each water closet below the top floor shall be individually back vented.

EXCEPTION: The water closets in bathroom groups shall not be required to be back vented if the following conditions are met:

1. The 2" waste serving the tubs/showers and lavatories connect directly into the water closet bend with a 45° wye tap in the direction of flow or,

2. A special stack fitting is used that consists of a 3" or 4" closet opening and two side inlets each 2" in size and the inverts of which are above the center, and below the top of the water closet opening; and one of the 2" inlets is connected to the tub/shower drains, and the other is connected to the waste pipe from a maximum of two lavatories that are vented to a vent stack or stack vent; or,

3. In lieu of the special stack fitting of Section 12.10.3b(2) above, 4" closet bends with two 2" wye taps may be used.

12.10.4 Bathtubs and Water Closets

a. An individually-vented bathtub in a single bathroom group shall be permitted to serve as a wet vent for the water closet if all of the following conditions are met:

1. The wet vent is 2" minimum size.

2. The distance from the outlet of the water closet to the connection of the wet vent is within the limits established by Section 12.8.4. Otherwise, the water closet shall be individually vented.

12.10.5 Waste Stacks in Dwelling Units

In a single dwelling unit, a waste stack that receives the discharge of a kitchen type sink or a 3 dfu fixture may also serve as a wet vent for a laundry tray or a 3 dfu fixture connected to the stack at the floor below. The minimum size of the waste stack and wet vent up to the upper branch connection shall be 2" in diameter. No sink shall be installed on a two-inch wet vent that vents a water closet.

12.11 STACK VENTING

12.11.1 Fixture Groups

a. A single bathroom group and a kitchen sink (with or without a disposer and/or dishwasher) located back-to-back, or two bathroom groups back-to-back may be installed without individual fixture vents in a one-story building or on the highest branch of a stack provided that the following conditions are met:

1. Each fixture drain connects independently to the stack.

2. The tub and/or shower and water closet enter the stack at the same level.

3. The requirements of Table 12.8.1 are met.

4. A side inlet connection into a 4" closet bend shall be considered to be an independent connection to the stack.

12.11.2 Lower Floors

a. Lower floor bathroom groups may be vented as provided in Section 12.11.1, provided the following conditions are met:

1. A wye is installed in the stack with an upright one-eighth bend continuing from the wye branch to serve the stack group.

2. A 2" relief vent is connected to the wye branch at least 6 inches above the flood level rim of the highest fixture on the wye branch.

12.12 FIXTURE REVENTING

12.12.1 Reserved

12.12.2 Horizontal Branches

Three lavatories or one sink within 8 feet developed length of a main-vented line may be installed on a 2" horizontal waste branch without reventing, provided the branch is not less than 2 inches in diameter throughout its length, and provided the wastes are connected into the side of the branch and the branch leads to its stack connection with a grade of not more than 1/4 inch per foot.

12.12.3 Fixtures without Revents Above Highest Bathtubs and Water Closets

a. Fixtures without revents may be connected to a soil or waste stack above the highest water closet or bathtub connection if all the following conditions are met:

1. The total load does not exceed 3 dfu's.
2. The soil or waste stack is 3" or larger.
3. The total load on the stack is in accordance with Table 11.5.1B.
4. The waste piping of the fixture above the water closet or bathtub connection is in accordance with Sections 12.8.1 and 12.12.2.

12.12.4 Vent Washdown

a. Fixtures other than kitchen sinks or food-waste-grinders shall be permitted to wash down a vertical loop vent, circuit vent or relief vent associated with a battery-vented horizontal soil or waste branch without reventing, provided that:

1. Not more than 2 drainage fixture units are drained to a 2" vent, nor more than 4 drainage fixture units are drained to a 3" vent;
2. The fixture trap arm lengths comply with Section 12.8.1;
3. The fixtures drained to the vent are within the same branch as the other fixtures served by the vent; and
4. No other fixtures are drained to the vent.

12.13 CIRCUIT AND LOOP VENTING

12.13.1 Battery Venting

a. A maximum of eight floor-outlet water closets, showers, bathtubs, or floor drains connected in battery on a horizontal branch drain shall be permitted to be battery vented.

EXCEPTION: Blowout type water closets.

b. Each fixture drain shall connect horizontally to the horizontal branch drain being so vented.

c. The horizontal branch drain shall be considered as a vent extending from the most downstream fixture drain connection to the most upstream fixture drain connection.

d. Back-outlet water closets shall be permitted to be battery vented provided than no floor-outlet fixtures are connected to the same horizontal branch drain.

EXCEPTION: Back-outlet blowout type water closets.

e. The battery vent shall be a circuit or loop vent connected to the horizontal branch drain between the two most upstream fixture drains and shall be installed in accordance with Section 12.6.

f. The entire length of the vent section of the horizontal branch drain shall be uniformly size for the total drainage discharge connected thereto.

g. The maximum slope of the horizontal branch drain shall be 1 inch per foot.

h. A relief vent shall be provided on battery-vented horizontal branch drains on lower floors that have four or more water closets connected.

i. The relief vent shall connect to the horizontal branch drain between the stack and the most downstream fixture drain connection.

j. Relief vents shall be installed in accordance with Section 12.6.

k. Circuit, loop, and relief vents shall be permitted to be a fixture drain or fixture branch for fixtures located within the same branch interval as the battery-vented horizontal branch drain.

EXCEPTION: No more than four drainage fixture units (DFU) shall discharge to the vent. (See Section 12.12.4).

l. Lavatories and similar fixtures shall be permitted to connect to the horizontal branch drain, either horizontally or vertically.

EXCEPTIONS:

(1) Fixtures that are not located on the same floor as the battery-vented fixtures.

(2) Fixtures that do not have an individual, common, or continuous vent.

m. Batteries of more than eight battery-vented fixtures shall have a circuit or loop vent for each group of eight or less fixtures.

n. Where there are two or more groups of battery-vented fixtures, the horizontal branch drain for each downstream group shall be sized for the total discharge into that group, including all upstream groups and the fixtures within the group being sized.

12.13.2 Joining Parallel Branches

Where parallel branches of up to eight battery-vented fixtures each are joined prior to connecting to a stack or building drain, the common downstream piping shall be sized for the combined total fixture unit load of both branches. A relief vent shall be provided on the common downstream piping when the parallel branches serve a combined total of four or more water closets and connect to a stack receiving drainage from an upper floor.

12.13.3 Vent Connections

Circuit, loop, and relief vent connections to battery-vented horizontal drain branches shall be taken off at a vertical angle or from the top of the horizontal drain.

12.13.4 Fixtures Back-to-Back in Battery

When fixtures are connected to one horizontal branch through a double wye or a sanitary tee in a vertical position, a common vent for each two fixtures back-to-back or double connection shall be provided. The common vent shall be installed in a vertical position as a continuation of the double connection.

12.14 VENTING OF BUILDING SUBDRAIN SYSTEMS

12.14.1 Fixture Venting

Fixtures and gravity drainage piping in a building subdrain system shall be vented in the same manner as a conventional gravity drainage system and shall be permitted to connect to vent piping for fixtures and gravity drainage piping that are not part of the subdrain system.

12.14.2 Sump Pits

a. The minimum size and maximum length of vents for atmospheric sump pits shall be as indicated in Table 12.14.2

b. Where subdrain systems utilize pneumatic sewage ejectors, atmospheric sump pits or surge tanks shall be provided if water closets, urinals, or other fixtures are close enough to the ejector that they will overflow if flushed while the ejector is discharging.

c. The atmospheric vents from sump pits and surge tanks shall be permitted to be connected to gravity vent piping for fixtures other than those served by the sump pit.

Table 12.14.2
SIZE AND LENGTH[1] OF SUMP VENTS

Discharge Capacity of Sump Pump (gpm)	Diameter of Vent, (inches) 1-1/4	1-1/2	2	2-1/2	3	4
	Maximum Equivalent Length of Vent, in Feet, (Given Below)					
10	N.L.[2]	N.L.	N.L.	N.L.	N.L.	N.L.
20	270	N.L.	N.L.	N.L.	N.L.	N.L.
40	72	160	N.L.	N.L.	N.L.	N.L.
60	31	75	270	N.L.	N.L.	N.L.
80	16	41	150	380	N.L.	N.L.
100	<10[3]	25	97	250	N.L.	N.L.
150	NP[4]	<10[3]	44	110	370	N.L.
200	NP	NP	20	60	210	N.L.
250	NP	NP	10	36	132	N.L.
300	NP	NP	<10[3]	22	88	380
400	NP	NP	NP	<10[3]	44	210
500	NP	NP	NP	NP	24	130

1. Developed length plus an appropriate allowance for effects of entrance losses and friction due to fittings, Changes in direction, and changes in diameter. Suggested allowances may be obtained from NBS Monograph 31 or other acceptable sources. An allowance of 50% of the developed length may be assumed if a more precise value is not available.
2. No Limit; actual values greater than 500 feet.
3. Less than 10 feet.
4. Not permitted.

12.14.3 Pneumatic Sewage Ejectors

Pressure release vents for pneumatic sewage ejectors shall extend to a vent terminal that is separate from any gravity system vents. Such pressure release vents shall be of sufficient size to reduce the ejector tank to atmospheric pressure within 10 seconds, but shall be not less than 1-1/4" pipe size.

12.15 SUDS PRESSURE VENTING

12.15.1 Relief Venting

Where fixture or branch drains connect to a soil or waste stack within a suds pressure zone as described in Section 11.11.2, a suds relief vent shall be provided for the fixture or branch drain. Suds relief vents shall be 2" minimum size but not less than one pipe size smaller than the drain branch that they serve. Such relief vents shall connect to the drain branch between the suds pressure zone and the first fixture trap on the branch.

Table 12.15.1
SUDS PRESSURE RELIEF VENTS

Drain Size	Relief Vent Size
1-1/2	2
2	2
3	2
4	3
5	4
6	5
8	6

12.15.2 Prohibited Vent Connections

Connections shall not be made within the suds pressure zone of a vent stack that connects at or downstream from the base of a soil or waste stack, as described in Section 11.11.2.d.

12.16 SIZE AND LENGTH OF VENTS

12.16.1 Size of Fixture Vents

a. Vents for individual fixtures shall be sized according to Table 12.16.

b. Vents shall be not less than 1-1/4" size nor less than one-half the size of the fixture drain that they serve.

c. Where a vent pipe serves two or more fixtures, the size of the combined vent pipe shall be based on the sum of the drainage fixture units (DFU) for all of the drains served.

d. Where the fixtures being vented are not connected to the same drain stack, the stack size used in Table 12.16 shall be the equivalent stack size for their total combined DFU load, based on Table 11.5.1B.

EXCEPTION: As otherwise provided in this Code.

12.16.2 Size of Circuit or Loop Vents

Circuit or loop vents shall be not less than one-half the size of the horizontal drainage branch that they serve.

12.16.3 Size of Relief Vents

a. The size of relief vents for circuit or loop vented branches of the drainage system shall be not less than one-half the size of the branch drain being served.

b. Relief vents for stacks having ten or more branch intervals and relief vents for horizontal offsets in such stacks shall be the same size as the vent stack to which they connect.

12.16.4 Size of Stack Vents and Vent Stacks

The minimum required size of stack vents and vent stacks shall be in accordance with Table 12.16. For the purpose of sizing, the length of a vent stack or stack vent shall be the developed length from its lowest connection with the drainage system to its termination in the open air, including any vent headers.

12.16.5 Vent Headers

a. Vent headers or portions thereof shall be sized according to Table 12.16.

b. The number of fixture units (DFU) used to size vent headers shall be the sum of all fixture units (DFU) on all stacks served by each section of the header.

c. The developed length of vent headers shall be the longest vent length from the vent connection at the base of the most distant stack to the vent terminal in the open air.

d. The soil or waste stack size used to size vent headers shall be the equivalent size capable of handling the fixture unit load (DFU) on the vent header, based on Table 11.5.1B.

12.16.6 Aggregate Size of Vent Terminals

a. Each building sewer shall be vented by one or more vents extending from the drainage system, or branches thereof, to the open air above the roof.

b. Stack vents and vent stacks shall be sized according to Table 12.16.4.

c. The aggregate cross-sectional area of all vent terminals serving a sewer shall be not less than the cross-sectional area of the minimum required size of the building drain that they serve, at the point where it connects to the building sewer. (See Table 12.16.6 for the cross-sectional areas of pipes).

EXCEPTION: The aggregate cross-sectional area requirement shall be exclusive of any requirements to prevent frost closure under Section 12.5.

d. One or more vent terminals having the aggregate cross-sectional area of a 3" vent terminal shall be permitted to vent a 4" building drain if the drainage fixture unit load (DFU) and number of bathroom groups served by the building drain does not exceed the maximum number allowed on a 3" building drain, as permitted by Section 12.16.6.c.

Table 12.16
SIZE AND LENGTH OF VENTS

Size of drainage stack or fixture drain inches	Drainage fixture units connected	Diameter of Vent Required (Inches)								
		1-1/4	1-1/2	2	2-1/2	3	4	5	6	8
		Maximum Length of Vent (Feet)								
1-1/4	1	(1)								
1-1/2	8	50	150							
2	12	30	75	200						
2	20	26	50	150						
3	10		30	100	100	600				
3	30			60	200	500				
3	60			50	80	400				
4	100			35	100	260	1000			
4	200			30	90	250	900			
4	500			20	70	180	700			
5	200				35	80	350	1000		
5	500				30	70	300	900		
5	1100				20	50	2200	700		
6	350				25	50	200	400	1300	
6	620				15	30	125	300	1100	
6	960					24	100	250	1000	
6	1900					20	70	200	700	
8	600						50	150	500	1300
8	1400						40	100	400	1200
8	2200						30	80	250	1100
8	3600						25	60	250	800
10	1000							75	125	1000
10	2500							50	100	500
10	3800							30	80	350
10	5600							25	60	250

(1) The length of the vent is unlimited

Table 12.16.6
NOMINAL PIPE CROSS SECTIONAL AREA (Sq. Inches)

Nominal Pipe Size (ID)	Cross Sectional Area (sq in.)
$1^1/_4$	1.2
$1^1/_2$	1.8
2"	3.1
$2^1/_2$"	4.9
3"	7.1
4"	12.6
5"	19.6
6"	28.3
8"	50.3
10"	78.5
12"	113.1
15"	176.7

12.16.7 Underground Vent Piping

The minimum size of vent piping installed underground shall be 1-1/2".

12.17 COMBINATION WASTE AND VENT SYSTEM

12.17.1 Where Permitted

a. A combination waste and vent system shall be permitted only where conditions preclude the installation of a conventionally vented drainage system as otherwise required by this Code.

b. Combination waste and vent systems shall be limited to floor drains and other floor receptors, sinks, lavatories, and standpipes.

12.17.2 Trap Size

Traps in a combination waste and vent system shall be the normal size for the particular fixture. See Table 5.2.

12.17.3 Trap Arms

a. Fixtures shall be considered to be vented at the point that they connect to a combination waste and vent system.

b. Where fixtures have conventionally sized trap arms, the maximum length of the trap arm from the weir of its trap to the point of connection to the combination waste and vent systems shall be as limited in Table 12.8.1.

c. In the case of fixtures with above-the-floor outlets, the vertical drop at the end of the trap arm shall be one size larger than the trap arm and be considered as the beginning of the combination waste and vent system.

d. Floor-outlet fixtures shall also be permitted to drop into a vertical combination waste and vent that is at least one size larger than the trap arm.

e. Where a fixture trap arm is sized as a combination waste and vent, its length shall not be limited and it shall be considered as a branch of the combination waste and vent system.

f. The maximum vertical drop from a fixture trap arm to a horizontal drain below shall be 6 feet.

12.17.4 Pipe Sizing

The piping in a combination waste and vent system shall be sized according to Table 12.17.4, based on the number of drainage fixture units (DFU) served and the slope of the piping.
EXCEPTION: No pipe shall be smaller than any section of piping upstream, including vertical drops from trap arms.

12.17.5 Maximum Slope

All piping in a combination waste and vent system shall be horizontal and sloped at not greater than 1/2 inch per foot.
EXCEPTIONS:
(1) Vertical drops at the end of trap arms.
(2) Vertical drops of not greater than 45 degrees from horizontal where the vertical drop is not greater than 6 feet and the offset is at least 10 pipe diameters from any turn or branch connection.

Table 12.17.4
PIPE SIZING FOR COMBINATION WASTE AND VENT SYSTEMS

Load	slope $^{1}/_{8}$" per ft	slope $^{1}/_{4}$" per ft	slope $^{3}/_{8}$" per ft	slope $^{1}/_{2}$" per ft
3 dfu	4"	2"	2"	2"
12 dfu	4"	4"	3"	3"
20 dfu	5"	4"	4"	4"
180 dfu	5"	5"	4"	4"
218 dfu	6"	5"	5"	5"
390 dfu	8"	8"	5"	5"
480 dfu	8"	8"	6"	6"
700 dfu	8"	8"	6"	6"
840 dfu	10"	8"	8"	8"
1600 dfu	10"	10"	8"	8"
1920 dfu	12"	10"	10"	10"

12.17.6 Branch Connections

a. Connections to mains and branches within combination waste and vent systems shall be made horizontally at a slope not greater than 1/2 inch per foot.
b. Branch connections shall not be made in vertical drops or offsets.

12.17.7 Minimum Distances

The distance between turns, offsets, and branch connections in combination waste and vent piping shall be not less than 10 pipe diameters.

12.17.8 Connections to Conventional Drainage Systems

a. Combination waste and vent systems shall extend to the point of connection to a conventionally sized and conventionally vented drainage system.
b. At the point of connection, the pipe size of the conventional system shall be at least as large as the combination system, and sized to accept the added drainage load from the combination system.
c. Such connection from the combination system to the conventional system shall be made at an angle above horizontal of not less than 22-1/2 degrees nor more than 45 degrees.

12.17.9 Connection of Individual Fixtures

Where drains from individual fixtures are designed as a combination waste and vent and are connected to a conventional drainage system, the connection from the fixture to the conventional system shall be made according to Section 12.17.8.

12.18 ISLAND SINK VENTING

12.18.1 Where Permitted

Island sink venting shall be permitted for sinks and lavatories where the vent pipe cannot rise 6 inches above the flood level rim of the fixture before turning horizontal. Kitchen sinks in dwelling units with dishwasher connections, food-waste-grinder connections, or both, shall be permitted to be island vented. Also see section 12.8.1 (3).

12.18.2 Arrangement of Vent Piping;

The island vent pipe shall rise vertically under the sink at the end of the fixture trap arm to at least 4 inches above the outlet of the fixture. The vent shall then turn downward and connect to the horizontal drain line below the floor downstream from the fixture drain connection so that the vertical vent drop will drain by gravity to the drainage system. A horizontal vent pipe shall be extended under the floor from the vertical vent drop to a point where it can rise vertically. The vertical rise at the end of the horizontal vent portion shall extend upward to at least 6 inches above the flood level rim of the fixture being vented before turning horizontal and connecting to a vent to the outdoors. The horizontal portion of the vent under the floor shall pitch back to the sink so that it will drain by gravity through the vertical vent drop connection to the drainage system.

12.18.3 Size of Island Vent Pipes

Island vent pipes shall be sized as individual or common vents in accordance with Section 12.16.1.

12.18.4 Cleanouts Required

Cleanouts shall be provided in the vertical vent drop under the sink and in the vertical rise beyond the horizontal portion of the vent so that any blockages in the vent piping can be rodded into the drainage system.

12.19 OTHER DESIGNS

Venting systems not described in this Code may be permitted by the Authority Having Jurisdiction if they provide the protection required by Section 12.2.1 and are individually designed by a licensed professonal engineer. (See Appendix E - SPECIAL DESIGN PLUMBING SYSTEMS.)

Chapter 13

Storm Water Drainage

13.1 GENERAL

13.1.1 Where Required

Roofs, paved areas, yards, courts, and courtyards shall be drained to either a storm sewer where available, a combined sewer where necessary, or to a place of disposal satisfactory to the Authority Having Jurisdiction. EXCEPTION: Storm water from one- and two-family dwellings may be discharged on lawns or streets provided that the storm water flows away from the dwelling and does not otherwise create a nuisance.

13.1.2 Storm Water Drainage to Sewer Prohibited

Storm water shall not be drained into sewers intended for sewage only, except as approved by the Authority Having Jurisdiction.

13.1.3 Sanitary and Storm Sewers

Where separate systems of sanitary drainage and storm water are installed in the same property, the storm and sanitary building sewers and drains may be laid side by side in the same trench.

13.1.4 Reserved

13.1.5 Foundation Drains

a. Foundation drains shall be provided around the perimeter of basements, cellars, crawl spaces or any building space below grade. The drains shall be positioned either inside or outside of the footings, and shall be of perforated or open-joint approved drain tile or pipe not less than 3" pipe size. The invert of foundation drains shall be not less than 2 inches below the underside of the floor slab being protected.

b. Foundation drains shall be laid in a filter bed of gravel, crushed stone, slag, approved 3/4" crushed recycled glass aggregate, or other approved porous materials. The bottom of the filter bed shall be no higher than the bottom of the base course beneath the floor slab. There shall be not less than 2 inches of filter bed beneath the foundation drain. Where foundation drains are located outside of the footings, there shall be at least 6 inches of filter bed above the top of the pipe.

c. Drainage from foundations shall be discharged to a storm drain, street, alley, approved water course, or at grade. When discharged at grade, the point of discharge shall be at least 10 feet from any property line and shall not create a nuisance.

d. Where foundation drains are below the required point of discharge, one or more automatic sump pumps shall be provided. The pump or pumps shall have adequate capacity to convey all drainage to its point of discharge. The minimum pump capacity shall be 15 gallons per minute at the required discharge head. Sump pits shall be sized to accommodate the pump(s), as recommended by the pump manufacturer, but shall be not less than 15 inches in diameter nor less than 18 inches deep. Sump pits shall be provided with fitted covers. Pits shall be located to avoid foot traffic where their covers do not have sufficient strength to carry such weight. Discharge lines from sump pumps shall be sized according to the design pump capacity and shall be not less than 1-1/4" pipe size. A check valve shall either be incorporated into each sump pump or be installed in the discharge line from each sump pump, except that check valves may be eliminated where the discharge pipe would be subject to freezing. Under such conditions the sump pit shall be adequately sized to prevent short cycling of the pump.

e. Where sump pumps discharge at grade on unpaved surfaces, the discharge pipe shall extend to a splash block or equivalent, which shall be designed to contain the discharge, reduce its velocity, and avoid disturbing adjacent areas. Where necessary, the discharge pipe shall terminate with an elbow to direct the flow along the splash block. Splash blocks shall be at least 24 inches long.

f. The water supply to water-operated storm water sump pumps shall be protected from backflow in accordance with Section 10.5.

13.1.6 Areaway Drains

a. Drainage shall be provided for open areaways below grade where storm water may accumulate. Areaways include outdoor spaces that provide access to basements or floor levels of a building that are below grade. Drains in such areas shall be sized according to Table 13.6.2 and shall include strainers as required for roof drains or floor drains.

b. Areaway drains shall not connect to a foundation drain.

EXCEPTION: Areaways not exceeding 100 square feet in area.

13.1.7 Window Well Drains

Window wells shall be drained as required for areaways, except that window wells not greater than 10 square feet in area shall be permitted to drain into a foundation drain, either directly by means of a 2" minimum size drain, or indirectly through a porous filter bed.

13.1.8 Parking and Service Garages

Storm water drainage from parking and service garages shall be in accordance with Sections 6.3.1.d and 6.3.1.e.

13.1.9 Reserved

13.1.10 Roof Drainage

13.1.10.1 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 Authority Having Jurisdiction, 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. (See Appendix A)

13.1.10.2 Secondary Roof Drainage

a. Where parapet walls or other construction extend above the roof and create areas where storm water would become trapped if the primary roof drainage system failed to provide sufficient drainage, an independent secondary roof drainage system consisting of scuppers, standpipes, or roof drains shall be provided. Secondary roof drainage shall be sized for a 100-year, 15-minute storm (see Appendix A). The capacity of the primary system shall not be considered in the sizing of the secondary system.

b. Where secondary drainage is provided by means of roof drains or standpipes, the secondary system shall be separate from the primary system and shall discharge independently at grade or other approved point of discharge.

c. Where secondary roof drainage is provided, the overflow level(s) into the secondary system shall be established by the amount of ponding that is allowed in the structural design of the roof, including roof deflection. An allowance shall be made to account for the required overflow head of water above the secondary inlets. The elevation of the secondary inlet plus the required overflow head shall not exceed the maximum allowable water level on the roof.

d. Scuppers shall be sized as rectangular weirs, using hydraulic principles to determine the required length and resulting overflow head (see Appendix A). Secondary roof drains and standpipes shall be sized according to Table 13.6.1 Where standpipes are used, the head allowance required under Section 13.1.10.2(3) shall be not less than 1-1/2 inches.

e. Strainers shall not be required on open standpipes when used for secondary inlets.

f. Where secondary roof drainage is provided by roof drains or standpipes, they shall be permitted to discharge horizontally, similar to scuppers, but below the roof level.

13.1.10.3 Vertical Walls

Where vertical walls drain onto roofs, an allowance based on 50% of the maximum projected wall area shall be added to the roof area onto which each wall drains.

13.1.10.4 Equivalent Systems

When approved by the Authority Having Jurisdiction, the requirements of Sections 13.1.10.1 and 13.1.10.2 shall not preclude the installation of an engineered roof drainage system that has sufficient capacity to prevent water from ponding on the roof in excess of that allowed in the roof structural design during a 100-year, 15-minute storm.

13.1.11 Continuous Flow

Where continuous flow from a spring or ground water is encountered in a foundation drainage system or other subsoil drain, the discharge shall be piped to a storm sewer or approved water course.

13.1.12 Backwater Valves

Where foundation drains, areaway drains, window well drains, or other storm water drains discharge by gravity and are subject to backflow from their point of discharge, a backwater valve shall be provided in the discharge line. Backwater valves shall comply with the requirements of Section 5.5.

13.2 MATERIALS

See Section 3.7.

13.3 TRAPS IN STORM DRAINAGE SYSTEMS

13.3.1 General

a. Traps shall be installed in a storm drainage system if it connects to a combined sewer conveying both sewage and storm water.

EXCEPTION: Traps shall not be required where roof drains, rain leaders, and other inlets are at locations allowed under Section 12.4.4 for vent terminals.

b. Floor drains or other receptors within a building shall be individually trapped if they are connected to a storm drainage system, regardless of whether or not the sewer is combined.

c. Traps required under this section shall comply with the requirements of Section 5.3.1, 5.3.2, 5.3.3, 5.3.5 and 13.3.2. Traps shall have accessible cleanouts or other means of clearing the trap.

13.3.2 Location of Traps

Where traps are required under Section 13.3.1.a, they shall be installed either on individual branches of the storm drainage system or in the building storm drain or building storm sewer before it connects to the combined sewer. Traps shall not be installed in locations where they will be subject to freezing. Where traps are required for rain leaders, the minimum earth cover shall be as required in Section 2.16.b.

13.3.3 Size of Traps

Traps shall be the same size as the drain pipe in which they are installed.

13.4 LEADERS OR CONDUCTORS AND CONNECTIONS

13.4.1 Not to be Used Improperly

Leaders or conductors shall not be used as soil, waste, or vent pipes nor shall soil, waste, or vent pipes be used as leaders.

13.4.2 Protection of Rain Water Leaders

Rain water leaders installed along alleyways, driveways, or other locations where they may be exposed to damage shall be protected by metal guards, shall be recessed into the wall, or shall be constructed from ferrous alloy pipe to a point 5 foot above grade.

13.4.3 Combining Storm with Sanitary Drainage

The sanitary and storm drainage system of a building shall be entirely separate, except that where a combined sewer is used, the building storm drain shall be connected in the same horizontal plane through a single wye fitting to the combined sewer at least 10 feet downstream from any soil stack.

13.4.4 Double Connections of Storm Drains

Where the sanitary and storm drains are connected on both sides of the combined sewer, single wyes shall be used and the requirements of Section 13.4.3 relative to the location of connections shall also apply.

13.5 ROOF DRAINS

13.5.1 Compliance and Materials

Roof drains shall comply with ASME A112.6.4 and be constructed of coated or galvanized cast iron, bronze, stainless steel, plastic, or other corrosion-resisting materials. Drains shall include any deck clamps or other appurtenances necessary for installation and coordination with the roofing system.

13.5.2 Dome Strainers

Roof areas shall be drained to roof drains having raised dome strainers with dome free areas complying with ASME A112.6.4. The minimum free dome area shall be one and one-half (1-1/2) times the area of the drain outlet connection.

EXCEPTIONS

(1) Pitched roofs draining to hanging gutters.

(2) Roof areas subject to pedestrian and/or vehicular traffic.

13.5.3 Flat Grates

Roof drains on patios, sun decks, parking decks, and other areas subject to pedestrian and/or vehicular traffic shall have flat grates with a free inlet area complying with ASME 112.6.4. The minimum grate free area shall be two times the cross-sectional area of the drain outlet. Such drains shall not be located where they cannot be readily inspected and maintained on a regular basis.

13.5.4 Roof Drain Flashings

The connection between roofs 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.

13.5.5 Roof Drain Restrictions

The roof drain size shall not be restricted by insertion of any roofing material or other objects to insure water flow into the drain.

13.5.6 Roof Drain Outlet Pipe Size

The outlet pipe size of roof drains having vertical conductors shall be not less than the size required for vertical conductors in Table 13.6.1.

13.6 SIZE OF LEADERS, GUTTERS AND STORM DRAIN PIPING

13.6.1 Vertical Conductors and Leaders

Vertical storm water conductors and leaders shall be sized according to Table 13.6.1. Where a vertical pipe section is smaller than the preceding horizontal pipe section, the reduction in size shall be made in the vertical pipe section.

13.6.2 Size of Horizontal Storm Drain Piping

Horizontal storm drain piping shall be sized according to Table 13.6.2. Such piping includes horizontal offsets in storm water conductors, building drains, building sewers, and branches thereof. The size of the horizontal drain piping shall not be reduced in the direction of flow.

13.6.3 Size of Roof Gutters

The size of semicircular roof gutters shall be based on the maximum projected roof area, according to Table 13.6.3.

13.7 RESERVED

13.8 SIZING FOR CONTINUOUS OR INTERMITTENT FLOWS

Continuous or intermittent flows from a sump pump, air conditioning condensate drain, or other approved discharge into a storm drainage system shall be determined in gallons per minute flow. Air conditioning condensate drainage shall be based on not less than 0.006 gpm/ton. Such flows shall be added to the stormwater load on the storm drainage system, which shall also be determined on the basis of gallons per minute according to Table A.1 and Section A.3 in Appendix A.

Table 13.6.1 SIZE OF VERTICAL CONDUCTORS AND LEADERS							
Nominal Diameter (inches)	**Flow Capacity (GPM)**	**Allowable Projected Roof Area at Various Rates of Rainfall per Hour (Sq. Ft.)**					
		1"	2"	3"	4"	5"	6"
2"	23	2,180	1,090	727	545	436	363
3"	67	6,426	3,213	2,142	1,607	1,285	1,071
4"	144	13,840	6,920	4,613	3,460	2,768	2,307
5"	261	25,094	12,547	8,365	6,273	5,019	4,182
6"	424	40,805	20,402	13,602	10,201	8,161	6,801
8"	913	87,878	43,939	29,293	21,970	17,576	14,646
10"	1655	159,334	79,667	53,111	39,834	31,867	26,556
12"	2692	259,095	129,548	86,365	64,774	51,819	43,183
15"	4880	469,771	234,886	156,590	117,443	93,954	78,295
		7"	8"	9"	10"	11"	12"
2"	23	311	272	242	218	198	182
3"	67	918	803	714	643	584	536
4"	144	1,977	1,730	1,538	1,384	1,258	1,153
5"	261	3,585	3,137	2,788	2,509	2,281	2,091
6"	424	5,829	5,101	4,534	4,080	3,710	3,400
8"	913	12,554	10,985	9,764	8,788	7,989	7,323
10"	1655	22,762	19,917	17,704	15,933	14,485	13,277
12"	2692	37,014	32,387	28,788	25,910	23,554	21,591
15"	4880	67,110	58,721	52,197	46,977	42,706	39,146

NOTES:

1. Flow capacities are based on stacks flowing 7/24 full.
2. Interpolation between rainfall rates is permitted.

13.9 CONTROLLED FLOW STORM WATER SYSTEM

13.9.1 Application

In lieu of sizing the storm drainage system on the basis of actual maximum projected roof areas as previously described in this Chapter, the roof drainage system, or part thereof may be sized on equivalent or adjusted maximum projected roof areas that result from controlled flow and storage of storm water on the roof provided flow control devices are used and subject to the approval of the Authority Having Jurisdiction.

13.9.2 Design

A controlled flow storm water system shall be designed, installed, inspected and certified as an engineered special design plumbing system as outlined in Appendix E of this Code.

Table 13.6.2 Part 1
SIZE OF HORIZONTAL STORM DRAINS (for 1"/hr to 6"/hr rainfall rates)

Size of Drain (inches)	Design Flow of Drain (GPM)	Allowable Projected Roof Area at Various Rates of Rainfall per Hour (Square Feet)					
		1"/hr	2"/hr	3"/hr	4"/hr	5"/hr	6"/hr
Slope 1/16 inch/foot							
2							
3							
4	53	5,101	2,551	1,700	1,275	1,020	850
5	97	9,336	4,668	3,112	2,334	1,867	1,556
6	157	15,111	7,556	5,037	3,778	3,022	2,519
8	339	32,629	16,314	10,876	8,157	6,526	5,438
10	615	59,194	29,597	19,731	14,798	11,839	9,866
12	999	96,154	48,077	32,051	24,039	19,231	16,026
15	1812	174,405	87,203	58,135	43,601	34,881	29,068
Size	GPM	1"/hr	2"/hr	3"/hr	4"/hr	5"/hr	6"/hr
Slope 1/8 inch/foot							
2							
3	35	3,369	1,684	1,123	842	674	561
4	75	7,219	3,609	2,406	1,805	1,444	1,203
5	137	13,186	6,593	4,395	3,297	2,637	2,198
6	223	21,464	10,732	7,155	5,366	4,293	3,577
8	479	46,104	23,052	15,368	11,526	9,221	7,684
10	869	83,641	41,821	27,880	20,910	16,728	13,940
12	1413	136,002	68,001	45,334	34,000	27,200	22,667
15	2563	246,689	123,345	82,230	61,672	49,338	41,115
Size	GPM	1"/hr	2"/hr	3"/hr	4"/hr	5"/hr	6"/hr
Slope 1/4 inch/foot							
2	17	1,636	818	545	409	327	273
3	50	4,813	2,406	1,604	1,203	963	802
4	107	10,299	5,149	3,433	2,575	2,060	1,716
5	194	18,673	9,336	6,224	4,668	3,735	3,112
6	315	30,319	15,159	10,106	7,580	6,064	5,053
8	678	65,258	32,629	21,753	16,314	13,052	10,876
10	1229	118,292	59,146	39,431	29,573	23,658	19,715
12	1999	192,404	96,202	64,135	48,101	38,481	32,067
15	3625	348,907	174,454	116,302	87,227	69,781	58,151
Size	GPM	1"/hr	2"/hr	3"/hr	4"/hr	5"/hr	6"/hr
Slope 1/2 inch/foot							
2	24	2,310	1,155	770	578	462	385
3	70	6,738	3,369	2,246	1,684	1,348	1,123
4	151	14,534	7,267	4,845	3,633	2,907	2,422
5	274	26,373	13,186	8,791	6,593	5,275	4,395
6	445	42,831	21,416	14,277	10,708	8,566	7,139
8	959	92,304	46,152	30,768	23,076	18,461	15,384
10	1738	167,283	83,641	55,761	41,821	33,457	27,880
12	2827	272,099	136,050	90,700	68,025	54,420	45,350
15	5126	493,379	246,689	164,460	123,345	98,676	82,230

NOTES:

1. Design flows in Table 13.6.2 Part 1 are based on fairly rough pipe with a Manning friction coefficient "n" = 0.015.
2. The Authority Having Jurisdiction should be consulted for the rainfall rate to be used for a particular location.

Table 13.6.2 Part 2
SIZE OF HORIZONTAL STORM DRAINS (for 7"/hr to 12"/hr rainfall rates)

Size of Drain (inches)	Design Flow of Drain	Allowable Projected Roof Area at Various Rates of Rainfall per Hour (Square Feet of Roof)					
Slope 1/16 inch/foot							
Size	(GPM)	7"/hr	8"/hr	9"/hr	10"/hr	11"/hr	12"/hr
2							
3							
4	53	729	638	567	510	464	425
5	97	1,334	1,167	1,037	934	849	778
6	157	2,159	1,889	1,679	1,511	1,374	1,259
8	339	4,661	4,079	3,625	3,263	2,966	2,719
10	615	8,456	7,399	6,577	5,919	5,381	4,933
12	999	13,736	12,019	10,684	9,615	8,741	8,013
15	1812	24,915	21,801	19,378	17,441	15,855	14,534
Slope 1/8 inch/foot							
Size	GPM	7"/hr	8"/hr	9"/hr	10"/hr	11"/hr	12"/hr
2							
3	35	481	421	374	337	306	281
4	75	1,031	902	802	722	656	602
6	223	3,066	2,683	2,385	2,146	1,951	1,789
8	479	6,586	5,763	5,123	4,610	4,191	3,842
10	869	11,494	10,455	9,293	8,364	7,604	6,970
12	1413	12,429	17,000	15,111	13,600	12,364	11,334
15	2563	35,241	30,836	27,410	24,669	22,426	20,557
Slope 1/4 inch/foot							
Size	GPM	7"/hr	8"/hr	9"/hr	10"/hr	11"/hr	12"/hr
2	17	234	205	182	164	149	136
3	50	688	602	535	481	438	401
4	107	1,471	1,287	1,144	1,030	936	858
5	194	2,668	2,334	2,075	1,867	1,698	1,556
6	315	4,331	3,790	3,369	3,032	2,756	2,527
8	678	9,323	8,157	7,251	6,526	5,933	5,438
10	1229	16,899	14,787	13,144	11,829	10,754	9,858
12	1999	27,486	24,051	21,378	19,240	17,491	16,034
15	3625	49,844	43,613	38,767	34,891	31,719	29,076

Table 13.6.2 Part 2 (continued)
SIZE OF HORIZONTAL STORM DRAINS (for 7"/hr to 12"/hr rainfall rates)

Slope 1/2 inch/foot							
Size	GPM	7"/hr	8"/hr	9"/hr	10"/hr	11"/hr	12"/hr
2	24	330	289	257	231	210	193
3	70	963	842	749	674	613	562
4	151	2,076	1,817	1,615	1,453	1,321	1,211
5	274	3,768	3,297	2,930	2,637	2,398	2,198
6	445	6,119	5,354	4,759	4,283	3,894	3,569
8	959	13,186	11,538	10,256	9,230	8,391	7,692
10	1738	23,898	20,910	18,587	16,728	15,208	13,940
12	2827	38,871	34,012	30,233	27,210	24,736	22,675
15	5126	70,483	61,672	54,820	49,338	44,835	41,115

NOTES:
1. Design flows in Table 13.6.2 Part 1 are based on fairly rough pipe with a Manning friction coefficient “n” = 0.015.
2. The Authority Having Jurisdiction should be consulted for the rainfall rate to be used for a particular location.

Table 13.6.3
SIZE OF ROOF GUTTERS[1]

Diameter of Gutter[2] Inches	Maximum Projected Roof Area for Gutters 1/16 in Slope[3] Sq. Ft.	GPM
3	170	7
4	360	15
5	625	26
6	960	40
7	1,380	57
8	1,990	83
10	3,600	150

1. Table 13.6.3 is based upon a maximum rate of rainfall of 4 inches per hour. Where maximum rates are more or less than 4 inches per hour, the figures for drainage area shall be adjusted by multiplying by 4 and dividing by the local rate in inches per hour. See Appendix A.
2. Gutters other than semicircular may be used provided they have an equivalent cross-sectional area.
3. Capacities given for slope of 1/16 inch per foot shall be used when designing for greater slopes.

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Chapter 14

Special Requirements For Health Care Facilities

14.1 GENERAL

This Chapter applies to special fixtures and systems that occur in health care facilities and to the special plumbing requirements in such facilities. Ordinary plumbing in such facilities shall comply with the other applicable Chapters of this Code.

14.2 WATER SERVICE

Where required by the Authority Having Jurisdiction, hospitals and similar health care facilities shall have dual water service lines to maintain a water supply in the event of a water main failure. Where possible, the service pipelines shall be connected to different water mains so that a single water main break can be isolated and repaired without shutting off all water service to the facility.

14.3 MEDICAL GAS AND VACUUM PIPING SYSTEMS

14.3.1 General

The installation of medical gas and vacuum piping systems shall be in accordance with the requirements of either NFPA 99 - Standard for Health Care Facilities or NFPA 99C - Gas and Vacuum Systems.

14.3.2 Professional Qualifications of Installers, Inspectors and Verifiers

Installers (including brazers), inspectors, and verifiers of medical gas and vacuum systems shall meet the requirements of ANSI/ASSE Series 6000 - Professional Qualification Standard for Medical Gas Systems Installers, Inspectors, and Verifiers, or the equivalent.

14.4 PROTRUSIONS FROM WALLS

Drinking fountains, control valves, medical gas station outlets, vacuum inlet stations, risers, cleanout covers, and other devices shall be fully-recessed in corridors and other areas where patients may be transported on a gurney, hospital bed, or wheelchair. Protective guards shall be provided where necessary.

14.5 MENTAL PATIENT ROOMS

Piping and drain traps in mental patient rooms shall be concealed. Fixtures and fittings shall be vandal-proof.

14.6 PROHIBITED LOCATIONS FOR ICE STORAGE

Ice makers or ice storage chests shall not be located in a Soiled Utility Room or similar areas where subject to possible contamination.

14.7 CROSS CONNECTION CONTROL AND BACKFLOW PREVENTION

a. Backflow prevention shall be in accordance with Section 10.5.
b. Vacuum breakers for bedpan washers shall be not less than 5 feet above the floor.

14.8 CLINICAL SINKS AND BEDPAN WASHERS

14.8.1 General

a. Clinical sinks and bedpan washers, and flushing-rim service sinks shall be installed in the same manner as water closets. Where such fixtures have a vent connection on the inlet side of their trap, a local vent shall be provided in accordance with Section 14.9.

b. Clinical sinks shall not be used as a substitute for non-flushing service sink, nor shall a non-flushing service sink be utilized to clean bedpans.

c. Vacuum breakers for bedpan washers shall be installed in accordance with Section 14.7.b.

14.9 LOCAL VENTS AND STACKS FOR CLINICAL SINKS OR BEDPAN WASHERS

14.9.1 General

Where clinical sinks or bedpan washers have provisions for a local vent, a local vent shall be extended to the outdoors above the roof. Local vents shall terminate in accordance with Section 12.4. Local vents from clinical sinks or bedpan washers shall not be connected to vapor vents for sterilizers or to any drainage system vent.

14.9.2 Material

Local vent piping shall be of a material acceptable for sanitary vents in accordance with Section 3.6.

14.9.3 Required Size and Arrangement

A local vent serving a single clinical sink or bedpan washer shall be not less than 2" pipe size. Where such fixtures are installed back-to-back or are located above each other on more than one floor, a local vent stack may be provided to serve multiple fixtures. A 2" local vent stack may serve up to three fixtures. A 3" local vent stack may serve up to six fixtures. A 4" local vent stack may serve up to twelve fixtures. In multiple installations, the connections to the local vent stack shall be made using sanitary tee or tee-wye fittings oriented for upward flow from the branch. A branch connection to a local vent stack shall extend not more than 5 feet horizontally and shall be sloped not less than 1/4 inch per foot back towards the fixture served.

14.9.4 Provisions for Drainage

Provisions shall be made for the drainage of vapor condensation within local vent piping. A local vent serving a single fixture may drain back to the fixture served. The base of a local vent stack serving one or more fixtures shall be directly connected to a trapped and vented waste branch of the sanitary drainage system. The trap and waste branch shall be the same size as the local vent stack. The trap seal depth shall be not less than 3 inches. The vent for the waste branch shall be 1-1/4" minimum size, but not less than one-half the size of the waste branch.

14.9.5 Trap Priming

The waste trap required under Section 14.9.4 shall be primed by at least one clinical sink or bedpan washer on each floor served by the local vent stack. A priming line not less than 1/4" OD size shall be extended from the discharge or fixture-side of the vacuum breaker protecting the fixture water supply to the local vent stack. A trap having not less than a 3-inch water seal shall be provided in the priming line. The line shall prime the trap at the base of the local vent stack each time that a fixture is flushed.

14.10 STERILIZERS

14.10.1 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 instructions.

14.10.2 Indirect Waste Connections

All waste drainage from sterilizers and bedpan steamers shall be indirectly connected to the sanitary drainage system through an air gap, in accordance with Chapter 9. Indirect waste pipes shall be not less than the size of the drain connection on the fixture. Separate waste pipes shall be provided for each fixture, except that up to three sterilizers may have a common indirect waste pipe if its developed length does not exceed 8 feet. The size of such common indirect waste pipes shall be not less than the aggregate cross-sectional area of the individual sterilizer drain connections. Except for bedpan steamers, indirect waste pipes shall not require traps.

14.10.3 Floor Drains

a. A trapped and vented floor drain, not less than 3" pipe size, shall be provided in each recess room or space where recessed or concealed portions of sterilizers are located. The floor drain shall drain the entire floor area and shall receive the indirect waste from at least one sterilizer. Where an air gap fitting is provided, the waste pipe from the fitting may connect to the body of the floor drain above its trap seal.

b. Where required by the sterilizer manufacturer, a floor drain shall be located directly beneath the sterilizer within the area of its base.

14.10.4 Cooling Required

Waste drainage from condensers or steam traps shall be cooled below 140°F before being discharged indirectly to the sanitary drainage system.

14.10.5 Traps Required for Bedpan Steamers

A trap having a minimum seal of 3 inches shall be provided in the indirect waste pipe for a bedpan steamer, located between the fixture and the air gap at the indirect waste receptor.

14.11 VAPOR VENTS AND STACKS FOR STERILIZERS

14.11.1 General

Where sterilizers have provisions for a vapor vent and such a vent is required by their manufacturer, a vapor vent shall be extended to the outdoors above the roof. Sterilizer vapor vents shall terminate in accordance with Section 12.4 and shall not be connected to local vents for clinical sinks or bedpan washers or to any drainage system vent.

14.11.2 Material

Sterilizer vapor vent piping shall be of a material acceptable for sanitary vents in accordance with Section 3.6.

14.11.3 Required Size and Arrangement

a. Sterilizer vapor vents and stacks for individual sterilizers shall be not less than the size of the sterilizer vent connection, except that stacks shall be not less than 1-1/2" pipe size. Where vapor vent stacks serve more than one sterilizer, the cross-sectional area of the stack shall be not less than the aggregate cross-sectional areas of the vapor vents for all of the sterilizers served.

b. In single and multiple installations, the connections to the vapor vent stack shall be made using sanitary tee or tee-wye fittings oriented for upward flow from the branch. A branch connection to a sterilizer vapor vent stack shall extend not more than 5 feet horizontally and shall be sloped not less than 1/4 inch per foot away from the sterilizer and toward the vent stack.

14.11.4 Provisions for Drainage

Provisions shall be made for the drainage of vapor condensation within sterilizer vapor vent piping. The base of stacks shall drain indirectly through an air gap to a trapped and vented waste receptor connected to the sanitary drainage system.

14.12 DRAINAGE FROM CENTRAL VACUUM SYSTEMS

14.12.1 General

Provisions for drainage from medical, surgical, dental, and similar central vacuum systems shall be as required by either NFPA 99 - Health Care Facilities or NFPA 99C - Gas and Vacuum Systems. In addition, drainage from dental and other vacuum systems that collect fluid waste centrally shall comply with Sections 14.12.2 through 14.12.4.

14.12.2 Positive Pressure Drainage from Air/Waste Separators in Dental Vacuum Systems

a. The waste outlet from an air/waste separator on the discharge side of a vacuum pump or blower shall be direct-connected to the sanitary drainage system through a deep-seal trap that is conventionally vented within the plumbing system. The trap vent shall extend vertically to not less than 6 inches above the top of the separator before making any horizontal turns. The vacuum exhaust air flow from the separator shall be separately vented to outodoors as required under NFPA 99 and NFPA 99C.

b. The trap and drain branch size shall be at least two pipe sizes larger than the waste pipe from the separator, but not less than 1-1/2" pipe size. The vent shall be the full size of the trap and drain. The trap seal shall be at least two times the exhaust backpressure in the separator, but not less than 4 inches deep.

14.12.3 Gravity Drainage from Waste Holding Tanks in Dental Vacuum Systems

a. The drainage from waste holding tanks shall extend from the vacuum check valve on the waste outlet of the tank and be direct-connected to the sanitary drainage system through a deep-seal trap that is conventionally vented within the plumbing system. In addition, a vent shall be installed between the vacuum check valve and the drain trap, on the inlet side of the trap, to seal the check valve when the holding tank is operating under vacuum and collecting waste. This vent shall be connected to the plumbing system vents. Both vents shall extend vertically to not less than 6 inches above the top of the holding tank before making any horizontal turns.

b. The trap and drain size shall be at least two pipe sizes larger than the waste outlet and vacuum check valve, but not less than 2" pipe size. The trap shall be not less than 4 inches deep. The vent for the vacuum check valve shall be not less than the size of the check valve. The trap vent shall be not less than one-half the size of the trap and drain branch.

14.12.4 Protection from Sewage Backup in Dental Vacuum Systems

A floor drain or other trapped and vented receptor shall be provided near the connection of the drain from a dental vacuum air/waste separator or waste holding tank to the sanitary drainage system that will overflow in the event of a backup in the sanitary drainage system and prevent the backup from reaching the level of the trap for the air /waste separator or the drain check valve for the waste holding tank. The trap of the floor drain or receptor shall be primed if it does not receive an indirect waste discharge.

14.13 ASPIRATORS

Provisions for aspirators or other water-supplied suction devices shall be installed only with the specific approval of the Authority Having Jurisdiction. Where aspirators are used for removing body fluids, they shall include a collection bottle or similar fluid trap. Aspirators shall indirectly discharge to the sanitary drainage system through an air gap, in accordance with Chapter 9. The potable water supply to an aspirator shall be protected by a vacuum breaker or equivalent, in accordance with Sections 14.7 and 10.5.3.

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Chapter 15

Tests and Maintenance

15.1 EXPOSURE OF WORK

New, altered, extended or replaced plumbing shall be left uncovered and unconcealed until it has been tested and approved. Where such work has been covered or concealed before it is tested and approved, it shall be exposed for testing.

15.2 EQUIPMENT, MATERIAL AND LABOR FOR TESTS

Equipment, material and labor required for testing a plumbing system or part thereof shall be furnished by the installing contractor.

15.3 TESTING OF PLUMBING SYSTEMS

15.3.1 General

New plumbing systems and parts of existing systems that have been altered, extended or repaired shall be tested as prescribed hereinafter to disclose leaks and defects only when required by the Authority Having Jurisdiction.

15.3.2 Exceptions

a. When required by the Authority Having Jurisdiction, where an existing concealed sewer or drain is reused as part of a new or renovated drainage system, the line shall be traced to its point of termination and shall be tested to determine that:

1. It is connected to the proper drainage system, such as sanitary or storm,
2. It will withstand a leak test, and,
3. It is free-flowing and not restricted.

15.4 METHODS OF TESTING THE DRAINAGE AND VENT SYSTEMS

15.4.1 Rough Plumbing

a. Except for outside leaders and perforated or open jointed drain tile, the piping of plumbing drainage and venting systems shall be tested upon completion of the rough piping installation by water or air and proved watertight. The Authority Having Jurisdiction may require the removal of any cleanout plugs to ascertain if the pressure has reached all parts of the system. Either of the following test methods shall be used.

1. The water test shall be applied to the drainage system either in its entirety or in sections after rough piping has been installed. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system filled with water to point of overflow. If the system is tested in

sections, each opening shall be tightly plugged except the highest opening of the section under test, and each section shall be filled with water, but no section shall be tested with less than a 10-foot head of water. In testing successive sections at least the upper 10 feet of the next preceding section shall be tested, so that no joint or pipe in the building (except the uppermost 10 feet of the system) shall have been submitted to a test of less than 10-foot head of water. The water shall be kept in the system or in the portion under test for at least 15 minutes before inspection starts; the system shall then be tight at all points.

2. The air test shall be made by attaching an air compressor testing apparatus to any 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 per square inch or sufficient to balance a column of mercury 10 inches in height. This pressure shall be held without introduction of additional air for a period of at least 15 minutes.

15.4.2 Finished Plumbing

a. When the rough plumbing has been tested in accordance with section 15.4.1, a final test of the finished plumbing system may be required to insure that the final fixture connections to the drainage system are gas-tight.

b. After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and watertight. A final smoke or peppermint test shall be required. except in the case of a previous on site-inspected water or air tested system. If a smoke or peppermint test is required, the following test methods shall be employed:

1. A smoke test shall be made by filling all traps with water and then reintroducing into the entire system a pungent, thick smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, they shall be closed and a pressure equivalent to a one-inch water column shall be developed and maintained for the period of the inspection.

2. Where the Authority Having Jurisdiction, due to practical difficulties or hardships, finds that a smoke test cannot be performed, a peppermint test shall be substituted in lieu thereof. Such peppermint test shall be conducted by the introduction of two ounces of oil of peppermint into the roof terminal of every line or stack to be tested. The oil of peppermint shall be followed at once by ten quarts of hot (140T) water whereupon all roof vent terminals shall be sealed. A positive test, which reveals leakage, shall be the detection of the odor of peppermint at any trap or other point on the system. Oil of peppermint or persons whose person or clothes have come in contact with oil of peppermint shall be excluded from the test area.

15.5 METHOD OF TESTING BUILDING SEWERS

The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer, private sewer, individual sewer disposal, or other point of disposal. It shall then be filled with water under a head of not less than 10 feet. The water level at the top of the test head of water shall not drop for at least 15 minutes. Where the final connection of the building sewer cannot reasonably be subjected to a hydrostatic test, it shall be visually inspected.

15.6 METHODS OF TESTING WATER SUPPLY SYSTEMS

a. Upon completion of a section or the entire 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 or 80 pounds per square inch, whichever is greater.

b. For metallic pipe and where the Authority Having Jurisdiction determines that providing potable water for the test represents a hardship or practical difficulty, the system may be tested with air to the pressures noted above, as allowed by the pipe manufacturer.

c. For plastic pipe, testing by compressed gas or air pressure shall be prohibited.

d. Piping shall be disinfected after testing per Section 10.9.

15.7 DEFECTIVE PLUMBING

Where there is reason to believe that the plumbing system of any building has become defective, it shall be subjected to test or inspection and any defects found shall be corrected.

15.8 MAINTENANCE

15.8.1 General

The plumbing and drainage systems shall be maintained at all times in compliance with the provisions of this Code.

15.8.2 Exception

Existing plumbing installed under prior regulations or lack thereof, may remain unchanged unless immediate hazards to health, life, or property are evident.

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Chapter 16

Regulations Governing Individual Sewage Disposal Systems for Homes and Other Establishments Where Public Sewage Systems Are Not Available

16.1 GENERAL PROVISIONS

16.1.1 General

In the absence of State or other local laws governing the installation, use and maintenance of private sewer disposal systems, the provisions of this Chapter shall apply.

16.1.2 Sewage Disposal

"Sewage disposal" under this section shall mean all private methods of collecting and disposing of domestic sewage, including septic tanks.

16.1.3 Domestic Sewage

Domestic sewage shall be disposed of by an approved method of collection, treatment and effluent discharge. Domestic sewage or sewage effluent shall not be disposed of in any manner that will cause pollution of the ground surface, ground water, bathing areas, lakes, ponds, watercourses, tidewater, or create a nuisance. It shall not be discharged into any abandoned or unused well, or into any crevice, sink hole, or other opening either natural or artificial in a rock formation.

16.1.4 Non-Water-Carried Sewage

When water under pressure is not available, all human body wastes shall be disposed of by depositing them in approved privies, chemical toilets, or such other installations acceptable to the Authority Having Jurisdiction.

16.1.5 Water-Carried Sewage

Water-carried sewage from bathrooms, kitchens, laundry fixtures and other household plumbing shall pass through a septic or other approved sedimentation tank prior to its discharge into the soil or into a sand filter. Where underground disposal or sand filtration is not feasible, consideration shall be given to special methods of collection and disposal.

16.1.6 Responsibility

The installing contractor is responsible for compliance with these regulations.

16.1.7 Abandoned Disposal Systems

Abandoned disposal systems shall be disconnected from the buildings, pumped out and filled with earth.

16.1.8 Absorption Capacity

No property shall be improved in excess of its capacity to properly absorb sewage effluent in the quantities and by means provided for in this Code. (See Section 2.19.2.)

16.1.9 Reserved

16.1.10 Higher Compliance

Nothing contained in this Chapter shall be construed to prevent the Authority Having Jurisdiction from requiring compliance with higher requirements than those contained herein where such higher requirements are essential to maintain a safe and sanitary condition.

16.2 RESERVED

16.3 DESIGN OF INDIVIDUAL SEWAGE SYSTEM

16.3.1 Design

The design of the individual sewage disposal system must take into consideration location with respect to wells or other sources of water supply, topography, water table, soil characteristics, area available, and maximum occupancy of the building.

16.3.2 Type of System

The type of system to be installed shall be determined on the basis of location, soil permeability, and groundwater elevation.

16.3.3 Sanitary Sewage

The system shall be designed to receive all sanitary sewage, including laundry waste, from the building. Drainage from footings or roofs shall not enter the system.

16.3.4 Discharge

The system shall consist of a septic tank discharging into either a subsurface disposal field or one or more seepage pits or into a combination of both, if found adequate as such and approved by the Authority Having Jurisdiction.

16.3.5 Backflow

Plumbing fixtures connected to a private sewage disposal system that are subject to backflow, shall be protected by a backwater valve or a sewage ejector.

16.3.6 Reserved

16.3.7 Design Criteria

Design criteria for sewage flows shall be selected according to type of establishment. (See Table 16.3.7.)

Table 16.3.7
SEWAGE FLOWS ACCORDING TO TYPE OF ESTABLISHMENT

Type of Establishment	
Schools (toilets and lavatories only)	15 Gal. per day per person
Schools (with above plus cafeteria)	25 Gal. per day per person
Schools (with above plus cafeteria and showers)	35 Gal. per day per person
Day workers at schools and offices	15 Gal. per day per person
Day camps	25 Gal. per day per person
Trailer parks or tourist camps (with built-in bath)	50 Gal. per day per person
Trailer parks or tourist camps (with central bathhouse)	35 Gal. per day per person
Work or construction camps	50 Gal. per day per person
Public picnic parks (toilet wastes only)	5 Gal. per day per person
Public picnic parks (bathhouse, showers and flush toilets)	10 Gal. per day per person
Swimming pools and beaches	10 Gal. per day per person
Country clubs	25 Gal. per day per person
Luxury residences and estates	150 Gal. per day per person
Rooming houses	40 Gal. per day per person
Boarding schools	50 gal. per day per person
Hotels (with connecting baths)	50 Gal. per day per person
Hotels (with private baths–2 persons per room	100 Gal. per day per person
Boarding schools	100 Gal. per day per person
Factories (gallons per person per shift–exclusive of industrial waste)	25 Gal. per day per person
Nursing homes	75 Gal. per day per person
General hospitals	150 Gal. per day per person
Public Institutions (other than hospitals)	100 Gal. per day per person
Restaurants (toilet and kitchen wastes per unit of serving capacity)	25 Gal. per day per person
Kitchen wastes from hotels, camps, boarding houses, etc. serving three meals per day	10 Gal. per day per person
Motels	50 Gal. per bed space
Motels with bath, toilet, and kitchen wastes	60 Gal. per bed space
Drive-in theatres	5 Gal. per car space
Stores	400 Gal. per toilet room
Service stations	10 Gal. per vehicle served
Airports	3-5 Gal. per passenger
Assembly halls	2 Gal. per seat
Bowling alleys	75 Gal. per lane
Churches (small)	3-5 Gal. per sanctuary seat
Churches (large with kitchen)	5-7 Gal. per sanctuary seat
Dance halls	2 Gal. per day per person
Laundries (coin operated)	400 Gal. per machine
Service stations	1000 Gal. (First Bay)
	500 Gal. (Each add. Bay)
Sub-divisions or individual homes	75 Gal. per day per person
Marinas–Flush toilets	36 Gal. per fixture per hr
Urinals	10 Gal. per fixture per hr
Wash basins	15 Gal. per fixture per hr
Showers	150 Gal. per fixture per hr

16.4 LOCATION OF INDIVIDUAL SEWAGE SYSTEM

16.4.1 Reserved

16.4.2 Reserved

16.4.3 Minimum Distances

The minimum distances that shall be observed in locating the various components of the disposal system shall be as given in Table 16.4.3.

Table 16.4.3
MINIMUM DISTANCE BETWEEN COMPONENTS OF AN INDIVIDUAL SEWAGE DISPOSAL SYSTEM (in feet)[1]

	Shallow Well	Deep Well	Single Suction Line	Septic Tank	Distribution Box	Disposal Field	Seepage Pit	Dry Well	Property Line	Building[1]
Bldg. Sewer other than cast-iron	50	50	50							
Bldg. Sewer cast-iron	10	10	10							
Septic Tank	100	50	50	–	5	10	10	10	10[1]	10
Distribution Box	100	50	50	5		–	5	5	10	20
Disposal Field	100	50	50	10	5	–	–	–	10	20
Seepage Pit	100	50	50	10	5	–	–	–	10	20
Dry Well	100	50	50	10	5	–	–	–	10	20
Shallow Well	–	–	–	100	100	100	100	100		
Deep Well	–	–	–	50	50	50	50	50		
Suction Line	–	–	–	50	50	50	50	50		

[1]May be closer to building when permission is given by the Authority Having Jurisdiction

16.4.4 General

All sewage disposal systems shall conform with the following general principles regarding site:

16.4.4.1 Location

Sewage disposal system shall be located at the lowest point on the premises consistent with the general layout topography and surroundings, including abutting lots. Locations at a higher elevation through employment of a forced system may be used with the specific approval of the Authority Having Jurisdiction.

16.4.4.2 Watersheds

Sewage disposal facilities shall not be located on any watershed for a public water supply system.

16.4.4.3 Septic Tanks and Underground Disposal

Septic tanks and underground disposal means shall not be within 200 feet measured horizontally from the high water level in a reservoir or the banks of tributary streams when situated less than 3,000 feet upstream from an intake structure.

16.4.4.4 Beyond 3,000 feet

Sewage disposal facilities situated beyond 3,000 feet upstream from intake structures shall be located no less than 100 feet measured horizontally from the high water level in the reservoir or the banks of tributary streams.

16.4.4.5 Percolation Test

Prior to approval, the soil must prove satisfactory by the standard percolation test when underground disposal is used.

16.5 PERCOLATION TEST

Percolation tests to determine the absorption capacity of soil for septic tank effluent shall be conducted in the following manner:

16.5.1 Subsurface Irrigation

When subsurface irrigation is contemplated, a test pit shall be prepared 2 feet square and not less than 1 foot deep. At the time of conducting the percolation test, a hole 1 foot square and 1 foot deep shall be prepared in the test pit.

16.5.2 Water Depth

The hole shall be filled with water to a depth of 7 inches. For pre-wetting purposes, the water level shall be allowed to drop 6 inches before time of recording is started.

16.5.3 Time Expired

The time required for the water level to drop 1 inch from 6 inches to 5 inches in depth shall be noted and the length of tile in the subsurface irrigation system shall be obtained from Section 16.5.4. In no case, however, shall less than 100 feet of tile be installed when 1 foot trenches are used.

16.5.4 Tile Length

The tile lengths, in feet, for each 100 gallons of sewage per day are as follows:

Time in Minutes for 1-inch Drop	Trench Width 1-foot	2-feet	3-feet
1	25	13	9
2	30	15	10
3	35	18	12
5	42	21	14
10	59	30	20
15	74	37	25
20	91	46	31
25	105	53	35
30	125	63	42

16.5.5 Seepage Pits

When seepage pits are contemplated, test pits approximately 5 feet in diameter to permit a man entering the pit by means of a ladder and to such depth as to reach a porous soil shall be prepared. In the bottom of this pit, a 1 foot square by 1 foot deep hole shall be made at the time of testing and the percolation test conducted as indicated under Sections 16.5.1, 16.5.2, and 16.5.3.

16.5.6 Seepage Pit Absorption Area

The absorption area of a seepage pit required shall be obtained from Table 16.5.6. In no case, however, shall the absorption area in the porous soil be less than 125 square feet. The bottom of the pit shall not be considered part of the absorption area.

Table 16.5.6
REQUIRED ABSORPTION AREA IN SEEPAGE PITS FOR EACH 100 GALLONS OF SEWAGE PER DAY

Time in Minutes 1 for 1-inch Drop	Effective Absorption Area Square Feet
1	32
2	40
3	45
5	56
10	75
15	96
20	108
25	139
30	167

16.5.7 Thickness of Porous Soil

The thickness of the porous soil below the point of percolation test must be determined by means of digging a pit or using a soil auger. The effective absorption area shall be calculated only within this porous soil.

16.6 CAPACITY OF SEPTIC TANKS

16.6.1 Liquid Capacity

The liquid capacity of all septic tanks shall conform to Tables 16.3.7 and 16.6.1 as determined by the number of bedrooms or apartment units in dwelling occupancies and the occupant load or the number of plumbing fixture units as determined from Table 11.4.1, (whichever is greater) in other building occupancies.

Table 16.6.1
CAPACITY OF SEPTIC TANKS

Single family dwelling-number of bedrooms	Multiple dwellings units or apartments-one bedroom each	Other uses; maximum fixture units served	Minimum septic tank capacity in gallons
1-3		20	1000
4	2 units	25	1200
5 or 6	3	33	1500
7 or 8	4	45	2000
	5	55	2250
	6	60	2500
	7	70	2750
	8	80	3000
	9	90	3250
	10	100	3500

Extra bedroom: 150 gallons each.
Extra dwelling units over 10: 250 gallons each.
Extra fixture units over 100: 25 gallons per fixture unit.

16.6.2 Reserved

16.6.3 Multiple Compartment

In a tank of more than one compartment, the inlet compartment shall have a capacity of not less than two-thirds of the total tank capacity.

16.6.4 Septic Tank Materials

See Sections 3.3.11, 16.6.5 and 16.6.6.

16.6.5 Steel Tanks

16.6.5.1 Welding

All steel tanks shall be continuous welded. (No spot welding is permitted.)

16.6.5.2 Wall Thickness

The minimum wall thickness of any steel septic tank shall be No. 12 U.S. gauge (0.109").

16.6.5.3 Coatings

Metal tanks shall be coated inside and out with an approved coating.

16.6.5.4 Baffles

The inlet and outlet baffles shall be at least 12 inches in diameter at the point opposite the opening in the tank.

16.6.5.5 Pumpout Opening

The pumpout opening in the top shall be large enough to permit a 6-inch cast-iron pumpout pipe to be inserted with a shoulder to support this pipe.

16.6.5.6 Tank Opening

The tank opening shall not be smaller than 6 inches with a 3-inch collar.

16.6.5.7 Outside Diameter of Collar

The outside diameter of this collar shall be 8 inches.

16.6.5.8 Pumpout Pipe

The pumpout pipe shall terminate at the surface and a 6-inch iron body brass cleanout shall be caulked into the hub of this pipe with oakum and molten lead; the cleanout nut shall be solid brass no smaller than one inch.

16.6.5.9 Manhole

There shall be a 24 x 24-inch manhole held in position by four 3/8" bolts securely welded in place.

16.6.5.10 Partition

There shall be a supporting partition welded in the center of these tanks as per drawings.

16.6.5.11 Partition Openings

This partition shall have 2-inch openings at intervals at the top for air circulation.

16.6.5.12 Capacity, Gauge Metal and Weight

The capacity, gauge metal, and weight must be stamped on a brass plate and welded to the top of metal septic tanks.

16.6.6 Concrete Tanks

16.6.6.1 Baffles

Concrete tanks shall have the same size baffles and pumpout openings as for steel tanks.

16.6.6.2 Tops

The tops shall have a 24-inch manhole with handle to remove same, or be cast in three or four sections cemented in place.

16.6.6.3 Wall Thickness

The minimum thickness of the walls shall be 2-3/4 inches.

16.6.6.4 Tops and Bottoms

The tops and bottoms shall be 4 inches thick unless placed under a driveway, then they shall be a minimum of 6 inches.

16.6.6.5 Walls and Bottoms

All tank walls and bottoms shall be reinforced with approved reinforcing.

16.6.6.6 Top Reinforcing

The tops shall have 3/8 inch steel reinforcing on 6-inch centers.

16.6.6.7 Watertight

The tank shall be watertight.

16.6.7 Depth of Septic Tank

The top of the septic tank shall be brought to within 36 inches of the finished grade. Where a greater depth is permitted by the Authority Having Jurisdiction, the access manhole must be extended to the finished grade and the manhole shall have a concrete marker at grade.

16.6.8 Limitation

No septic tank shall serve more than one property unless authorized by the Authority Having Jurisdiction.

16.6.9 Effluent

The effluent from all septic tanks shall be disposed of underground by subsurface irrigation or seepage pits or both.

16.7 DISTRIBUTION BOX

16.7.1 When Required

A distribution box shall be required when more than one line of subsurface irrigation or more than one seepage pit is used.

16.7.2 Connection

Each lateral line shall be connected separately to the distribution box and shall not be subdivided.

16.7.3 Invert level

The invert of all distribution box outlets shall be at the same level and approximately 2 inches above the bottom of the box. The inlet invert shall be at least 1 inch above the invert of the outlets. The size of the distribution box shall be sufficient to accommodate the number of lateral lines.

16.7.4 Watertight

The distribution box shall be of watertight construction arranged to receive the septic tank effluent and with an outlet or connecting line serving each trench or seepage pit.

16.7.5 Baffle

A baffle at least 6 inches high and 12 inches long shall rest on the bottom of the box and be placed at right angles to the direction of the incoming tank effluent and 12 inches in front of it.

16.7.6 Reserved

16.7.7 Inspection

The sides of the box shall extend to within a short distance of the ground surface to permit inspection, and shall have a concrete marker at grade.

16.8 SEEPAGE PITS

16.8.1 Use

Seepage pits may be used either to supplement the subsurface disposal field or in lieu of such field where conditions favor the operation of seepage pits, as may be found necessary and approved by the Authority Having Jurisdiction.

16.8.2 Water Table

Seepage pits shall not penetrate the water table.

16.8.3 Septic Tank Effluent Disposal

Where seepage pits are used for septic tank effluent disposal, the number, diameter and depth of the pits shall be determined after percolation tests have been made to ascertain the porosity of the soil.

16.8.4 Excavation

The excavation for a seepage pit shall be greater in diameter than the outside diameter of the vertical sidewalls to allow for the footing.

16.8.5 Annular Space

The annular space between the outside of the vertical walls and the excavation shall be backfilled with broken stone, coarse gravel, or other suitable material.

16.8.6 Construction

Seepage pits shall be constructed with the bottom being open with an outer ring, or footing, to support the sidewalls.

16.8.7 Sidewalls

The sidewalls shall be made of pre-cast concrete, stone, concrete or cinder blocks, or brick laid in cement mortar for strength, with openings at sufficient intervals to permit the septic tank effluent to pass out through the wall to the surrounding porous soil.

16.8.8 Cover Strength

All septic tank tops and seepage pit covers shall be of sufficient strength to carry the load imposed. Seepage pit covers shall be at least as required in Sections 16.8.9, 16.8.10, and 16.8.11.

16.8.9 Pre-Cast Top

Seepage pit tops shall be pre-cast, reinforced concrete (2,500 pounds per square inch minimum compressive strength) not less than 5 inches thick and designed to support an earth load of not less than 400 pounds per square foot. Each such cover shall extend not less than 3 inches beyond the sidewalls of the pit, shall be provided with a 6-inch minimum inspection hole with pipe extended to the surface, and a 6-inch cast-iron standpipe with cleanout at grade.

16.8.10 Depth Below Grade

The top shall be at least 36 inches below finished grade, except where less is permitted by the Authority Having Jurisdiction.

16.8.11 Field Fabricated Slabs

Where field fabricated slabs are used, Table 16.8.11 indicates the requirements.

Table 16.8.11
DESIGN OF SEEPAGE PIT COVERS

Pit Diameter	Pit Wall Thickness	Cover Thickness	Cover Weight	Reinforcing Steel Req'd in Two Perpendicular Directions
5ft.	4"	5"	1230 lb	#5 @ 10$^1/_2$" c/c
6ft.	8"	5"	1770 lb	#5 @ 9" c/c
8ft.	8"	6"	3780 lb	#5 @ 7$^1/_2$" c/c
10ft.	8"	8"	7850 lb	#5 @ 6$^1/_2$" c/c

16.9 ABSORPTION TRENCHES

16.9.1 General

Absorption trenches shall be designed and constructed on the basis of the required effective percolation area.

16.9.2 Filter Material

The filter material shall cover the tile and extend the full width of the trench and shall be not less than 6 inches deep beneath the bottom of the tile, and 2 inches above the top of the tile. The filter material may be washed gravel, crushed stone, slag, or clean bank-run gravel ranging in size from 1/2 to 2-1/2 inches. The filter material shall be covered with burlap, filter cloth, 2 inches of straw, or equivalent permeable material prior to backfilling the excavation.

16.9.3 Absorption Field

The size and minimum spacing requirements for absorption fields shall conform to those given in Table 16.9.3.

Table 16.9.3
SIZE AND SPACING FOR DISPOSAL FIELDS

Width of trench at bottom (in.)	Recommended depth of trench (in.)	Spacing tile lines[1] (ft.)	Effective absorption area per lineal ft. of trench (sq. ft.)
18	18 to 30	6.0	1.5
24	18 to 30	6.0	2.0
30	18 to 36	7.6	2.5
36	24 to 36	9.0	3.0

1. A greater spacing is desirable where available area permits.

16.9.4 Lateral Length

Length of laterals shall not exceed 100 feet.

16.9.5 Absorption Lines

Absorption lines shall be constructed of 4" pipe of open jointed or perforated vitrified clay pipe, open jointed or horizontally split or perforated clay tile, perforated plastic pipe or open jointed cast iron soil pipe, all conforming to approved standards. In the case of clay tile, open jointed clay pipe, or open jointed cast-iron soil pipe, the sections shall be spaced not more than 1/2 inch apart, and the upper half of the joint shall be protected by asphalt-treated paper while the piping is being covered.

16.9.6 Grade

The trench bottom shall be uniformly graded to slope from a minimum of 2 inches to a maximum of 4 inches per 100 feet.

16.10 RESERVED

16.11 PIPING MATERIAL

See Chapter 3.

16.12 SAND FILTERS

16.12.1 General Specifications for Design and Construction of a Sand Filter with Chlorination

16.12.1.1 General

A sand filter shall consist of a bed of clean, graded sand on which septic tank effluent is distributed by means of a siphon and pipe, with the effluent percolating through the bed to a series of underdrains through which it passes to the point of disposal.

16.12.1.2 Filter Size

The filter size shall be determined on the basis of 1.15 gallons per square foot per day if covered, and 2.3 gallons per square foot per day if an open filter is to be used.

16.12.1.3 Dosing Tank Size

The septic tank effluent shall enter a dosing siphon tank of a size to provide a 2-inch coverage of the sand filter.

16.12.1.4 Siphon

The siphon shall be of a commercial type and shall discharge the effluent to the sand filter intermittently. The siphon shall be omitted if a pump is used to lift the septic tank effluent to the sand filter.

16.12.1.5 Surge Tank

A surge tank shall be used to receive the pump discharge prior to dosing on the sand filter.

16.12.1.6 Underdrains

Four-inch diameter vitrified clay pipe in 2-foot lengths laid with 1/2 inch open joints or unglazed farm tile in 1-foot lengths laid with open joints, with the top half of each joint covered with 4-inch wide strips of tar paper, burlap, or copper screen, or perforated bituminized-fiber pipe or other approved material shall be used for the underdrains.

16.12.1.7 Underdrain Bed

The underdrains shall be laid at the bottom of the sand filter, surrounded by washed gravel, crushed stone, slag, or clean bank-run gravel ranging in size from 1/2 inch to 2-1/2 inches and free of fines, dust, ashes or clay. The gravel shall extend from at least 2 inches below the bottom of the tile to a minimum of 2 inches above the top of the tile.

16.12.1.8 Underdrain Slope and Spacing

The underdrains shall have a slope from 2 inches to 4 inches per 100 feet and shall be placed at 6-foot to 8-foot intervals.

16.12.1.9 Underdrain Fill

Above the gravel or other material surrounding the underdrain shall be placed 2 feet of washed and graded sand having an effective size of from 0.35-0.5 mm and a uniformity coefficient of not over 3.5. (The effective size of a sand filter is that size of which 10% by weight is smaller and the uniformity coefficient is the ratio of that size of which 60% by weight is smaller to the effective size.)

16.12.1.10 Distribution Pipes

The distribution pipes shall be laid at the surface of the sand filter, surrounded by gravel as specified for the underdrains.

16.12.1.11 Gravel Cover

The gravel should be covered with untreated building paper and the entire area covered with a minimum of 12 inches of earth if the filter is to be covered.

16.12.1.12 Open Filter

If the filter is an open one, the four sides shall be constructed of wood or concrete to prevent earth erosion from entering the sand filter bed.

16.12.1.13 Chlorine Contact Tank

The chlorine contact tank for disinfection of sand filter effluent shall provide 20 minutes detention at average flow, but in no case shall it be smaller than 50 gallons capacity. Chlorine control should be provided by the use of hypochlorite or chlorine machines commercially available.

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Chapter 17

Potable Water Supply Systems

17.1 GENERAL REGULATION

17.1.1 Jurisdiction

The regulations in this chapter apply to any water system where plumbing fixtures are installed for human occupancy.

17.1.2 Pumps

Pumps shall be installed only in wells, springs and cisterns that comply with the rules and regulations as determined by the Authority Having Jurisdiction.

17.2 QUANTITY OF WATER REQUIRED

17.2.1 Single Dwelling Unit

The minimum capacity of the system in gallons per minute shall equal the number of fixtures installed.

17.2.2 Other Than a Single Dwelling Unit

In other than a single dwelling unit, the water system shall be designed in accordance with Tables 10.14.2A, and 10.14.2B and shall be capable of supplying the maximum demand to the system according to usage, but, in no case, less than for a minimum period of 30 minutes.

17.2.3 Available Water

Total water available during any 24-hour period shall not be less than the requirements of Table 16.3.7.

17.2.4 Secondary Sources of Water

a. When the available primary source of water does not meet the minimum requirement of Sections 17.2.1, 17.2.2, and 17.2.3, one of the following methods shall be used:

1. Pressure tank of sufficient size.
2. Gravity tank, see Section 10.8.
3. Two pump system.

(a) The capacity of the first well pump shall not exceed the well capacity in flow. This pump supplies water to another tank that stores the water at atmospheric pressure and has a control to start and stop the pump.

(b) The second pump delivers the water to a hydropneumatic tank at the required pressure and quantity.

17.3 PRESSURE

Pressure shall be as required in Section 10.14.3.

17.4 PIPING MATERIALS

Piping from the well to inside of the dwelling shall be as required in Section 3.8.

17.5 STORAGE TANKS

Storage equipment shall be as follows:

17.5.1 Certified Tanks

All tanks shall be certified under Water Systems Council Standards for size and pressure.

17.5.2 Tank Material

All tanks shall be coated or made of material to resist corrosion.

17.5.3 Pressure Rating

Hydropneumatic tanks shall have a working pressure rating in excess of the maximum required system pressure.

17.5.4 Non-Toxic Materials

All tanks shall be constructed of materials and/or coatings that are non-toxic.

17.5.5 Drain Required

All tanks shall be provided with a means for draining.

17.5.6 Covers

Atmospheric storage tanks shall be provided with a cover as required in Section 10.8.

17.6 PUMPS

17.6.1 Certified Pumps

Pumps shall be certified under Water Systems Council Rating and Rating Standards.

17.6.2 Installation

Pumps shall be installed in accordance with the manufacturer's recommendations.

17.6.3 Equipment Installation

Pumping equipment shall be installed to prevent the entrance of contamination or objectionable material either into the well or into the water that is being pumped.

17.6.4 Pump Location

The pump shall be located to facilitate necessary maintenance and repair, including overhead clearance for removal of drop pipe and other accessories.

17.6.5 Pump Mounting

The pump shall be suitably mounted to avoid objectionable vibration and noise, and to prevent damage to pumping equipment.

17.6.6 Pump Accessories

The pump controls and/or accessories shall be protected from weather.

17.7 PUMP DOWN CONTROL

17.7.1 Tailpipe

30 feet of tailpipe shall be installed below the jet on deep well installation.

17.7.2 Switches

Low pressure cut-off switch and/or water level cut-off switch shall be installed.

17.7.3 Suction Pipe

Use a vertical suction pipe of 30-foot length on shallow well jet installation.

17.8 CONTROLS

a. The following controls are required on all pump installations:

1. Pressure switch
2. Thermal overload switch
3. Pressure relief valve on positive displacement pumps
4. Low water cut-off switch where the pump capacity exceeds the source of water.

17.9 WELL TERMINAL

17.9.1 Upper Well Terminal

Well casing, curbs and pitless adapters shall terminate not less than eight inches above the finished ground surface or pump house floor and at least 24 inches above the maximum high water level where flooding occurs. No casing shall be cut off or cut in below ground level except to install a pitless adapter.

17.9.2 Pitless Adapter

17.9.2.1 Design

Pitless adapters designed to replace a section of well casing or for attachment to the exterior of a well casing shall be constructed of materials that provide strength and durability equal to the well casing.

17.9.2.2 Installation

Installation shall be by threaded, welded or compression-gasketed connection to cutoff casing or attachment to the exterior wall of the casing and shall be watertight.

17.9.2.3 Adapter Units

Adapter units designed to replace a section of the well casing shall extend above the finished ground surface as provided in Section 17.9.1. The top of the adapter unit shall be capped with a cover having a downward flange that will overlap the edge of the unit. The cover shall be securely fastened to the unit and shall fit sufficiently snug to the unit to be vermin proof. The cover shall provide for watertight entrance of electrical cables and vent piping or air line if installed.

17.9.3 Hand Pumps

17.9.3.1 General

Hand pumps shall be of the force type equipped with a packing gland around the pump rod, a delivery spout that is closed and downward directed, and a one-piece bell type base that is part of the pump stand or is attached to the pump column in a watertight manner.

17.9.3.2 Installation

The bell base of the pump shall be bolted with a gasket to a flange that is securely attached to the casing or pipe sleeve.

17.9.4 Power Driven Pumps

17.9.4.1 General

The design and operating principles of each type of power driven pump determines where each may be located with respect to a well. The location selected for the pump determines what factors must be considered to make an acceptable installation.

17.9.4.2 Location Above Well

Any power driven pump located over a well shall be mounted on the well casing, pipe sleeve, pump foundation or pump stand such that a watertight closure is or can be made for the open end of the casing or sleeve.

17.9.4.3 Pump Base

The pump base bolted with a neoprene or rubber gasket or equivalent watertight seal to a foundation or plate provides an acceptable seal.

17.9.4.4 Large Pump Installation

On large pump installations, the bolting may be omitted when the weight of the pump and column is sufficient to make a watertight contact with the gasket.

17.9.4.5 Pump Location Other Than Over Casing

If the pump unit is not located over the casing or pipe sleeve, the pump delivery or suction pipes emerge from the top of the well, a watertight expanding rubber seal or equivalent shall be installed between the well casing and piping to provide a watertight closure.

17.9.4.6 Seal Top

The top of the seal shall not extend below the uppermost edge of the casing or pipe sleeve.

17.9.5 Location in Well For Submersible Pumps

17.9.5.1 General

This type of location is permissible for submersible pumps only.

17.9.5.2 Top Discharge Line

When the discharge line leaves the well at the top of the casing, the opening between the discharge line and casing or pipe sleeve shall be sealed watertight with an expanding rubber seal or equivalent device.

17.9.5.3 Underground Discharge

When an underground discharge is desired, a properly installed pitless adapter shall be used. A check-valve shall be installed in the discharge line above the pump in the well.

17.9.5.4 Top Discharge Line Sloped to Drain to Well

When the discharge pipe leaves the well at the top, remains above ground, and slopes to drain back to the well, the check-valve can be located beyond the well.

17.9.6 Offset from Well

17.9.6.1 Location

Pumps offset from the well, if not located in an above-ground pump house or other building, may be located in an approved basement provided the pump and all suction pipes are elevated at least 12 inches above the floor.

17.9.6.2 Buried Lines

All portions of suction lines buried below the ground surface between the well and the pump and that are not enclosed in a protective pipe shall be located the same minimum distance from sources of contamination as are prescribed for the well in Section 16.4.3.

17.9.6.3 Protective Pipe

When these minimum distances cannot be obtained, the suction line shall be enclosed in a protective pipe of standard thickness from the well to the pump. The protective pipe shall be sealed watertight at both ends. This requirement shall be considered satisfied if the suction line lies within a pressure discharge line.

17.10 VENTS

17.10.1 Size

All vent piping shall be of adequate size to allow equalization of air pressure in the well and shall not be less than one-half inch in diameter.

17.10.2 Toxic or Flammable Gases

Particular attention shall be given to proper venting of wells and pressure tanks in areas where toxic or flammable gases are known to be a characteristic of the water. If determined that either of these types of gases are present, all vents when located in buildings shall be extended to discharge outside of the building at a height where they will not be a hazard.

17.10.3 Vent Extension

The vent shall extend above the upper terminal of the well with the end downturned and covered with not less than 16 mesh screen wire. The point of entry into the well shall be sealed watertight.

17.11 PUMP BEARING LUBRICATION

17.11.1 General

Lubrication of bearings of power driven pumps shall be with water or oil that will not adversely affect the quality of the water to be pumped.

17.11.2 Water Lubrication

If a storage tank is required for the lubrication water, it shall be designed to protect the water from contamination.

17.11.3 Oil Lubrication

The reservoir shall be designed to protect the oil from contamination. The oil shall not contain substances that will cause odor or taste to the water pumped.

17.12 WATER LEVEL MEASUREMENT

On wells of large capacity where access for measuring the water level in the well is provided, piping for this purpose shall terminate above the upper well terminal, be capped or otherwise closed, and all openings around the piping at the point of entry into the well sealed watertight.

17.13 PROHIBITED PUMPS

No pitcher or chain-bucket pump shall be installed on any water supply.

17.14 PUMP HOUSING

17.14.1 Watertight

A separate structure housing the water supply and pumping equipment shall have an impervious floor and rain-tight walls and roof.

17.14.2 Pump Pit

A pump pit shall be of watertight construction and provided with a positive drain or sump pump to keep the pit dry.

17.15 CROSS CONNECTION

17.15.1 Restriction

There shall be no cross-connection between an individual water supply system and other individual or public water supply system.

17.15.2 Limitations

No water supply shall serve more than one property unless authorized by the Authority Having Jurisdiction.

Chapter 18

Mobile Home & Travel Trailer Park Plumbing Standards

The primary objective of this Chapter is to assure sanitary plumbing installations in trailer home parks. Reference should be made to the Authority Having Jurisdiction and the regulations promulgated by the Authority Having Jurisdiction governing the establishment and operation of trailer home parks.

18.1 DEFINITIONS

Service Buildings

A building housing toilet, laundry and any other such facilities as may be required.

Sewer Connection

Sewer connection is that portion of the drainage piping that extends as a single terminal under the trailer coach for connection with the trailer park drainage system.

Trailer Coach

Any camp-car, trailer, or other vehicle with or without motive power, designed and constructed to travel on the public thoroughfares in accordance with provisions of the Vehicle Code and designed or used for human habitation.

Trailer Coach, Dependent

One which is not equipped with a water closet for sewage disposal.

Trailer Coach, Independent

One which is equipped with a water closet for sewage disposal.

Trailer Coach Drain Connection

The removable extension connecting the trailer coach drainage system to the trailer connection fixture.

Trailer Coach, Left Side

The side farthest from the curb when the trailer home is being towed or in transit.

Trailer Connection Fixture

A connection to a trap that is connected to the park drainage system, and receives the water, liquid or other waste discharge from a trailer coach.

Trailer Park Drainage System

The entire system of drainage piping used to convey sewage or other waste from a trailer connection fixture to the sewer.

Trailer Park Branch Line

That portion of drainage piping that receives the discharge from not more than two trailer connection fixtures.

Trailer Park

Any area or tract of land where space is rented or held-out for rent, or occupied by two or more trailer coaches.

Trailer Park Sewer System

That piping that extends from the public or private sewage disposal system to a point where the first trailer park drainage system branch fitting is installed.

Trailer Park Water Service Main

That portion of the water distribution system that extends from the street main, water meter, or other source of supply to the trailer site water service branch.

Trailer Site

That area set out by boundaries on which one trailer can be located.

Trailer Site Water Service Branch

That portion of the water distributing system extended from the park service main to a trailer site, and includes connections, devices, and appurtenances thereto.

Water Service Connection

That portion of the water supply piping that extends as a single terminal under the trailer coach for connection with the trailer coach park water supply system.

18.2 STANDARDS

18.2.1 General

Plumbing systems hereafter installed in trailer home parks shall conform to the provisions set forth in the preceding chapters of this Code, where applicable, and also to the provisions set forth in this Chapter. Trailer home park plumbing and drainage systems shall, in addition, conform to all other applicable Authority Having Jurisdiction regulations.

18.2.2 Plans and Specifications

Before any plumbing or sewerage disposal facilities are installed or altered in any trailer park, duplicate plans and specifications shall be filed, and proper permits obtained from the Authority Having Jurisdiction. Plans shall show in detail.

18.2.2.1 Plot Plan

Plot plan of the park, drawn to scale, indicating elevations, property lines, driveways, existing or proposed buildings, and sizes of trailer sites.

18.2.2.2 Plumbing Layout

Complete specifications and piping layout of proposed plumbing system or alteration.

18.2.2.3 Sewerage Disposal Layout

Complete specifications and piping layout of proposed sewer system or alteration.

18.2.2.4 Conformance

Trailer park plumbing system shall be designed and installed in accordance with the requirements of this Code and shall, in addition, conform to all other pertinent local ordinances and State regulations.

18.2.3 Materials

Materials shall conform to the approved standards set forth in other sections of this Code.

18.3 SEWER

18.3.1 Design and Installation

The trailer park drainage system shall be designed and installed in accordance with the requirements of this Code.

18.3.2 Alternate

The trailer park drainage system may be installed by the use of a combination waste and vent drainage system (see Section 12.17), which shall consist of an installation of waste piping, as hereinafter provided in this Section, in which the traps for one or more trailer connection fixtures are not separately or independently vented, but which is vented through the waste piping of such size to secure free circulation of air therein.

18.3.3 Each Independent Trailer Site

Each independent trailer site shall be provided with a trapped trailer connection that shall consist of a three-inch horizontal iron pipe-size threaded connection, installed a minimum of three inches and a maximum of six inches (from the bottom of the connection), above the finished grade. The vertical connection to the trailer connection fixture shall be anchored in a concrete slab four inches thick, and 18" x 18" square.

18.3.4 Above Ground

Any part of the plumbing system extending above the ground shall be protected from damage when deemed necessary by the Authority Having Jurisdiction.

18.3.5 Trap Connections

Each trailer site shall be provided with a three-inch I.P.S. male or female threaded connection, extended above the surrounding grade, from a three- inch minimum size vented p-trap.

18.3.5.1 Location

Traps shall be located with reference to the immediate boundary lines of the designated space or area within each trailer site that will actually be occupied by the trailer. Each such trap shall be located in the rear third-quarter section along the left boundary line of the trailer parking area not less than one foot or more than three feet from the road side of the trailer and shall be a minimum of five feet from the rear boundary of the trailer site. This location may be varied by permission of the Authority Having Jurisdiction when unusual conditions are encountered.

18.3.5.2 Material

All traps, tail pipes, vertical vents, the upper five feet of any horizontal vent, and the first five feet of any trap branch shall be fabricated from materials approved for use within a building.

18.3.6 Restriction

No vertical pipe shall be used in a special waste and vent system, except the vent pipe, and the connection to the trailer connection fixture.

18.3.7 Drain Connections

Mobile home and travel trailer drain connections shall be of approved semi-rigid or flexible reinforced hose having smooth interior surfaces and not be less than a 3-inch inside diameter. Main connections shall be equipped with a standard quick-disconnect screw or clamp type fitting, not smaller than the outlet. Main connections shall be gas-tight and no longer than necessary to make the connection between the trailer coach drain connection and the trailer connector fixture on the site.

18.3.8 Cleanouts

Cleanouts shall be provided as required by Chapter 5 of this Code, except cleanouts shall be provided in the vent stacks one foot above grade.

18.3.9 Fixture Unit Loading

For the purpose of determining pipe sizes, each trailer site connection shall be assigned a waste loading value of six fixture units and each trailer park drainage system shall be sized as provided in Table 18.3.12. Private sewage disposal shall conform to the requirements of Chapter 16 of this Code.

18.3.10 Slope

The grade on sewers shall provide a minimum velocity of two feet per second when the pipe is flowing half full.

18.3.11 Discharge

The discharge of the park drainage system shall be connected to a public sewer. Where a public sewer is not available within 300 feet for use, an individual sewage disposal system of a type that is acceptable and approved by the Authority Having Jurisdiction shall be installed.

18.3.12 Minimum Pipe Size

Minimum pipe size of the drainage system shall be as set forth in Table 18.3.12.

Table 18.3.12 DRAIN PIPE SIZING		
Max. No. of Trailers, Individually Vented Systems	**Max. No. of Trailers, Wet-Vented Systems**	**Size of Drain**
2	1	3"
30	10	4"
100	50	6"
400	-	8"
1000	-	10"

18.4 VENTING

18.4.1 Location

Each wet-vented drainage system shall be provided with a vent not more than 15 feet downstream from its upper trap, and long mains shall be provided with additional relief vents at intervals of not more than 100 feet thereafter. The minimum size of each vent serving a wet-vented system shall be as set forth in Table 18.4.1.

Table 18.4.1 VENT SIZING	
Size of Wet-Vented Drain	**Minimum Size of Vent**
3"	2"
4"	3"
5"	4"
6"	5"

18.4.2 Reserved

18.4.3 Reserved

18.4.4 Reserved

18.4.5 Vent Connections

All vent intersections shall be taken off above the center line of the horizontal pipe. All vent stacks shall be supported by a four-inch by four-inch redwood post, set in at least two feet of concrete extending at least four inches above the ground, or supported by another approved method.

18.4.6 Galvanized Steel Vent Pipe

Galvanized steel vent pipe may extend below the ground vertically, and may directly intersect a drainage line with an approved fitting, if the entire section around both the drain and the galvanized pipe is encased in concrete to prevent any movement. Galvanized steel pipe encased in concrete shall be first coated with bituminous paint, or equivalent protective material.

18.4.7 Location of Vent Pipes

Vent pipes shall be located at least 10 feet above grade and 10 feet from the property line. No vent shall terminate directly beneath any door, window, or other ventilating openings of the building or of an adjacent building, nor shall any such vent terminal be within 10 feet horizontally of such opening unless it is at least 2 feet above the top of such opening.

18.4.8 Size of Vent Stack

All vent stacks in the wet-vented system shall be three inches or more in diameter, except that a three-inch branch line may be vented by a two-inch vent.

18.4.9 Branch Lines

No three-inch branch line shall exceed six feet in length, and no four-inch branch shall exceed 15 feet in length, unless they are properly vented.

18.4.10 Trailer Connections

Each trailer connection fixture outlet shall be provided with a screw-type plug or cap, and be effectively capped when not in use.

18.5 WATER DISTRIBUTION SYSTEM

18.5.1 Conformance

Each trailer park water distribution system shall conform to the requirements of Chapter 10 of this Code and shall be so designed and maintained as to provide a residual pressure of not less than 20 psi at each trailer site under normal operating conditions. (See Table 10.14.3.)

18.5.2 Individual Water Service Branch

Every trailer site shall be provided with an individual water service branch line that shall not be less than 3/4" size, delivering safe, potable water.

18.5.3 Connection Components

A control valve shall be installed on the water service branch, followed by an approved backflow preventer in accordance with ASSE 1024 or CSA B64.6 on the discharge side of the control valve, with a pressure relief valve located on the discharge side of the backflow preventer; with a hose connection or other approved attachment on the trailer side of the relief valve. Each such pressure relief valve shall be equipped with a full-size drain with the end of the pipe not more than two feet or less than six inches above the ground and pointing downward. Such drain may terminate at other approved locations. No part of such drain pipe shall be trapped. No shut-off valve shall be installed between any such pressure relief valve and the trailer it serves. The backflow device and relief valve shall be located not less than 12 inches above the grade.

18.5.4 Connection Details

The service connection shall not be rigid. Flexible metal tubing is permitted. Fittings at either end shall be of a quick disconnect type not requiring any special tools or knowledge to install or remove.

18.5.5 Water Fixture Units

Each trailer outlet on the water distribution system shall be rated as six water fixture units.

18.5.6 Location of Water Connection

The trailer park water outlet for each trailer coach space shall be located near the center of the left side of each trailer coach.

18.5.7 Fire Protection

In the design of the water distribution system in a trailer park, consideration for fire outlet stations throughout the park should be made relative to the location and quantity of water necessary during an emergency period.

18.5.8 Backflow Protection

All requirements as described in Chapter 10 of this Code shall be considered a part of this Section.

18.6 RESERVED

18.7 TESTING

Installations shall be tested and inspected as required by this Code.

18.8 SANITARY FACILITIES

18.8.1 Public Water Closets, Showers, and Lavatories

Separate public water closets, showers, and lavatories shall be installed and maintained for each sex in accordance with the following ratio of trailer sites:

18.8.1.1 Dependent Trailer

Trailer parks constructed and operated exclusively for dependent trailers shall have one water closet, one shower, and one lavatory for each 10 sites or fractional part thereof.

18.8.1.2 Independent Trailer

Trailer parks constructed and operated exclusively for independent trailers shall have one water closet, one shower, and one lavatory for each 100 sites or fractional part thereof.

18.8.1.3 Combined Trailer Use

Trailer parks constructed and operated for the combined use of dependent and independent trailers shall have facilities as shown in Table 18.8.1.3.

Table 18.8.1.3
FACILITIES REQUIRED

Sites	Water Closets	Showers	Lavatories
2-25	1	1	1
26-70	2	2	2

18.8.1.4 Additional Water Closets

For combined trailer use, one additional water closet shall be provided for each 100 sites or fractional part thereof in excess of 70 sites.

18.8.2 Exclusivity

Each toilet facility shall be for the exclusive use of the occupants of the trailer sites in the trailer park.

18.8.3 Showers

In every auto and trailer park, shower bathing facilities with hot and cold running water shall be installed in separate compartments. Every compartment shall be provided with a self-closing door or otherwise equipped with a waterproof draw curtain.

18.8.4 Laundry Facilities

Every trailer park shall be provided with an accessory utility building containing at least one mechanical washing machine or laundry tray equipped with hot and cold running water for every 20 trailer sites or fractional part thereof, but in no case shall there be less than two laundry trays in any trailer park.

18.8.5 Shower Compartments

The inner face of walls of all shower compartments shall be finished with cement, concrete, metal, tile or other approved waterproof materials extending to a height of not less than six feet above the floor. Floors or shower compartments shall be made of concrete or other similar impervious material. Floors shall be waterproof and slope 1/4 inch per foot to the drains.

18.9 MAINTENANCE

All required devices or safeguards shall be maintained in good working order. The owner, operator, or lessee of the trailer park, or his designated agent shall be responsible for the maintenance.

18.10 OPERATOR'S RESPONSIBILITY-VIOLATIONS

When it is evident that there exists, or may exist, a violation of any pertinent regulation, the owner, operator, lessee, person in charge of the park, or any other person causing a violation shall immediately disconnect the trailer water supply and sewer connection from the park systems and shall employ such other corrective measures as may be ordered by the Authority Having Jurisdiction.

Appendix A

Sizing Storm Drainage Systems

A.1 Rainfall Rates for Cities

The rainfall rates in Table A.1, RAINFALL RATES FOR CITIES, are based on U.S. Weather Bureau Technical Paper No. 40, specifically Chart 14: 100-YEAR 1 HOUR RAINFALL (inches) and Chart 7: 100-YEAR 30-MINUTE RAINFALL (inches). The data in Chart 7 were multiplied by 0.72 to determine the rainfall for a 15-minute period, then multiplied by 4 to establish the corresponding rainfall rate in inches per hour. The flow rates in gallons per minute (gpm) were established by dividing the inches per hour by 12 to determine cubic feet per hour per square foot, then multiplying by 7.48 gallons per cubic foot to determine gallons per hour per square foot, then dividing by 60 minutes per hour to determine the equivalent gallons per minute.

A.2 Roof Drainage

Primary roof drainage systems are sized for a 100-year, 60-minute storm. Secondary roof drainage systems are sized for a more severe 100-year, 15-minute storm. The rainfall rates in Table A.1 should be used for design unless higher rates are established locally.

A.3 Sizing by Flow Rate

Storm drainage systems may be sized by stormwater flow rates, using the appropriate GPM/SF of rainfall listed in Table A.1 for the local area. Multiplying the listed GPM/SF by the roof area being drained (in square feet) produces the gallons per minute (gpm) of required flow for each drain inlet. The flow rates (gpm) can then be added to determine the flows in each section of the drainage system. Required pipe sizes can be determined from Table 13.6.1 and Table 13.6.2.

A.4 Sizing by Roof Area

Storm drainage systems may be sized using the roof area served by each section of the drainage system. Required pipe sizes can be determined from Table 13.6.1 and Table 13.6.2. Using this method, it may be necessary to interpolate between the various listed rainfall rates (inches per hour). To determine the allowable roof area for a listed size pipe at a listed slope, divide the allowable square feet of roof area for a 1" rainfall rate by the listed rainfall rate for the local area. For example, the allowable roof area for a 6" drain at 1/8" slope with a rainfall rate of 3.2 inches/hour is 21400/3.2 = 6688 square feet.

A.5 Capacity of Rectangular Scuppers

Table A.5 lists the discharge capacity of various width rectangular roof scuppers with various heads of water. The maximum allowable level of water on the roof should be obtained from the structural engineer, based on the design of the roof.

Table A.1 RAINFALL RATES FOR CITIES

STATES AND CITIES	PRIMARY STORM DRAINAGE 60-MIN DURATION 100-YR RETURN		SECONDARY STORM DRAINAGE 15-MIN DURATION 100-YR RETURN	
	IN/HR	GPM/SF	IN/HR	GPM/SF
ALABAMA				
Birmingham	3.7	0.038	7.8	0.081
Huntsville	3.3	0.034	7.5	0.078
Mobile	4.5	0.047	10.1	0.105
Montgomery	3.8	0.039	8.4	0.087
ALASKA				
Aleutian Islands	1.0	0.010	2.5	0.026
Anchorage	0.6	0.006	1.5	0.016
Bethel	0.8	0.008	2.0	0.021
Fairbanks	1.0	0.010	2.5	0.026
Juneau	0.6	0.006	1.5	0.016
ARIZONA				
Flagstaff	2.3	0.024	5.2	0.054
Phoenix	2.2	0.023	4.9	0.051
Tucson	3.0	0.031	5.8	0.060
ARKANSAS				
Eudora	3.8	0.039	8.6	0.089
Ft. Smith	3.9	0.041	8.9	0.092
Jonesboro	3.5	0.036	7.5	0.078
Little Rock	3.7	0.038	8.6	0.089
CALIFORNIA				
Eureka	1.5	0.016	3.7	0.038
Lake Tahoe	1.3	0.014	2.9	0.030
Los Angeles	2.0	0.021	4.3	0.045
Lucerne Valley	2.5	0.026	4.3	0.045
Needles	1.5	0.016	3.7	0.038
Palmdale	3.0	0.031	7.2	0.075
Redding	1.5	0.016	3.7	0.038
San Diego	1.5	0.016	3.7	0.038
San Francisco	1.5	0.016	3.5	0.036
San Luis Obispo	1.5	0.016	3.7	0.038
COLORADO				
Craig	1.5	0.016	3.5	0.036
Denver	2.2	0.023	4.6	0.048
Durango	1.8	0.019	4.3	0.045
Stratton	3.0	0.031	6.6	0.069
CONNECTICUT				
Hartford	2.8	0.029	6.6	0.069
New Haven	3.0	0.031	7.2	0.075
DELAWARE				
Dover	3.5	0.036	7.8	0.081
Rehobeth Beach	3.6	0.037	8.6	0.089
DISTRICT OF COLUMBIA				
Washington	4.0	0.042	8.6	0.089
FLORIDA				
Daytona Beach	4.0	0.042	8.6	0.089
Ft. Myers	4.0	0.042	10.1	0.105
Jacksonville	4.3	0.045	8.6	0.089
Melbourne	4.0	0.042	8.6	0.089
Miami	4.5	0.047	11.5	0.119
Palm Beach	5.0	0.052	11.5	0.119
Tampa	4.2	0.044	10.1	0.105
Tallahassee	4.1	0.043	9.2	0.096
GEORGIA				
Atlanta	3.5	0.036	7.8	0.081
Brunswick	4.0	0.042	8.6	0.089
Macon	3.7	0.038	8.1	0.084
Savannah	4.0	0.042	8.6	0.089
Thomasville	4.0	0.042	8.6	0.089
HAWAII				
Hawaiian Islands	(1)			

Table A.1 RAINFALL RATES FOR CITIES, Continued

STATES AND CITIES	PRIMARY STORM DRAINAGE 60-MIN DURATION 100-YR RETURN		SECONDARY STORM DRAINAGE 15-MIN DURATION 100-YR RETURN	
	IN/HR	GPM/SF	IN/HR	GPM/SF
IDAHO				
Boise	1.0	0.010	2.3	0.024
Idaho Falls	1.2	0.012	3.2	0.033
Lewiston	1.0	0.010	2.9	0.030
Twin Falls	1.1	0.011	2.3	0.024
ILLINOIS				
Chicago	2.7	0.028	6.3	0.065
Harrisburg	3.1	0.032	6.9	0.072
Peoria	2.9	0.030	6.6	0.069
Springfield	3.0	0.031	6.6	0.069
INDIANA				
Evansville	3.0	0.031	6.9	0.072
Indianapolis	2.8	0.029	6.3	0.065
Richmond	2.7	0.028	6.3	0.065
South Bend	2.7	0.028	6.0	0.062
IOWA				
Council Bluffs	3.7	0.038	8.1	0.084
Davenport	3.0	0.031	7.2	0.075
Des Moines	3.4	0.035	7.8	0.081
Sioux City	3.6	0.037	7.8	0.081
KANSAS				
Goodland	3.5	0.036	7.5	0.078
Salina	3.8	0.039	8.6	0.089
Topeka	3.8	0.039	8.6	0.089
Wichita	3.9	0.041	8.9	0.092
KENTUCKY				
Bowling Green	2.9	0.030	6.9	0.072
Lexington	2.9	0.030	6.6	0.069
Louisville	2.8	0.029	6.3	0.065
Paducah	3.0	0.031	6.9	0.072
LOUISIANA				
Monroe	3.8	0.039	8.9	0.092
New Orleans	4.5	0.047	10.1	0.105
Shreveport	4.0	0.042	9.5	0.099
MAINE				
Bangor	2.2	0.023	4.9	0.051
Kittery	2.4	0.025	5.8	0.060
Millinocket	2.0	0.021	4.3	0.045
MARYLAND				
Baltimore	3.6	0.037	8.6	0.089
Frostburg	2.9	0.030	6.6	0.069
Ocean City	3.7	0.038	8.6	0.089
MASSACHUSETTS				
Adams	2.6	0.027	6.0	0.062
Boston	2.7	0.028	6.3	0.065
Springfield	2.7	0.028	6.3	0.065
MICHIGAN				
Cheboygan	2.1	0.022	4.6	0.048
Detroit	2.5	0.026	5.5	0.057
Grand Rapids	2.6	0.027	5.5	0.057
Kalamazoo	2.7	0.028	6.0	0.062
Traverse City	2.2	0.023	4.9	0.051
MINNESOTA				
Duluth	2.6	0.027	6.0	0.062
Grand Forks	2.5	0.026	6.0	0.062
Minneapolis	3.0	0.031	6.9	0.072
Worthington	3.4	0.035	7.5	0.078
MISSISSIPPI				
Biloxi	4.5	0.047	10.1	0.105
Columbus	3.5	0.036	7.8	0.081
Jackson	3.8	0.039	8.6	0.089

Table A.1 RAINFALL RATES FOR CITIES, Continued

STATES AND CITIES	PRIMARY STORM DRAINAGE 60-MIN DURATION 100-YR RETURN		SECONDARY STORM DRAINAGE 15-MIN DURATION 100-YR RETURN	
	IN/HR	GPM/SF	IN/HR	GPM/SF
MISSOURI				
Independence	3.7	0.038	8.4	0.87
Jefferson City	3.4	0.035	7.8	0.081
St. Louis	3.2	0.033	7.2	0.075
Springfield	3.7	0.038	8.1	0.084
MONTANA				
Billings	1.8	0.019	3.7	0.038
Glendive	2.5	0.026	5.8	0.060
Great Falls	1.8	0.019	3.7	0.038
Missoula	1.3	0.014	2.9	0.030
NEBRASKA				
Omaha	3.6	0.037	8.1	0.084
North Platte	3.5	0.036	7.5	0.078
Scotts Bluff	2.8	0.029	6.0	0.062
NEVADA				
Las Vegas	1.5	0.016	3.5	0.036
Reno	1.2	0.012	2.9	0.030
Winnemucca	1.0	0.010	2.3	0.024
NEW HAMPSHIRE				
Berlin	2.2	0.023	5.2	0.054
Manchester	2.5	0.026	5.8	0.060
NEW JERSEY				
Atlantic City	3.4	0.035	8.1	0.084
Paterson	3.0	0.031	6.9	0.072
Trenton	3.2	0.033	7.2	0.075
NEW MEXICO				
Albuquerque	2.0	0.021	4.0	0.042
Carlsbad	2.6	0.027	6.0	0.062
Gallup	2.1	0.022	4.9	0.051
NEW YORK				
Binghamton	2.4	0.025	5.5	0.057
Buffalo	2.3	0.024	5.2	0.054
New York	3.1	0.032	6.9	0.072
Schenectady	2.5	0.026	5.8	0.060
Syracuse	2.4	0.025	5.2	0.054
NORTH CAROLINA				
Ashville	3.2	0.033	7.2	0.075
Charlotte	3.4	0.035	8.1	0.084
Raleigh	4.0	0.042	8.9	0.092
Wilmington	4.4	0.046	9.5	0.099
NORTH DAKOTA				
Bismarck	2.7	0.028	6.3	0.065
Fargo	2.9	0.030	6.6	0.069
Minot	2.6	0.027	5.8	0.060
OHIO				
Cincinnati	2.8	0.029	6.3	0.065
Cleveland	2.4	0.025	5.5	0.057
Columbus	2.7	0.028	6.3	0.065
Toledo	2.6	0.027	5.8	0.060
Youngstown	2.4	0.025	5.8	0.060
OKLAHOMA				
Boise City	3.4	0.035	7.8	0.081
Muskogee	4.0	0.042	9.2	0.096
Oklahoma City	4.1	0.043	9.2	0.096
OREGON				
Medford	1.3	0.014	3.2	0.033
Portland	1.3	0.014	3.2	0.033
Ontario	1.0	0.010	2.3	0.024

Table A.1 RAINFALL RATES FOR CITIES, Continued

STATES AND CITIES	PRIMARY STORM DRAINAGE 60-MIN DURATION 100-YR RETURN		SECONDARY STORM DRAINAGE 15-MIN DURATION 100-YR RETURN	
	IN/HR	GPM/SF	IN/HR	GPM/SF
PENNSYLVANIA				
Erie	2.4	0.025	5.5	0.057
Harrisburg	2.9	0.030	6.6	0.069
Philadelphia	3.2	0.033	7.2	0.075
Pittsburg	2.5	0.026	5.8	0.060
Scranton	2.8	0.029	6.0	0.062
RHODE ISLAND				
Newport	3.0	0.031	7.2	0.075
Providence	2.9	0.030	6.9	0.072
SOUTH CAROLINA				
Charleston	4.1	0.043	7.8	0.081
Columbia	3.5	0.036	8.4	0.087
Greenville	3.3	0.034	9.2	0.096
SOUTH DAKOTA				
Lemmon	2.7	0.028	6.3	0.065
Rapid City	2.7	0.028	6.3	0.065
Sioux Falls	3.4	0.035	7.5	0.078
TENNESSEE				
Knoxville	3.1	0.032	7.2	0.075
Memphis	3.5	0.036	7.5	0.078
Nashville	3.0	0.031	7.2	0.075
TEXAS				
Corpus Christi	4.6	0.048	10.7	0.111
Dallas	4.2	0.044	9.5	0.099
El Paso	2.0	0.021	4.9	0.051
Houston	4.6	0.048	10.7	0.111
Lubbock	3.3	0.034	7.5	0.078
San Antonio	4.4	0.046	9.8	0.102
UTAH				
Bluff	2.0	0.021	4.3	0.045
Cedar City	1.5	0.016	3.5	0.036
Salt Lake City	1.3	0.014	2.6	0.027
VERMONT				
Bennington	2.5	0.026	5.8	0.060
Burlington	2.3	0.024	5.2	0.054
Rutland	2.4	0.025	5.5	0.057
VIRGINIA				
Charlottesville	3.4	0.035	7.8	0.081
Richmond	4.0	0.042	8.9	0.092
Roanoke	3.3	0.034	7.8	0.081
Norfolk	4.0	0.042	9.5	0.099
WASHINGTON				
Seattle	1.0	0.010	2.3	0.024
Spokane	1.0	0.010	2.6	0.027
Walla Walla	1.0	0.010	2.9	0.030
WEST VIRGINIA				
Charleston	2.9	0.030	6.6	0.069
Martinsburg	3.0	0.031	7.2	0.075
Morgantown	2.7	0.028	6.3	0.065
WISCONSIN				
La Cross	2.9	0.030	6.9	0.072
Green Bay	2.5	0.026	5.8	0.060
Milwaukee	2.7	0.028	6.3	0.065
Wausau	2.5	0.026	5.8	0.60
WYOMING				
Casper	1.9	0.020	4.3	0.045
Cheyenne	2.5	0.026	5.5	0.057
Evaston	1.3	0.014	2.9	0.030
Rock Springs	1.4	0.015	3.5	0.036

1. Rainfall rates in Hawaiian Islands vary from 1.5 in/hr to 8.0 in/hr depending on location and elevation. Consult local data.

Table A.5
DISCHARGE FROM RECTANGULAR SCUPPERS - GALLONS PER MINUTE

WATER HEAD (Inches)	WIDTH OF SCUPPER - (Inches) 6	12	18	24	30	36
0.5	6	13	19	25	32	38
1	17	35	53	71	89	107
1.5	31	64	97	130	163	196
2		98	149	200	251	302
2.5		136	207	278	349	420
3		177	271	364	458	551
3.5			339	457	575	693
4			412	556	700	844

NOTES:
1. Table A.5 is based on discharge over a rectangular weir with end contractions.
2. Head is depth of water above bottom of scupper opening.
3. Height of scupper opening should be 2 times the design head.
4. Coordinate the allowable head of water with the structural design of the roof.

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Appendix B

Sizing the Building Water Supply System

B.1 GENERAL

Note that there are two questions regarding water supply to a building: first, total consumption of water (hot or cold or both) over a period of time, or second, peak flow at any instant of time. This appendix considers only the second question.

Proper design of the water-distributing system in a building is necessary to avoid excessive installed cost and in order that the various fixtures may function properly under normal conditions. The instantaneous flow of either hot or cold water in any building is variable, depending on the type of structure, usage, occupancy, and time of day. The correct design results in piping, water heating, and storage facilities of sufficient capacity to meet the probable peak demand without wasteful excess in either piping or maintenance cost.
For additional information on this subject, the reader is referred to:

National Bureau of Standards Building Materials and Structures Report BMS 65 (1940), Methods of Estimating Loads in Plumbing Systems, by R. B. Hunter

National Bureau of Standards Building Materials and Structures Report BMS 79 (1941), Water-Distributing Systems for Buildings, by R. B. Hunter

New York State Division of Housing and Community Renewal Building Codes Bureau Technical Report No. 1, (1964), A Simplified Method for Checking Sizes of Building Water Supply Systems, by Louis S. Nielsen.

B.2 PRELIMINARY INFORMATION

B.2.1 General

The information necessary for sizing the building water supply system is described in B.2.2 through B.2.9. Correct sizing is contingent upon accuracy and reliability of the information applied. Thus, such information should be obtained from responsible parties and appropriate local authorities recognized as sources of the necessary information.

B.2.2 Materials for System

Determine what kind or kinds of piping materials are to be installed in the system. This is a matter of selection by the owner of the building or his authorized representative, who may be the architect, engineer, or contractor, as the case may be.

B.2.3 Characteristics of the Water Supply

The corrosivity and the scale-forming tendency of a given water supply with respect to various kinds of piping materials is information that most officials, architects, engineers, and contractors in a water district normally have at their fingertips, as a result of years of experience. For anyone without such experience and knowledge, significant characteristics of the water supply, such as its pH value, CO_2 content, dissolved air content, carbonate hardness, Langelier Index, and Ryznar Index, may be applied to indicate its corrosivity and scale-forming tendency. The most appropriate source of such information is the local water authority having jurisdiction over the system supplying the water, or over the wells from which water is pumped from the underground water table.

B.2.4 Location and Size of Water Supply Source

Location and size of the public water main, where available, should be obtained from the local water authority. Where a private water supply source, such as a private well system, is to be used, the location and size as designed for the premises should be determined.

B.2.5 Developed Length of System

Information should be obtained regarding the developed length of the piping run from the source of water supply to the service control valve of the building (i.e., the developed length of the water service pipe as shown on site plans). Also, determine the developed length of the piping run from the service control valve to the highest and/or the most remote water outlet on the system. This may be established by measurement of the piping run on the plans of the system.

B.2.6 Pressure Data Relative to Source of Supply

Maximum and minimum pressures available in the public main at all times should be obtained from the water authority, as it is the best source of accurate and reliable information on this subject.

Where a private well water supply system is to be used, the maximum and minimum pressures at which it will be adjusted to operate may be applied as appropriate in such cases.

B.2.7 Elevations

The relative elevations of the source of water supply and the highest water supply outlets to be supplied in the building must be determined. In the case of a public main, the elevation of the point where the water service connection is to be made to the public main should be obtained from the local water authority. It has the most authoritative record of elevations of the various parts of the public system, and such elevations are generally referred to a datum as the reference level, usually related to curb levels established for streets.

Elevation of the curb level directly in front of the building should be obtained from building plans, as such information is required to be shown on the building site plans. Elevations of each floor on which fixtures are to be supplied also may be determined from the building plans.

B.2.8 Minimum Pressure Required at Water Outlets

Information regarding the minimum flowing pressure required at water outlets for adequate, normal flow conditions consistent with satisfactory fixture usage and equipment function may be deemed to be as follows: 15 psig flowing for all water supply outlets at common plumbing fixtures, except 20 psig for flushometer valves on siphon jet water closets and 25 psig for flushometer valves for blowout water closets and blowout urinals. Flushometer tank (pressure assisted) water closets require a minimum of 25 psig static pressure. For other types of water supplied equipment, the minimum flow pressure required should be obtained from the manufacturer.

B.2.9 Provision of Necessary Information on Plans

The basis for designing sizes of water supply piping should be provided on plans of the water supply system when submitted to plumbing plan examiners for proposed installations. Provision of such information permits the examiner to quickly and efficiently check the adequacy of sizes proposed for the various parts of the building water supply system.

B.3 DEMAND AT INDIVIDUAL OUTLETS

Maximum possible flow rates at individual fixtures and water outlets have become generally accepted as industry practice, which have since become maximum rates set by law. Recognized flow rates at individual water outlets for various types of typical plumbing fixtures and hose connections are given in Table B.3.
For older faucets, if the applied pressure is more than twice the minimum pressure required for satisfactory water supply conditions, an excessively high discharge rate may occur. Such rates may cause the actual flow in the piping to exceed greatly the estimated probable peak demand rate determined in accordance with the standard method discussed in Section B.5. Such excessive velocity of flow and friction loss in piping may adversely affect performance and durability of the system.

More recent faucets, however, are equipped with flow limiting devices that control the discharge rate at a nearly constant value over a large range of pressures.

Where necessary, it is recommended that means to control the rate of supply should be provided in the fixture supply pipe (or otherwise) wherever the available pressure at an outlet is more than twice the minimum pressure required for satisfactory supply. For this purpose, individual regulating valves, variable orifice flow control devices, or fixed orifices may be provided. They should be designed or adjusted to control the rate of supply to be equal to or less than the maximum rates set by law.

Table B.3
MAXIMUM DEMAND AT INDIVIDUAL WATER OUTLETS

Type of Outlet	Maximum Demand, (gpm)
Metering lavatory faucet	0.25 gal/cycle
Self-closing lavatory faucet	0.5
Drinking fountain jet	0.75
Ordinary lavatory faucet	2.5
Shower head, 1/2"	2.5
Laundry faucet, 1/2"	2.5
Ballcock in water closet flush tank	3.0
Dishwashing machine (domestic)	4.0
Laundry machine (8 or 16 lbs.)	4.0
Sink faucet, 3/8" or 1/2"	4.5
Bath faucet, 1/2"	5.0
Hose bibb or sillcock (1/2")	5.0
Sink faucet, 3/4"	6.0
1/2" flush valve (15 psi flow pressure)	15.0
1" flush valve (15 psi flow pressure)	27.0
1" flush valve (25 psi flow pressure)	35.0

B.4 RESERVED

B.5 ESTIMATING DEMAND

B.5.1 Standard Method

A standard method for estimating the maximum probable demand in building water supply systems has evolved and become recognized as generally acceptable. In 1923, the fixture unit method of weighting fixtures in accordance with their load-producing effects was proposed by Roy B. Hunter, of the National Bureau of Standards. After studying application of the method in the design of federal buildings over a period of years, the method was revised by Hunter in 1940[1], and then recommended for general application. With appropriate modifications recently made for modern fixtures, the method fills the need for a reliable, rational way to estimate probable peak demand in water supply systems for all types of building occupancy.

Note that the concept of **maximum probable demand** is one of probability. We are saying, in effect, that the calculated flow rate at any point in a water piping system will not be exceeded more than, say, 0.1% of the time. For most systems designed by the method described herein, the design flow rates are never reached. Therefore, the method gives a conservative approach that still does not result in wasteful oversizing.

B.5.2 Water Supply Fixture Units (WSFU) Assigned to Fixtures

Individual fixture branch piping should be sized to provide the flow rates listed in Table B.3 for the particular fixture. Minimum fixture branch pipe sizes are listed in Table B.5.2.

Peak demand in building water supply systems serving multiple fixtures cannot be determined exactly. The demand imposed on a system by intermittently used fixtures is related to the number, type, time between uses, and probable number of simultaneous uses of the fixtures installed in the building. In the standard method, fixtures using water intermittently under several conditions of service are assigned specific load values in terms of water supply fixture units. The water supply fixture unit (WSFU) is a factor so chosen that the load-producing effects of different kinds of fixtures under their conditions of service can be expressed approximately as multiples of that factor. WSFUs for two or more fixtures can then be added to determine their combined effect on the water supply system.

Values assigned to different kinds of fixtures and different types of occupancies are shown in Table B.5.2. The total WSFUs represent the fixture's demand on the domestic water service to the building. For fixtures having both hot and cold water supplies, the values for separate hot and cold water demands are taken as being three-quarters (3/4) of the total value assigned to the fixture in each case, rounded to the nearest tenth of a WSFU. As an example, since the value assigned to a kitchen sink in an individual dwelling unit is 1.5 WSFU, the separate demands on the hot and cold water piping thereto are taken as being 1.1 WSFU.

Another consideration, added in 1994, is the nature of the application of the plumbing fixture. Table B.5.2 includes columns for Individual Dwelling Units, More Than 3 Dwelling Units, Other Than Dwelling Units, and Heavy-Use Assembly. The concept behind these added classifications is that the maximum probable demand created by plumbing fixtures varies depending on the type of occupancy in which they are installed.

1. National Bureau of Standards Building Materials and Structures Report BMS 6, Methods of Estimating Loads in Plumbing Systems, by R. B. Hunter.

Table B.5.2
WATER SUPPLY FIXTURE UNITS (WSFU)[1] AND MINIMUM FIXTURE BRANCH PIPE SIZE FOR INDIVIDUAL FIXTURES

	Minimum Branch Pipe Size[2]		In Individual Dwelling Units			In 3 or More Dwelling Units			In Other than Dwelling Units			In Heavy-Use Assembly		
INDIVIDUAL FIXTURES	**Cold**	**Hot**	**Total**	**Cold**	**Hot**	**Total**	**Cold**	**Hot**	**Total**	**Cold**	**Hot**	**Total**	**Cold**	**Hot**
Bathtub or Combination Bath/Shower	1/2"	1/2"	4.0	3.0	3.0	3.5	2.6	2.6						
Bidet	1/2"	1/2"	1.0	0.8	0.8	0.5	0.4	0.4						
Clothes Washer, Domestic	1/2"	1/2"	4.0	3.0	3.0	2.5	1.9	1.9	4.0	3.0	3.0			
Dishwasher, Domestic		1/2"	1.5		1.5	1.0		1.0	1.5		1.5			
Drinking Fountain or Water Cooler	3/8"								0.5	0.5		0.8	0.8	
Hose Bibb	1/2"		2.5	2.5		2.5	2.5		2.5	2.5				
Hose Bibb, Each Additional	1/2"		1.0	1.0		1.0	1.0		1.0	1.0				
Kitchen Sink, Domestic	1/2"	1/2"	1.5	1.1	1.1	1.0	0.8	0.8	1.5	1.1	1.1			
Laundry Sink	1/2"	1/2"	2.0	1.5	1.5	1.0	0.8	0.8	2.0	1.5	1.5			
Lavatory	3/8"	3/8"	1.0	0.8	0.8	0.5	0.4	0.4	1.0	0.8	0.8	1.0	0.8	0.8
Service Sink Or Mop Sink	1/2"	1/2"							3.0	2.3	2.3			
Shower	1/2"	1/2"	2.0	1.5	1.5	2.0	1.5	1.5	2.0	1.5	1.5			
Shower, Continuous Use	1/2"	1/2"							5.0	3.8	3.8			
Urinal, 1.0 GPF	3/4"								4.0	4.0		5.0	5.0	
Urinal, Greater Than 1.0 GPF	3/4"								5.0	5.0		6.0	6.0	
Water Closet, 1.6 GPF Gravity Tank	1/2"		2.5	2.5		2.5	2.5		2.5	2.5		4.0	4.0	
Water Closet, 1.6 GPF Flushometer Tank	1/2"		2.5	2.5		2.5	2.5		2.5	2.5		3.5	3.5	
Water Closet, 1.6 GPF Flushometer Valve	1"		5.0	5.0		5.0	5.0		5.0	5.0		8.0	8.0	
Water Closet, 3.5 GPF[3] Gravity Tank	1/2"		3.0	3.0		3.0	3.0		5.5	5.5		7.0	7.0	
Water Closet, 3.5 GPF[3] Flushometer Valve	1"		7.0	7.0		7.0	7.0		8.0	8.0		10.0	10.0	
Whirlpool Bath or Combination Bath/Shower	1/2"	1/2"	4.0	3.0	3.0	4.0	3.0	3.0						

NOTES:

1. The "total" WSFU values for fixtures represent their load on the water service. The separate cold water and hot water supply fixture units for fixtures having both hot and cold connections are each taken as ¾ of the listed total value for the individual fixture.
2. The fixture branch pipe sizes in Table B.5.2 are the minimum allowable. Larger sizes may be necessary if the water supply pressure at the fixture will be too low due to the available building supply pressure or the length of the fixture branch and other pressure losses in the distribution system.
3. The WSFU values for 3.5 GPF water closets also apply to water closets having flushing volumes greater than 3.5 gallons.
4. Gravity tank water closets include the pump assisted and vacuum assisted types.

Table B.5.3-BATHROOM GROUPS HAVING 1.6 GPF WATER CLOSETS OTHER THAN THE FLUSHOMETER VALAVE TYPE

	Totals In Individual Dwelling Units			Each Group In 3 or More Dwelling Units		
BATHROOM GROUPS HAVING 1.6 GPF WATER CLOSETS[2] OTHER THAN THE FLUSHOMETER VALVE TYPE	**Total WSFU**	**Cold WSFU**	**Hot WSFU**	**Total WSFU**	**Cold WSFU**	**Hot WSFU**
Half-Bath or Powder Room	3.5	3.3	0.8	2.5	2.5	0.4
1 Bathroom Group	5.0	5.0	3.8	3.5	3.5	3.0
1-1/2 Bathrooms	6.0	6.0	4.5			
2 Bathrooms	7.0	7.0	7.0			
2-1/2 Bathrooms	8.0	8.0	8.0			
3 Bathrooms	9.0	9.0	9.0			
Each Additional ½ Bath	0.5	0.5	0.5			
Each Additional Bathroom Group	1.0	1.0	1.0			
BATHROOM GROUPS HAVING 3.5 GPF[3] GRAVITY-TANK WATER CLOSETS	**Total WSFU**	**Cold WSFU**	**Hot WSFU**	**Total WSFU**	**Cold WSFU**	**Hot WSFU**
Half-Bath or Powder Room	4.0	3.8	0.8	3.0	3.0	0.4
1 Bathroom Group	6.0	6.0	3.8	5.0	5.0	3.0
1-1/2 Bathrooms	8.0	8.0	4.5			
2 Bathrooms	10.0	10.0	7.0			
2-1/2 Bathrooms	11.0	11.0	8.0			
3 Bathrooms	12.0	12.0	9.0			
Each Additional ½ Bath	0.5	0.5	0.5			
Each Additional Bathroom Group	1.0	1.0	1.0			
OTHER GROUPS OF FIXTURES	**Total WSFU**	**Cold WSFU**	**Hot WSFU**	**Total WSFU**	**Cold WSFU**	**Hot WSFU**
Bath Group with 1.6 GPF Flushometer Valve	6.0	6.0	3.8	4.0	4.0	3.0
Bath Group with 3.5 GPF[3] Flushometer Valve	8.0	8.0	3.8	6.0	6.0	3.0
Kitchen Group (Sink and Dishwasher)	2.0	1.1	2.0	1.5	0.8	1.5
Laundry Group (Sink and Clothes Washer)	5.0	4.5	4.5	3.0	2.6	2.6

NOTES:

1. The “Total WSFU” values for fixture groups represent their load on the water service. The separate cold and hot water supply fixture units for the group are each taken as ¾ of the WSFU values for the individual fixtures in the group according to Table B.5.2, but not greater than the “Total WSFU” for the group in Table B.5.3, except that the hot WSFU for groups having 3.5 GPF water closets are the same as those having 1.6 GPF water closets.
2. The WSFU values for 1.6 GPF water closets other than the flushometer valve type apply to gravity tanks, flushometer tanks (pressure assisted), pump assisted tanks, and vacuum assisted tanks.
3. The WSFU values for 3.5 GPF water closets also apply to water closets having flushing volumes greater than 3.5 gallons.

B.5.3 Water Supply Fixture Units for Fixture Groups

Table B.5.3 lists water supply fixture unit values for typical groups of fixtures in bathrooms, kitchens, and laundries in dwelling units. There is more diversity in the use of the fixtures in these groups than is reflected by WSFU values for the individual fixtures. The "Total WSFU" represents the demand that the group places on the domestic water service to the building. The separate cold and hot WSFU's for the group are each taken as ¾ of the WSFU values for the individual fixtures in the group according to Table B.5.3, but not greater than the "Total WSFU" for the group. An exception is that the hot WSFU values for bathroom groups having 3.5 GPF (or greater) water closets are the same as those having 1.6 GPF water closets, since the hot WSFU's are not affected by the demand of the water closet.

B.5.4 Demand (GPM) Corresponding to Fixture Load (WSFU)

To determine the maximum probable demand in gallons per minute corresponding to any given load in water supply fixture units, reference should be made to Table B.5.4, in which the values have been arranged for convenient conversion of maximum probable demand from terms of water supply fixture units of load to gallons per minute of flow. Intermediate values may be interpolated for loads between those shown in Table B.5.4.

Note in the table that the maximum probable demand corresponding to a given number of water supply fixture units is generally much higher for a system in which water closets are flushed by means of direct-supply flushometer valves than for a system in which the water closets are flushed by other types of flushing devices. The difference in maximum probable demand between the two systems diminishes as the total number of fixture units of load rises. At 1,000 water supply fixture units, the maximum probable demand in both types of systems is the same, 210 gpm.

Where a part of the system does not supply flushometer water closets, such as in the case with hot water supply piping and some cold water supply branches, the maximum probable demand corresponding to a given number of water supply fixture units may be determined from the values given for a system in which water closets are flushed by flush tanks.

B.5.5 Total Demand Including Continuous Flow

To estimate the maximum probable demand in gpm in any given water supply pipe that supplies outlets at which demand is intermittent and also outlets at which demand is continuous, the demand for outlets that pose continuous demand during peak periods should be calculated separately and added to the maximum probable demand for plumbing fixtures used intermittently. Examples of outlets that impose continuous demand are those for watering gardens, washing sidewalks, irrigating lawns, and for air conditioning or refrigeration apparatus.

Note that some continuous-flow outlets may be controlled to be used only during low-flow periods in the system. Such time-controlled loads should not be added to the maximum probable demand for intermittently used fixtures, since they will not occur at the same times. In such cases, it will be necessary to consider both situations and size the piping for the worse case.

Table B.5.4
TABLE FOR CONVERTING DEMAND IN WSFU TO GPM[1]

WSFU	GPM FlushTanks[2]	GPM FlushValves[3]	WSFU	GPM FlushTanks[2]	GPM FlushValves[3]
3	3		120	49	74
4	4		140	53	78
5	4.5	22	160	57	83
6	5	23	180	61	87
7	6	24	200	65	91
8	7	25	225	70	95
9	7.5	26	250	75	100
10	8	27	300	85	110
11	8.5	28	400	105	125
12	9	29	500	125	140
13	10	29.5	750	170	175
14	10.5	30	1000	210	210
15	11	31	1250	240	240
16	12	32	1500	270	270
17	12.5	33	1750	300	300
18	13	33.5	2000	325	325
19	13.5	34	2500	380	380
20	14	35	3000	435	435
25	17	38	4000	525	525
30	20	41	5000	600	600
40	25	47	6000	650	650
50	29	51	7000	700	700
60	33	55	8000	730	730
80	39	62	9000	760	760
100	44	68	10,000	790	790

NOTES: 1. This table converts water supply demands in water supply fixture units (WSFU) to required water flow in gallons per minute (GPM) for the purpose of pipe sizing.

2. This column applies to the following portions of piping systems:
   (a). Hot water piping;
   (b). Cold water piping that serves no water closets; and
   (c). Cold water piping that serves water closets other than flush valve type.

3. This column applies to portions of piping systems where the water closets are the flush valve type.

B.6 LIMITATION OF VELOCITY

B.6.1 Consideration of Velocity in Design

Velocity of flow through water supply piping during periods of peak demand is an important factor that must be considered in the design of building water supply systems. Limitation of water velocity should be observed in order to avoid objectionable noise effects in systems, shock damage to piping, equipment, tanks, coils, and joints, and accelerated deterioration and eventual failure of piping from corrosion. (Also see Section 10.14.1)

B.6.2 Good Engineering Practice

In accordance with good engineering practice, it is recommended generally that maximum velocity at maximum probable demand in supply piping be limited to 8 fps. This is deemed essential in order to avoid such objectionable effects as the production of whistling line noise, the occurrence of cavitation, and associated excessive noise in fittings and valves.

Note that this velocity is too great for systems where the flow is continuous, as in the case of recirculated hot water piping. The **continuous flow rate** for hot water with modest chemical content should be limited to not more than 2 fps for such continuous systems. That is, verify that the flow rate in the system as a result of the circulation pump only does not exceed 2 fps at any point.

It is also recommended that maximum velocity be limited to 4 fps in water supply piping that supply a quick-closing device, such as a solenoid valve, pneumatic valve, or a quick-closing valve or faucet of the self-closing, push-pull, push-button, or other similar type. This limitation is necessary in order to avoid excessive and damaging shock pressures in the piping and equipment when flow is suddenly shut off. Plumbing equipment and systems are not designed to withstand the very high shock pressures that may occur as the result of sudden cessation of high velocity flow in piping. (Also see Section 10.14.1)

B.6.3 Manufacturers' Recommendations for Avoiding Erosion/Corrosion

Velocity limits recommended by pipe manufacturers to avoid accelerated deterioration of their piping materials due to erosion/corrosion should be observed. Recent research studies have shown that turbulence accompanying even relatively low flow velocities is an important factor in causing erosion/corrosion, and that this is especially likely to occur where the water supply has a high carbon dioxide content (i.e., in excess of 10 ppm), and where it has been softened to zero hardness. Another important factor is elevated water temperature (i.e., in excess of 110°F).

To control erosion/corrosion effects in copper water tube, and copper and brass pipe, pipe manufacturers' recommendations are as follows:

(1) Where the water supply has a pH value higher than 6.9 and a positive scale-forming tendency, such as may be shown by a positive Langelier Index, peak velocity should be limited to 8 fps;

(2) Where the water supply has a pH value lower than 6.9 and may be classified as aggressively corrosive, or where the water supply has been softened to zero hardness by passage through a water softener, peak velocity should be limited to 4 fps; and

(3) The velocity in copper tube conveying hot water at up to 140°F should be limited to 5 fps because of the accelerated corrosion rate with hot water. Velocities should be limited to 2 - 3 fps for temperatures above 140° F.

Note that the above values apply to velocities at maximum probable demand. For continous flow circulating systems, do not exceed 2 fps flow rate for the flow produced by the circulator.

B.7 SIMPLIFIED METHOD FOR SIZING SYSTEMS IN RELATIVELY LOW BUILDINGS

B.7.1 Application

A simplified method for sizing building water supply systems in accordance with the maximum probable demand load, in terms of water supply fixture units, has been found to constitute a complete and proper method for adequately sizing the water supply systems of a specific category of buildings. In this category are all buildings supplied from a source at which the minimum available water pressure is adequate for supplying the highest and most remote fixtures satisfactorily during peak demand. Included are almost all one- and two-family dwellings, most multiple dwellings up to at least three stories in height, and a considerable portion of commercial and industrial buildings of limited height and area, when supplied from a source at which the minimum available pressure is not less than 50 psi. Under such conditions, the available pressure generally is more than enough for overcoming static head and ordinary pipe friction losses, so that pipe friction is not an additional factor to consider in sizing.

B.7.2 Simplified Method Based on Velocity Limitations

This method is based solely on the application of velocity limitations that are:

(1) Recognized as good engineering practice; and

(2) Authoritative recommendations issued by manufacturers of piping materials regarding proper use of their products in order to achieve durable performance and avoid failure in service, especially in water areas where the supply is aggressively corrosive. These limitations have been detailed in Section B.6. (Also see Section 10.14.1.)

B.7.3 Sizing Tables Based on Velocity Limitations

Tables B.7.3.A through G provide a means of sizing water supply piping on the basis of flow velocities ranging from 4 fps to 8 fps. The velocity in copper water tube for hot water up to 140ºF should not exceed 5 fps. The water flow rates, flow velocities, and pressure loss rates are based on Tables B.9.8.1 through B.9.8.7 for the various piping materials. The allowable water supply fixture unit (WSFU) fixture loadings are based on Table B.5.4.

The pressure loss data in the B.7.3 tables is based on friction for straight pipe and tube and does not include allowances for fittings, valves, and appurtenances. The equivalent length of the piping can be determined by adding the equivalent length of fittings and valves in Tables B.9.7.A, B, C, D, and E. If the exact layout of the piping systems cannot be determined, allowances for fittings and valves range up to 50% of the pipe length for smooth bore piping such as copper and solvent cement joint plastic piping and up to 75% of the pipe length for steel and plastic piping with threaded joints.

In Tables B.7.3.A through B.7.3.G, the columns headed “WSFU (tanks)” apply to piping that serves water closets having gravity or pressure-type flush tanks and no fixtures that are flushed by flushometer valves. The columns headed “WSFU (valves)” apply to piping that serves fixtures that are flushed by flushometer valves.

B.7.4 Step-by-Step Procedure of Simplified Sizing Method

For sizing systems in relatively low buildings, the simplified sizing method consists of the following seven steps:

1. Obtain all information necessary for sizing the system. Such information should be obtained from responsible parties and appropriate local authorities recognized as sources of the necessary information. (See Section B.2.)

2. Provide a schematic elevation of the complete water supply system. Show all piping connections in proper sequence and all fixture supplies. Identify all fixtures and risers by means of appropriate letters, numbers, or combinations thereof. Identify all piping conveying water at a temperature above 150°F, and all branch piping to such water outlets as solenoid valves, pneumatic valves, or quick-closing valves or faucets. Provide on the schematic elevation all the necessary information obtained in Step 1. (See Section B.2.9.)

3. Mark on the schematic elevation, for each section of the complete system, the hot and cold water loads conveyed thereby in terms of water supply fixture units in accordance with Table B.5.2.

Table B.7.3.A GALVANIZED STEEL PIPE - STD WT WATER FLOW VELOCITY									
PIPE SIZE	4 FPS				8 FPS				PIPE SIZE
	WSFU (tanks)	WSFU (valves)	FLOW GMP	PD psi/100ft	WSFU (tanks)	WSFU (valves)	FLOW GMP	PD psi/100ft	
1/2"	4		3.8	7.6	9		7.6	27.3	1/2"
3/4"	8		6.6	5.5	19		13.3	19.7	3/4"
1"	15		10.8	4.1	33	5	21.5	14.9	1"
1-1/4"	28		18.6	3.0	74	24	37.3	10.8	1-1/4"
1-1/2"	41	8	25.4	2.5	129	49	50.8	9.1	1-1/2"
2"	91	31	41.8	1.9	293	163	83.7	6.8	2"
2-1/2"	174	73	59.7	1.5	472	363	119.4	5.5	2-1/2"
3"	336	207	92.2	1.2	840	817	184.4	4.3	3"
4"	687	634	158.7	0.9	1925	1925	317.5	3.1	4"
5"	1329	1329	249.4	0.7	3710	3710	498.9	2.4	5"
6"	2320	2320	360.2	0.5	7681	7681	720.4	1.9	6"

Table B.7.3.B - TYPE K COPPER TUBE WATER FLOW VELOCITY													
TUBE SIZE	4 FPS				5 FPS				8 FPS				TUBE SIZE
	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	
3/8"			1.6	8.4			2.0	12.7	3		3.2	30.4	3/8"
1/2"			2.7	6.1	3		3.4	9.3	6		5.4	22.1	1/2"
3/4"	6		5.4	4.1	8		6.8	6.2	15		10.9	14.8	3/4"
1"	13		9.7	2.9	16		12.1	4.4	29		19.4	10.6	1"
1-1/4"	22		15.2	2.3	28		19.0	3.4	53	14	30.4	8.1	1-1/4"
1-1/2"	33	5	21.5	1.8	45	10	26.9	2.8	96	33	43.0	6.7	1-1/2"
2"	75	24	37.6	1.3	112	40	47.0	2.0	251	126	75.2	4.8	2"
2-1/2"	165	69	58.1	1.0	238	115	72.6	1.6	456	341	116.1	3.7	2-1/2"
3"	289	159	82.8	0.8	392	267	103.4	1.3	725	682	165.5	3.0	3"
4"	615	541	145.7	0.6	826	801	182.1	0.9	1678	1678	291.4	2.2	4"
5"	1134	1134	226.1	0.5	1605	1605	282.6	0.7	3191	3191	452.2	1.7	5"
6"	1978	1978	322.8	0.4	2713	2713	403.5	0.6	5910	5910	645.5	1.4	6"

Table B.7.3.C - TYPE L COPPER TUBE WATER FLOW VELOCITY													
TUBE SIZE	4 FPS				5 FPS				8 FPS				TUBE SIZE
	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	
3/8"			1.8	7.8	2		2.3	11.7	4		3.6	28.0	3/8"
1/2"	3		2.9	5.9	4		3.6	8.9	7		5.8	21.3	1/2"
3/4"	7		6.0	3.9	9		7.5	5.8	16		12.1	13.9	3/4"
1"	14		10.3	2.8	18		12.9	4.3	31		20.6	10.2	1"
1-1/4"	23		15.7	2.2	29		19.5	3.3	56	15	31.3	8.0	1-1/4"
1-1/2"	34	5	22.2	1.8	47	11	27.7	2.7	101	36	44.4	6.5	1-1/2"
2"	79	26	38.6	1.3	117	43	48.2	2.0	261	136	77.2	4.7	2"
2-1/2"	173	73	59.5	1.0	247	120	74.4	1.5	470	360	119.0	3.7	2-1/2"
3"	300	170	84.9	0.8	406	281	106.2	1.3	749	713	169.9	3.0	3"
4"	635	567	149.3	0.6	854	833	186.7	0.9	1739	1739	298.7	2.2	4"
5"	1189	1189	232.7	0.5	1674	1674	290.9	0.7	3338	3338	465.5	1.7	5"
6"	2087	2087	334.6	0.4	2847	2847	418.2	0.6	6382	6382	669.1	1.4	6"

Table B.7.3.D - TYPE M COPPER TUBE WATER FLOW VELOCITY													
TUBE SIZE	4 FPS				5 FPS				8 FPS				TUBE SIZE
	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	
3/8"			2.0	7.3			2.5	11.1	4		4.0	26.6	3/8"
1/2"	3		3.2	5.6	4		4.0	8.5	7		6.3	20.2	1/2"
3/4"	7		6.4	3.7	10		8.1	5.6	18		12.9	13.4	3/4"
1"	15		10.9	2.7	19		13.6	4.1	34	5	21.8	9.9	1"
1-1/4"	24		16.3	2.2	30		20.4	3.3	59	17	32.6	7.8	1-1/4"
1-1/2"	36	6	22.8	1.8	49	12	28.5	2.7	107	38	45.7	6.4	1-1/2"
2"	82	28	39.5	1.3	122	46	49.4	2.0	270	144	79.1	4.7	2"
2-1/2"	180	77	61.0	1.0	256	131	76.2	1.5	485	380	121.9	3.6	2-1/2"
3"	310	180	87.0	0.8	419	294	108.8	1.2	775	743	174.0	3.0	3"
4"	648	583	151.6	0.6	872	854	189.5	0.9	1783	1783	303.3	2.1	4"
5"	1215	1215	235.8	0.5	1706	1706	294.8	0.7	3407	3407	471.6	1.7	5"
6"	2125	2125	338.7	0.4	2894	2894	423.4	0.6	6548	6548	677.4	1.3	6"

Table B.7.3.E CPVC, PVC, ABS PLASTIC PIPE - SCHEDULE 40 WATER FLOW VELOCITY

PIPE SIZE	4 FPS				8 FPS				PIPE SIZE
	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100 ft	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	
1/2"	4		3.6	5.2	9		7.3	18.7	1/2"
3/4"	7		6.4	3.7	18		12.9	13.4	3/4"
1"	14		10.5	2.8	32	4	20.9	10.1	1"
1-1/4"	27		18.2	2.0	71	22	36.4	7.3	1-1/4"
1-1/2"	40	8	24.9	1.7	124	47	49.7	6.1	1-1/2"
2"	89	30	41.1	1.3	286	157	82.2	4.6	2"
2-1/2"	168	70	58.5	1.0	460	347	117.1	3.7	2-1/2"
3"	328	198	90.6	0.8	820	795	181.2	2.9	3"
4"	675	618	156.5	0.6	1881	1881	313.1	2.1	4"
5"	1303	1303	246.4	0.5	3642	3642	492.8	1.6	5"
6"	2284	2284	356.2	0.4	7413	7413	712.4	1.3	6"

Table B.7.3.F CPVC, PVC, ABS PLASTIC PIPE - SCHEDULE 80 WATER FLOW VELOCITY

PIPE SIZE	4 FPS				8 FPS				PIPE SIZE
	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	
1/2"	3		2.7	6.1	7		5.5	22.1	1/2"
3/4"	6		5.1	4.2	14		10.3	15.3	3/4"
1"	11		8.6	3.1	25		17.2	11.3	1"
1-1/4"	22		15.4	2.2	55	15	30.8	8.1	1-1/4"
1-1/2"	33	4	21.3	1.9	95	33	42.7	6.7	1-1/2"
2"	70	21	35.8	1.4	233	112	71.7	4.9	2"
2-1/2"	132	51	51.4	1.1	389	264	102.7	4.0	2-1/2"
3"	277	149	80.3	0.9	698	648	160.7	3.1	3"
4"	585	503	140.4	0.6	1590	1590	280.7	2.2	4"
5"	1105	1105	222.6	0.5	3114	3114	445.3	1.7	5"
6"	1942	1942	319.2	0.4	5767	5767	638.3	1.4	6"

Table B.7.3.G CPVC PLASTIC TUBING (Copper Tube Size) - SDR 11 WATER FLOW VELOCITY

TUBE SIZE (CTS)	4 FPS				8 FPS				TUBE SIZE (CTS)
	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	WSFU (tanks)	WSFU (valves)	FLOW GPM	PD psi/100ft	
1/2"	2		2.4	6.6	6		4.8	23.9	1/2"
3/4"	6		4.9	4.4	13		9.8	15.8	3/4"
1"	10		8.1	3.3	24		16.2	11.8	1"
1-1/4"	16		12.1	2.6	38	7	24.2	9.3	1-1/4"
1-1/2"	25		16.9	2.1	62	18	33.7	7.7	1-1/2"
2"	50	12	28.9	1.6	164	68	57.8	5.6	2"

4. Mark on the schematic elevation, adjacent to all fixture unit notations, the demand in gallons per minute corresponding to the various fixture unit loads in accordance with Table B.5.3.

5. Mark on the schematic elevation, for appropriate sections of the system, the demand in gallons per minute for outlets at which demand is considered continuous, such as outlets for watering gardens, irrigating lawns, air conditioning apparatus, refrigeration machines, and similar equipment using water at a relatively continuous rate during **peak demand periods**. Add the continuous demand to the demand for intermittently used fixtures, and show the total demand at those sections where both types of demand occur. (See Section B.5.4.)

6. Size all individual fixture supply pipes to water outlets in accordance with the minimum sizes permitted by regulations. Minimum fixture supply pipe sizes for typical plumbing fixtures are given in Table B.5.2.

7. Size all other parts of the water supply system in accordance with velocity limitations recognized as good engineering practice, and with velocity limitations recommended by pipe manufacturers for avoiding accelerated deterioration and failure of their products under various conditions of service. (Sizing tables based on such velocity limitations and showing permissible loads in terms of water supply fixture units for each size and kind of piping material have been provided and may be applied in this step.) (See Section B.6.)

B.8 ILLUSTRATION OF SIMPLIFIED SIZING METHOD APPLICATION

B.8.1 Example

A three-story, nine-family multiple dwelling fronts on a public street and is supplied by direct street pressure from a public main in which the certified minimum pressure is 50 psi. The building has a full basement and three above-grade stories, each of which is 10’ in height from floor to floor. The first floor is 2’ above the curb level in front of the building. The public water main is located under the street: 5’ out from and 4’ below the curb.

On each of the above-grade stories there are three dwelling units. Each dwelling unit has a sink and dishwasher, tank-type water closet, lavatory, and bathtub/shower combination.
The basement contains two automatic clothes washing machines, two service sinks, and a restroom with a flush-tank water closet and lavatory.

Two lawn faucets are installed, one on the front of the building and one in the rear.
Hot water is to be supplied from a central storage-tank water heater.
The water supply to the building will be metered at the water service entry point to the building.
An isometric drawing of the water piping layout is shown in Figure B.8.1.

B.8.2 Solution

1. All information necessary to develop the design must be obtained from appropriate sources.

2. After the information is known, the isometric drawing (Figure B.8.1) is marked up with general water supply information, and the mains, risers, and branches are suitably identified.

3. The water supply fixture unit loads are marked on the drawing next to each section of the system. These values are obtained from Tables B.5.2 and B.5.3. Many designers use parentheses marks for WSFU to distinguish them from gpm values.

4. The maximum probable demand in gpm is marked on the drawing for each section next to the WSFU values. These values are obtained from Table B.5.4, using the columns for flush-tank systems.

5. Where sections of the piping serve more than one hose bibb, each additional hose bibb adds a demand of 1.0 WSFU to the piping. Wherever a section of piping serves a single hose bibb, it adds a demand of 2.5 WSFU.

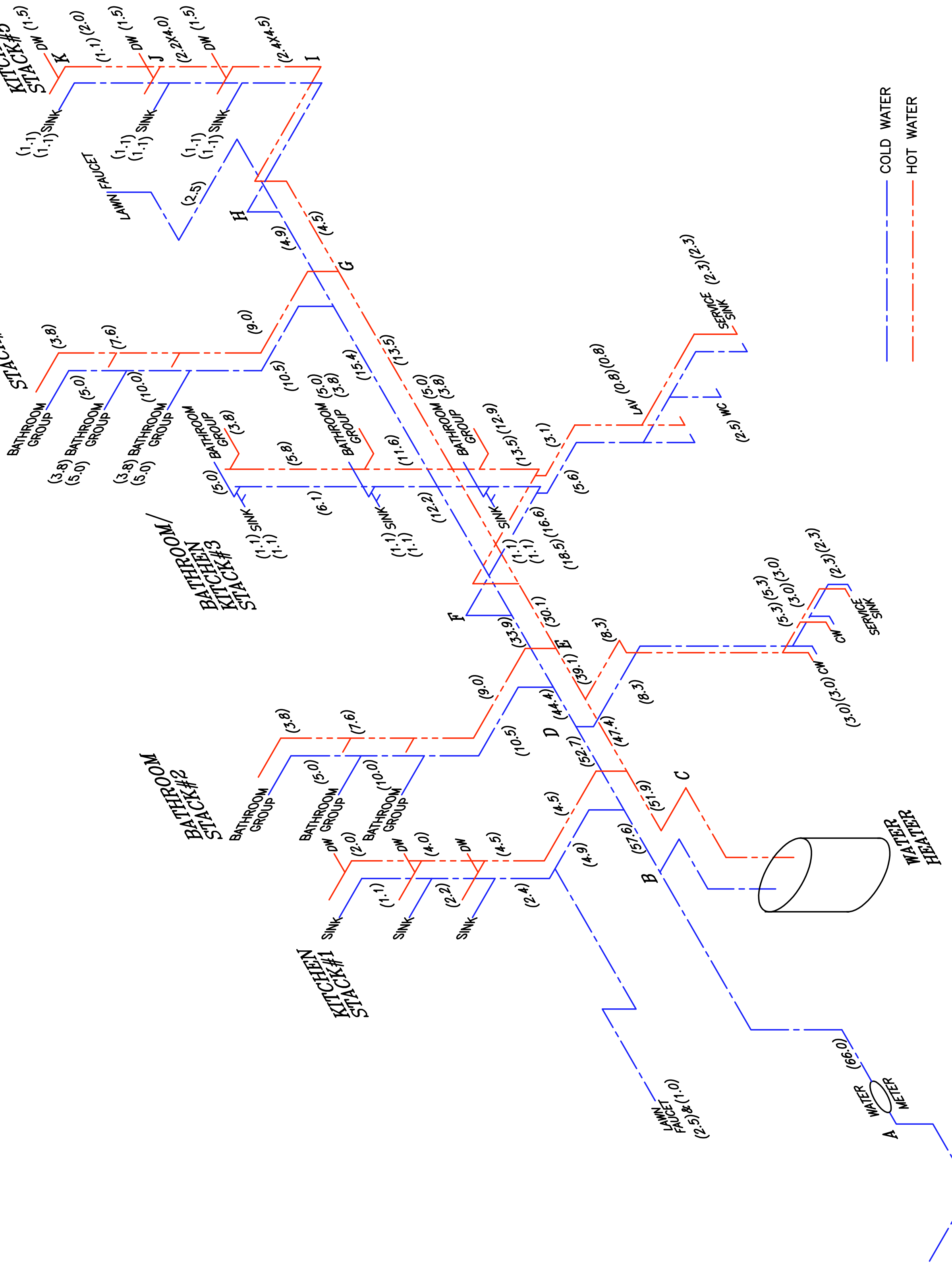


Figure B.8.1
WATER SUPPLY FIXTURE UNITS(WSFU)

DESIGN BASIS

DATA for Figure B.8.1 - WATER SUPPLY FIXTURE UNITS (WSFU)

PIPING
Copper water tube, Type L
wrought fittings and lead-free solder

PUBLIC WATER SUPPLY
10 inch main, 50 psig minimum pressure

WATER CHARACTERISTICS
No significant fouling or corrosive agents

ELEVATIONS

Curb as datum	10.0 ft
Water main	6.0 ft
Basement floor	2.0 ft
First floor	12.0 ft
Second floor	22.0 ft
Third floor	32.0 ft
Highest outlet @ "K"	35.0 ft

MINIMUM OUTLET PRESSURE
15 psig required

VELOCITY LIMITATIONS
8 fps
except 4 fps for branches with quick-closing valves
and 5 fps for hot water up to 140 deg F

LENGTH OF RUN TO FARTHEST OUTLET

Main - A	50 ft
A - B	12 ft
B - C	8 ft
C - D	10 ft
D - E	8 ft
E - F	8 ft
F - G	10 ft
G - H	4 ft
H - I	10 ft
I - J	10 ft
J - K	10 ft

Total = 140 ft plus fitting allowance

Hot water temperature is 140 deg F
controlled by water heater thermostat

WATER SUPPLY FIXTURE UNITS (WSFU)

Fixtures	Piping Serving Fixtures in 1 or 2 Dwellings			Piping Serving Fixtures in 3 or More Dwellings			Piping Serving Fixtures in Other than Dwelling Units		
	Total	Cold	Hot	Total	Cold	Hot	Total	Cold	Hot
Bathroom Group (1.6 GPF tank-type WC)	5.0	5.0	3.8	3.5	3.5	3.0			
Half Bath (1.6 GPF tank-type WC)	3.5	3.3	0.8	2.5	2.5	0.4			
Kitchen Group (sink & dishwasher)	2.0	1.1	2.0	1.5	0.8	1.5			
Clothes Washer							4.0	3.0	3.0
Service Sink							3.0	2.3	2.3
Hose Bibb							2.5	2.5	
Hose Bibb, each additional							1.0	1.0	

WATER SERVICE PIPE SIZING

Fixtures	Qty	WSFU	Total
Bathroom Groups (1.6 tank-type WC) (1)	9	3.5	31.5
Kitchen Groups (sink + dishwasher) (1)	9	1.5	13.5
Clothes Washers (2)	2	4.0	8.0
Service Sinks (2)	2	3.0	6.0
Half Bath (2)	1	3.5	3.5
Hose Bibb (2)	1	2.5	2.5
Hose Bibb (each additional) (2)	1	1.0	1.0
TOTAL WSFU			66.0
DEMAND (GPM)			34.8

(1) Fixtures in 3 or more dwellings

(2) Fixtures in other than dwelling units.

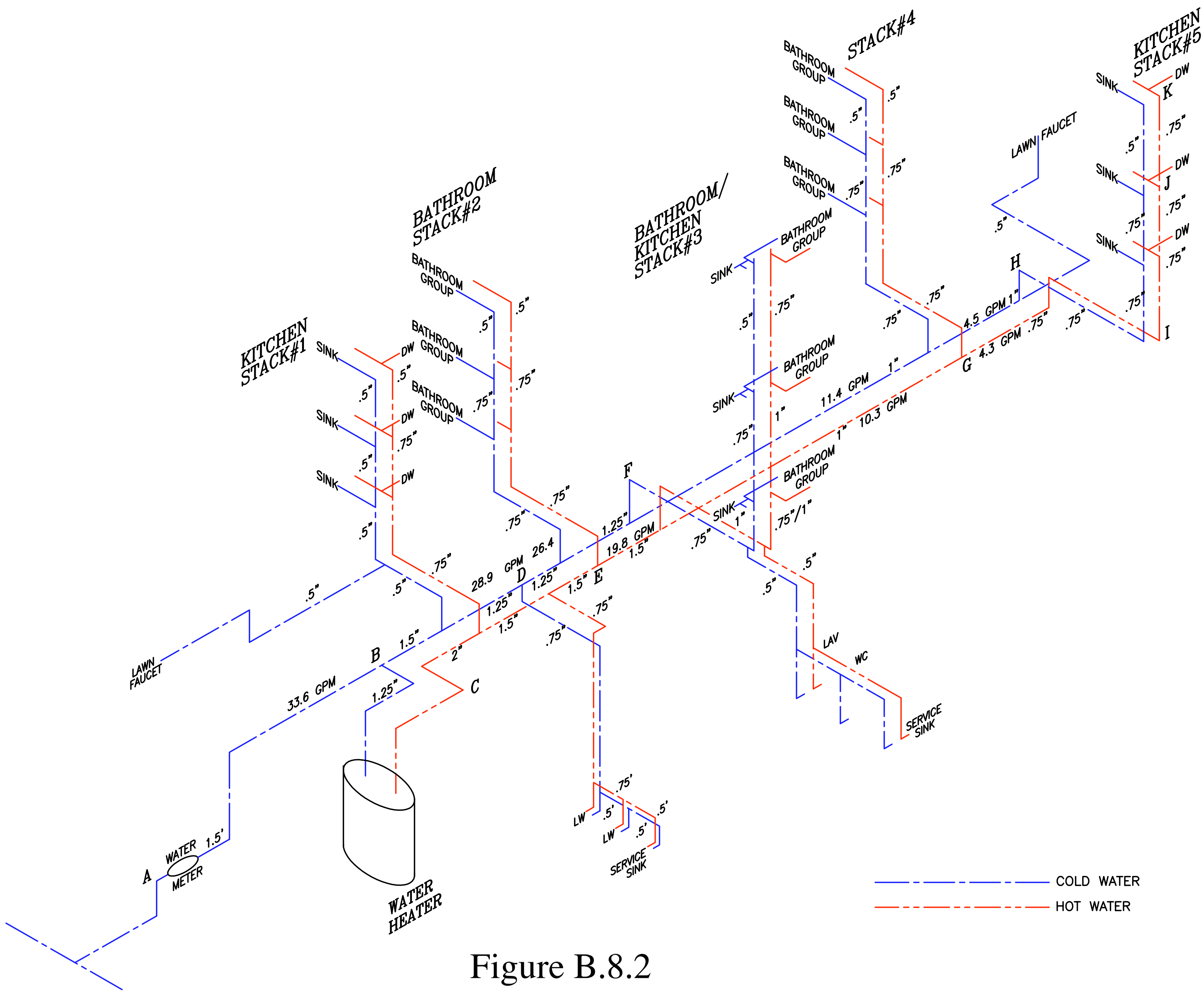


Figure B.8.2
DESIGN FLOW(GPM)AND PIPE SIZES

Table B.8.2
PRESSURE DROPS IN THE BASIC DESIGN CIRCUIT IN FIGURE B.8.2

COLD WATER FRICTION PRESSURE DROP FROM MAIN TO "K"							
SECTION	**WSFU** (1)	**FLOW (gpm)**	**LENGTH (feet)**	**PIPE SIZE**	**VELOCITY (feet/second)**	**PD (psi/100 ft)**	**PRESSURE DROP (psi)**
MAIN - A	66.0	34.8	50	1-1/2"	6.3	4.0	2.0
A - B	66.0	34.8	12	1-1/2"	6.3	4.0	0.5
B - C	57.6	32.0	8	1-1/2"	5.8	3.6	0.3
C - D	52.7	30.1	4	1-1/4"	7.7	8.0	0.3
D - E	44.4	26.8	8	1-1/4"	6.8	6.0	0.5
E - F	33.9	22.0	8	1-1/4"	5.6	4.0	0.3
F - G	15.4	11.4	10	1"	4.4	3.2	0.3
G - H	4.9	10.0 (6)	4	1" (4)	3.9	2.7	0.1
H - I	2.4	5.0 (7)	10	3/4" (4)	3.3	2.7	0.3
I - J	2.2 (2)	5.0 (7)	10	3/4" (4)	3.3	2.7	0.3
J - K	1.1 (2)	2.5 (8)	10	1/2" (4)	3.4	4.3	0.4
Total Pipe Pressure Drop (psig)							5.3
Fitting Allowance (50% of pipe loss, psig)							2.6
Total Pressure Drop Due to Pipe Friction (psig)							7.9

HOT WATER FRICTION PRESSURE DROP FROM MAIN TO "K"							
SECTION	**WSFU** (1)	**FLOW (gpm)**	**LENGTH (feet)**	**PIPE SIZE**	**VELOCITY (feet/second)**	**PD (psi/100 ft)**	**PRESSURE DROP (psi)**
MAIN - A	66.0	34.8	50	1-1/2"	6.3	4.0	2.0
A - B	66.0	34.8	12	1-1/2"	6.3	4.0	0.5
B - HWH	51.9	29.8	4	1-1/4"	7.6	7.5	0.3
HWH - C	51.9	29.8	4	2" (5)	3.1	0.8	0.0
C - D	47.4	28.0	10	1-1/2" (5)	5.0	2.7	0.3
D - E	39.1	24.6	8	1-1/2" (5)	4.4	2.1	0.2
E - F	30.1	20.1	8	1-1/2" (5)	3.6	1.6	0.1
F - G	13.5	10.3	10	1" (5)	4.0	3.0	0.3
G - H	4.5	4.3	4	3/4" (4)	2.9	2.1	0.1
H - I	4.5	4.3	10	3/4" (4)	2.9	2.1	0.2
I - J	4.0 (2)	4.0	10	3/4" (4)	2.7	1.8	0.2
J - K	2.0 (2)	4.0 (3)	10	3/4" (4)	2.7	1.8	0.2
Total Pipe Pressure Drop (psig)							4.3
Fitting Allowance (50% of pipe loss, psig)							2.2
Total Pressure Drop Due to Pipe Friction (psig)							6.5

NOTES FOR PRESSURE DROP CALCULATIONS

(1) Water supply fixture units (WSFU) are for sections of piping serving 3 or more dwelling units except as noted by (2).
(2) Water supply fixture units (WSFU) are for sections of piping serving fixtures in less than 3 dwelling units.
(3) Water flow (gpm) for the dishwasher.
(4) Velocity limited to 4 fps because of dishwashers and quick-closing sink faucets.
(5) Velocity in copper tube with 140 deg F domestic hot water is limited to 5 fps using Chart B.9.8.3.
(6) Allowance of 5 gpm for the hose bibb and two sinks at 2.5 gpm each.
(7) Allowance for two sinks at 2.5 gpm each.
(8) Allowance for one sink at 2.5 gpm.

SUMMARY OF PRESSURE DROP CALCULATIONS

Minimum pressure in water main = 50.0 psig.
Water meter pressure drop = 3.0 psig
Total cold water friction pressure drop from water main to "K" = 7.9 psig
Total hot water friction pressure drop from water main to "K" = 6.5 psig
Elevation pressure drop = (35 ft - 6 ft)(0.433) = 12.6 psig
Cold water pressure available at "K" = 50 - 3 - 7.9 -12.6 = 26.5 psig
Minimum required water pressure at "K" = 15 psig
Therefore, the pipe sizing is satisfactory.

If this calculation had shown that the pressure drop was excessive at "K", it would be necessary to examine the design for sections of the Basic Design Circuit that had the highest pressure drops and then increasse those segment pipe sizes.

6. All individual fixture supply pipes to water outlets are sized in Figure B.8.1 in accordance with the minimum sizes shown in Table B.5.2.

7. All other parts of the system are sized in accordance with the velocity or pressure limitations established for this system as the basis of design. Piping is sized in accordance with the maximum probable demand for each section of the system. Sizing is done using Table B.7.3A through Table B.7.3H, and specifically the tables dealing with Copper Water Tube, Type K for sizing the water service pipe; and with Copper Water Tube, Type L, for sizing piping inside the building since these are the materials of choice as given in the general information on the drawing.

B.8.3 Supplementary Check of Friction Loss in Main Lines and Risers

A supplementary check of the total friction loss in the main lines and risers is made for the longest run of piping from the public water outlet to be sure that the sizes determined were adequate. This run has been shown in heavy lines with letters noted at various points.

The sum of all friction losses due to flow through pipe, valves, and fittings is found to be 17.9 psi, whereas the amount of excess pressure available for such friction loss is 19.4 psi. Thus, the sizes determined on the basis of velocity limitations exclusively are proven adequate. Checking of friction loss in this case is performed following steps 8 through 15 of the Detailed Sizing Method for Building of Any Height presented in Section B.10. The calculations are shown on Figure B.8.2.

B.8.4 Application to Systems in High Buildings

This method of sizing, based upon the velocity limitations that should be observed in design of building water supply systems, has much broader application than just to systems in one-, two-, and three-story buildings where ample excess pressure is available at the source of supply. These velocity limitations should be observed in all building water supply systems. Thus, the sizes determined by this method are the minimum sizes recommended for use in any case. Where pipe friction is an additional factor to be considered in design, larger sizes may be required.

B.9 LIMITATION OF FRICTION

B.9.1 Basic Criterion

The design of a building water supply system must be such that the highest water outlets will have available, during periods of peak demand, at least the minimum pressure required at such outlets for satisfactory water supply conditions at the fixture or equipment.

B.9.2 Maximum Permissible Friction Loss

The maximum allowable pressure loss due to friction in the water lines and risers to the highest water outlets is the amount of excess static pressure available above the minimum pressure required at such outlets when no-flow conditions exist. This may be calculated as the difference between the static pressure existing at the highest water outlets during no-flow conditions, and the minimum pressure required at such outlets for satisfactory supply conditions.

Where water is supplied by direct pressure from a public main, to calculate the static pressure at the highest outlet, deduct from the certified minimum pressure available in the public main the amount of static pressure loss corresponding to the height at which the outlet is located above the public main (i.e., deduct 0.433 psi pressure for each foot of rise in elevation from the public main to the highest outlet).

Where supplied under pressure from a gravity water supply tank located at an elevation above the highest water outlet, the static pressure at that outlet is calculated as being equal to 0.433 psi pressure for each foot of difference in elevation between the outlet and the water level in the tank. In this case, the minimum static pressure at the outlet should be determined as that corresponding to the level of the lowest water level at which the tank is intended to operate.

B.9.3 Basic Design Circuit

Of all the water outlets on a system, the one at which the least available pressure will prevail during periods of peak demand is the critical outlet that controls the design. Normally, it is the highest outlet that is supplied through the longest run of piping extending from the source of supply.

This circuit is called the Basic Design Circuit (BDC) for sizing the main water lines and risers.

In most systems, the BDC will be found to be the run of cold water supply piping extending from the source of supply to the domestic hot water vessel plus the run of hot water supply piping extending to the highest and most remote hot water outlet on the system. However, in systems supplied directly from the public main and having flushometer-valve water closets at the topmost floor, the BDC may be found to be the run of cold water supply piping extending from the public main to the highest and most remote flushometer valve on the system.

B.9.4 Friction Loss in Equipment

Where a water meter, water filter, water softener, fish trap or strainer, or instantaneous or tankless water heating coil is provided in the BDC, the friction loss corresponding to the maximum probable demand through such equipment must be determined and included in pressure loss calculations. Manufacturers’ charts and data sheets on their products provide such information generally, and should be used as a guide in selecting the best type and size of equipment to use with consideration for the limit to which pressure loss due to friction may be permitted to occur in the BDC. The rated pressure loss through such equipment should be deducted from the friction loss limit to establish the amount of pressure that is available to be dissipated by friction in pipe, valves, and fittings of the BDC.

B.9.5 Estimating Pressure Loss in Displacement Type Cold-Water Meters

The American Water Works Association standard for cold-water meters of the displacement type is designated AWWA C 700-64. It covers displacement meters known as nutating- or oscillating-piston or disc meters, which are practically positive in action. The standard establishes maximum capacity or delivery classification for each meter size as follows:

5/8"	20 gpm
3/4"	30 gpm
1"	50 gpm
1-1/2"	100 gpm
2"	160 gpm
3"	300 gpm

Also, the standard establishes the maximum pressure loss corresponding to these maximum capacities as follows:

15 psi for the 5/8", 3/4" and 1" meter sizes
20 psi for the 1-1/2", 2", 3", 4" and 6" sizes.

B.9.6 Uniform Pipe Friction Loss

To facilitate calculation of appropriate pipe sizes corresponding to the permissible friction loss in pipe, valves, and fittings, it is recommended that the BDC be designed in accordance with the principle of uniform pipe friction loss throughout its length. In this way, the friction limit for the piping run may be established in terms of pounds per square inch per 100 feet of piping length. The permissible uniform pipe friction loss in psi/100' is calculated by dividing the permissible friction loss in pipe, valves, and fittings by the total equivalent length of the basic design circuit, and multiplying by 100.

B.9.7 Equivalent Length of Piping

The total equivalent length of piping is its developed length plus the equivalent pipe length corresponding to the frictional resistance of all fittings and valves in the piping. When size of fittings are known, or has been established in accordance with sizes based upon appropriate limitation of velocity, corresponding equivalent lengths may be determined directly from available tables. Five such tables are included herein for various piping materials. See Tables B.9.7.A through B.9.7.E.

As a general finding, it has been shown by experience that the equivalent length to be allowed for fittings and valves as a result of such calculations is approximately fifty percent of the developed length of the BDC in the case of copper water tube systems, and approximately seventy-five percent for standard threaded pipe systems.

B.9.8 Determination of Flow Rates Corresponding to Uniform Pipe Friction Loss

Flow rates corresponding to any given uniform pipe friction loss may be determined readily for each nominal size of the kind of pipe selected for the system. Pipe friction charts[1] are presented herewith for each of the standard piping materials used for water supply systems in buildings. The appropriate chart to apply in any given case depends upon the kind of piping to be used and the effect the water to be conveyed will produce within the piping after extended service.

These charts are based on piping in average service. If piping is used in adverse service or in retrofit applications, conservative practice suggests selecting lower flow rates for a given pipe, or larger pipe for a given required flow rate.

For new work, with the range of materials now available, select a piping material that will not be affected by the water characteristics at the site.

Table B.9.7.A
EQUIVALENT LENGTH OF PIPE FOR FRICTION LOSS IN THREADED FITTINGS & VALVES

Fitting or Valve	Equivalent Feet of Pipe for Various Pipe Sizes									
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	5"	6"
45 deg Elbow	0.8	1.1	1.4	1.8	2.2	2.8	3.3	4.1	5.4	6.7	8.1
90 deg Elbow, std	1.6	2.1	2.6	3.5	4.0	5.2	6.2	7.7	10.1	12.6	15.2
Tee, run	1.0	1.4	1.8	2.3	2.7	3.5	4.1	5.1	6.7	8.4	10.1
Tee, Branch	3.1	4.1	5.3	6.9	8.1	10.3	12.3	15.3	20.1	25.2	30.3
Gate Valve	0.4	0.6	0.7	0.9	1.1	1.4	1.7	2.0	2.7	3.4	4.0
Globe Valve	17.6	23.3	29.7	39.1	45.6	58.6	70.0	86.9	114	143	172
Angle Valve	7.8	10.3	13.1	17.3	20.1	25.8	30.9	38.4	50.3	63.1	75.8
Butterfly Valve						7.8	9.3	11.5	15.1	18.9	22.7
Swing Check Valve	5.2	6.9	8.7	11.5	13.4	17.2	20.6	25.5	33.6	42.1	50.5

NOTES FOR TABLE B.9.7.A
1) Equivalent lengths for valves are based on the valves being wide open.

Table B.9.7.B EQUIVALENT LENGTH OF PIPE FOR FRICTION LOSS IN COPPER TUBE FITTINGS &VALVES											
Fitting or Valve	Equivalent Feet of Pipe for Various Tube Sizes										
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	5"	6"
45 deg Elbow	0.5	0.5	1.0	1.0	1.5	2.0	2.5	3.5	5.0	6.0	7.0
90 deg Elbow, std	1.0	2.0	2.5	3.0	4.0	5.5	7.0	9.0	12.5	16.0	19.0
Tee, run	0.0	0.0	0.0	0.5	0.5	0.5	0.5	1.0	1.0	1.5	2.0
Tee, Branch	2.0	3.0	4.5	5.5	7.0	9.0	12.0	15.0	21.0	27.0	34.0
Gate Valve	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.5	2.0	3.0	3.5
Globe Valve	17.6	23.3	29.7	39.1	45.6	58.6	70.0	86.9	114.0	143.0	172.0
Angle Valve	0.0	0.0	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0
Butterfly Valve	7.8	10.3	13.1	17.3	20.1	25.8	30.9	38.4	50.3	63.1	75.8
Swing Check Valve						7.5	10.0	15.5	16.0	11.5	13.5
Fitting or Valve	2.0	3.0	4.5	5.5	6.5	9.0	11.5	14.5	18.5	23.5	26.5

NOTES FOR TABLE B.9.7.B
1) Equivalent lengths for valves are based on the valves being wide open.
2) Data based in part on the 2004 Copper Tube Handbook by the Copper Development Association.

Table B.9.7.C EQUIVALENT LENGTH OF PIPE FOR FRICTION LOSS IN SCHEDULE 40 CPVC FITTINGS											
Fitting	Equivalent Feet of Pipe for Various Pipe Sizes										
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	5"	6"
45 deg Elbow	0.8	1.1	1.4	1.8	2.1	2.7	3.3	4.1	5.3	6.7	8.0
90 deg Elbow	1.5	2.0	2.6	3.4	4.0	5.1	6.1	7.6	10.0	12.5	15.1
Tee, Run	1.0	1.4	1.7	2.3	2.7	3.4	4.1	5.1	6.7	8.4	10.1
Tee, Branch	3.0	4.1	5.2	6.8	8.0	10.2	12.2	15.2	20.0	25.1	30.2

Table B.9.7.D EQUIVALENT LENGTH OF PIPE FOR FRICTION LOSS IN SCHEDULE 80 CPVC FITTINGS											
Fitting	Equivalent Feet of Pipe for Various Pipe Sizes										
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	5"	6"
45 deg Elbow	0.7	1.0	1.2	1.7	2.0	2.6	3.1	3.8	5.0	6.4	7.6
90 deg Elbow	1.3	1.8	2.3	3.1	3.7	4.8	5.7	7.2	9.5	11.9	14.3
Tee, Run	0.9	1.2	1.6	2.1	2.5	3.2	3.8	4.8	6.3	7.9	9.5
Tee, Branch	2.6	3.6	4.7	6.3	7.4	9.6	11.5	14.3	18.9	23.8	28.5

Table B.9.7.E EQUIVALENT LENGTH OF PIPE FOR FRICTION LOSS IN CPVC SDR 11 CTS TUBING FITTINGS						
Fitting	Equivalent Feet of Pipe for Various Pipe Sizes					
	1/2" CTS	3/4" CTS	1" CTS	1-1/4" CTS	1-1/2" CTS	2" CTS
45 deg Elbow	0.8	1.1	1.4	1.8	2.2	2.8
90 deg Elbow	1.6	2.1	2.6	3.5	4.0	5.2
Tee, Run	1.0	1.4	1.8	2.3	2.7	3.5
Tee, Branch	3.1	4.1	5.3	6.9	8.1	10.3

B.10 DETAILED SIZING METHOD FOR SYSTEMS IN BUILDINGS OF ANY HEIGHT

For sizing water supply systems in buildings of any height, a detailed method may be applied in the design of modern buildings. The procedure consists of sixteen steps, as follows:

1. Obtain all information necessary for sizing the system. Such information shall be obtained from responsible parties and appropriate local authorities recognized as sources of the necessary information. (See Section B.2.)

2. Provide a schematic elevation of the complete water supply system. Show all piping connections in proper sequence and all fixture supplies. Identify all fixtures and risers by means of appropriate letters, numbers, or combinations thereof. Identify all piping conveying water at a temperature above 150°F, and all branch piping to such water outlets as solenoid valves, pneumatic valves, or quick-closing valves or faucets. Provide on the schematic elevation all the general information obtained per Step 1. (See Section B.2.9.)

3. Mark on the schematic elevation, for each section of the complete system, the hot and cold water loads served in terms of water supply fixture units in accordance with Table B.5.2.

4. Mark on the schematic elevation, adjacent to all fixture unit notations, the probable maximum demand in gallons per minute corresponding to the various fixture unit loads in accordance with Table B.5.4.

5. Mark on the schematic elevation, for appropriate sections of the system, the demand in gallons per minute for outlets at which demand is considered continuous, such as outlets for watering gardens, irrigating lawns, air-conditioning apparatus, refrigeration machines, and similar equipment. Add the continuous demand to the demand for intermittently used fixtures, and show the total demand at those sections where both types of demand occur. (See Section B.5.4.)

6. Size all individual fixture supply pipes to water outlets in accordance with the minimum sizes permitted by regulations. Minimum fixture supply pipe sizes for typical plumbing are given in Table B.5.2.

7. Size all other parts of the water supply system in accordance with velocity limitations recognized as good engineering practice, and with velocity limitations recommended by pipe manufacturers for avoiding accelerated deterioration and failure of their products under various conditions of service. Sizing tables based on such velocity limitations and showing permissible loads in terms of water supply fixture units for each size and kind of piping material have been provided and may be applied as a convenient and simplified method of sizing in this step. (See Section B.6)

Note: These sizes are tentative until verified in Steps 12, 13, 14, 15.

8. Assuming conditions of no-flow in the system, calculate the amount of pressure available at the topmost fixture in excess of the minimum pressure required at such fixtures for satisfactory supply conditions. This excess pressure is the limit for friction losses for peak demand in the system (1' of water column = 0.433 psi pressure). (See Section B.9.2.)

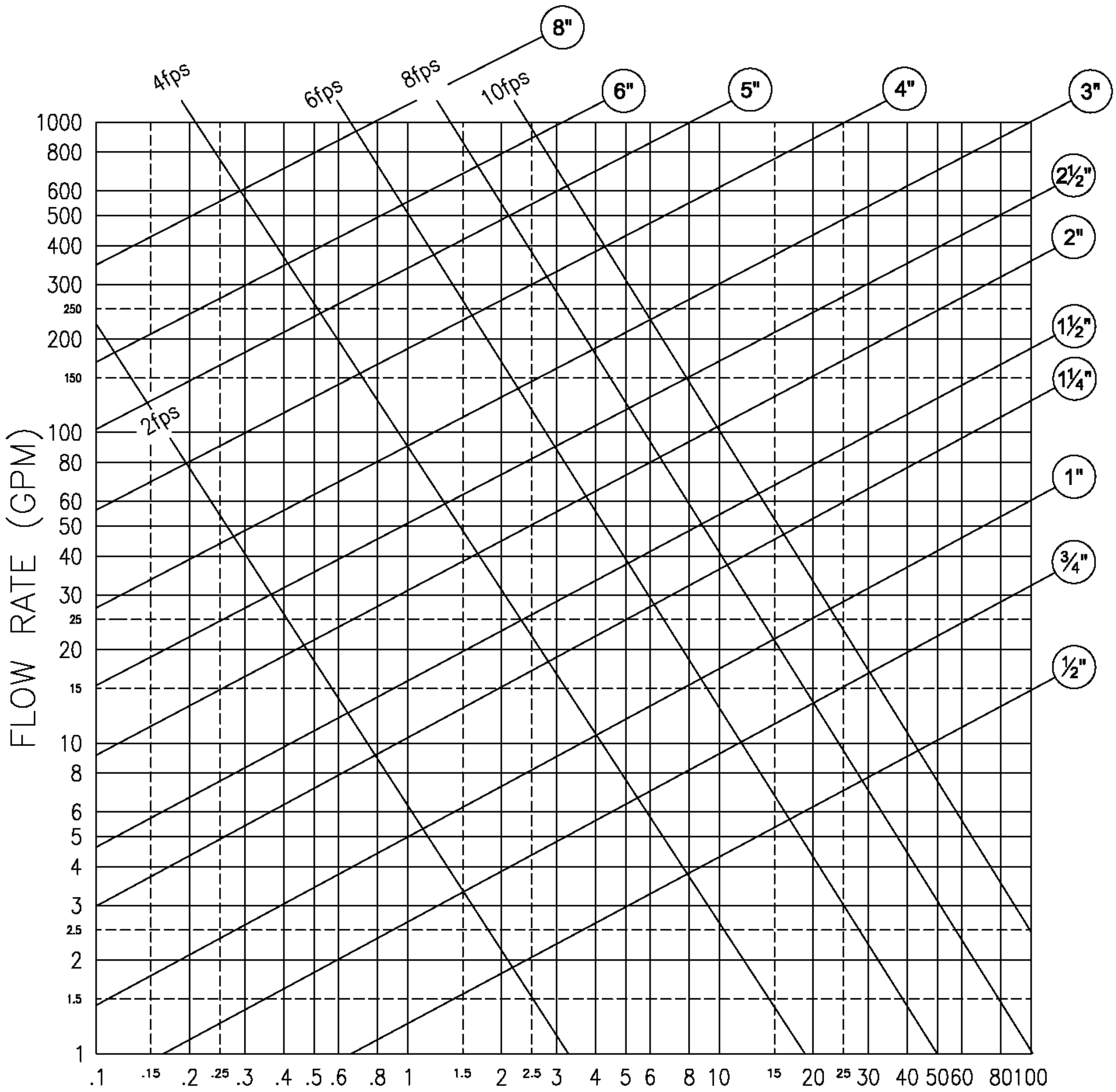
9. Determine which piping circuit of the system is the basic one for which pipe sizes in main lines and riser should be designed in accordance with friction loss limits. This circuit is the most extreme run of piping through which water flows from the public main, or other source of supply, to the highest and most distant water outlet. This basic design circuit (BDC) should be specifically identified on the schematic elevation of the system. (See Section B.9.3.)

10. Mark on the schematic elevation the pressure loss due to friction corresponding to the maximum probable demand through any water meter, water softener, or instantaneous or tankless water heating coil that may be provided in the BDC. (See Sections B.9.4 and B.9.5.)

11. Calculate the amount of pressure remaining and available for dissipation as friction loss during peak demand through pipe, valves, and fittings in the BDC. Deduct from the excess static pressure available at the topmost fixtures (determined in Step 8), the friction losses for any water meters, softeners, and water heating coils provided in the BDC determined in Step 10. (See Section B.9.4.)

12. Calculate the total equivalent length of the BDC. Pipe sizes established on the basis of velocity limitation in Step 7 for main lines and risers must be considered just tentative at this stage, but may be deemed appropriate for determining corresponding equivalent lengths of fittings and valves in this step. (See Section B.9.7.)

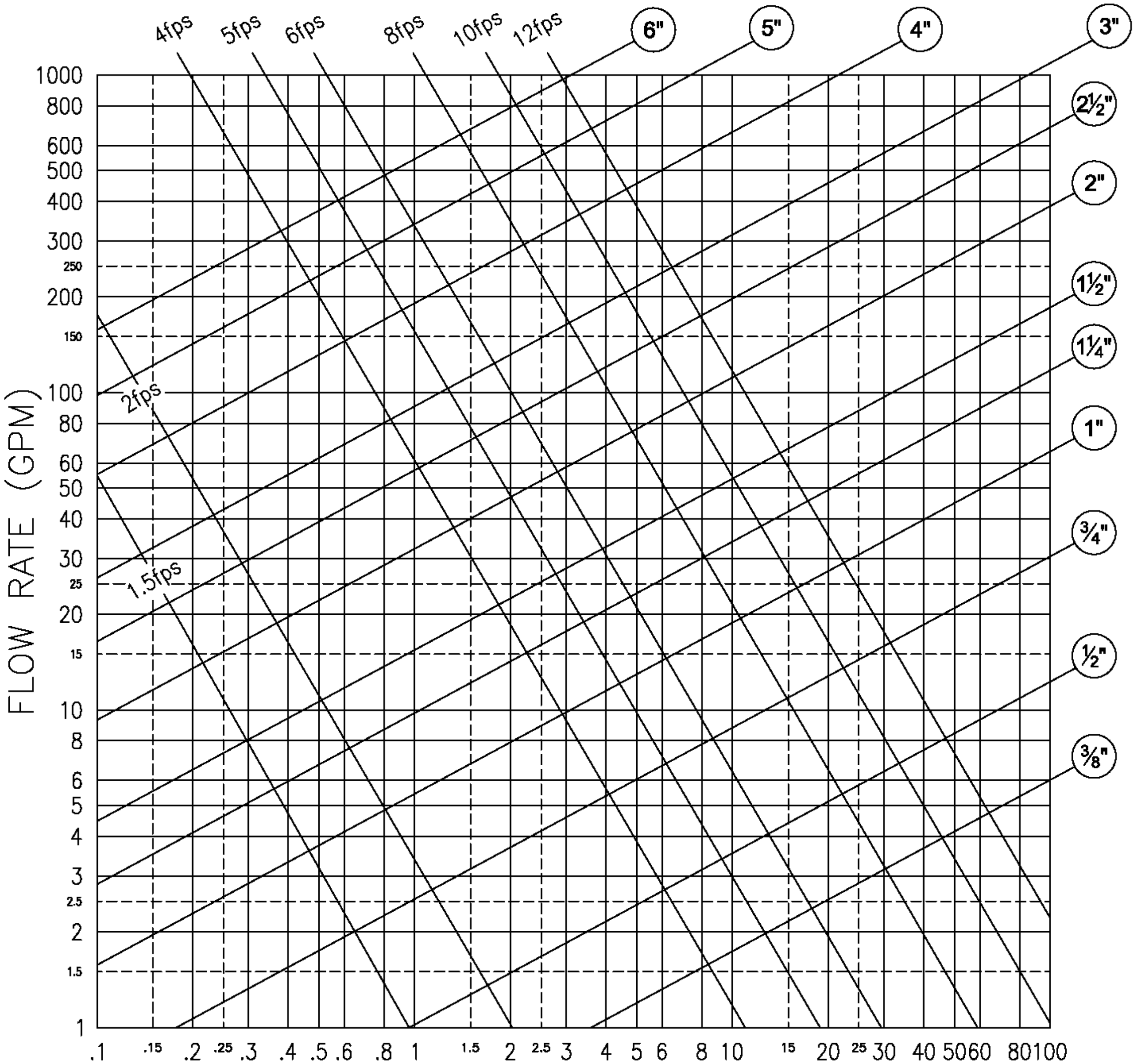
GALVANIZED STEEL
ASTM A53



PRESSURE DROP (psi/100')

FLOW VS. PRESSURE DROP
CHART B.9.8.1

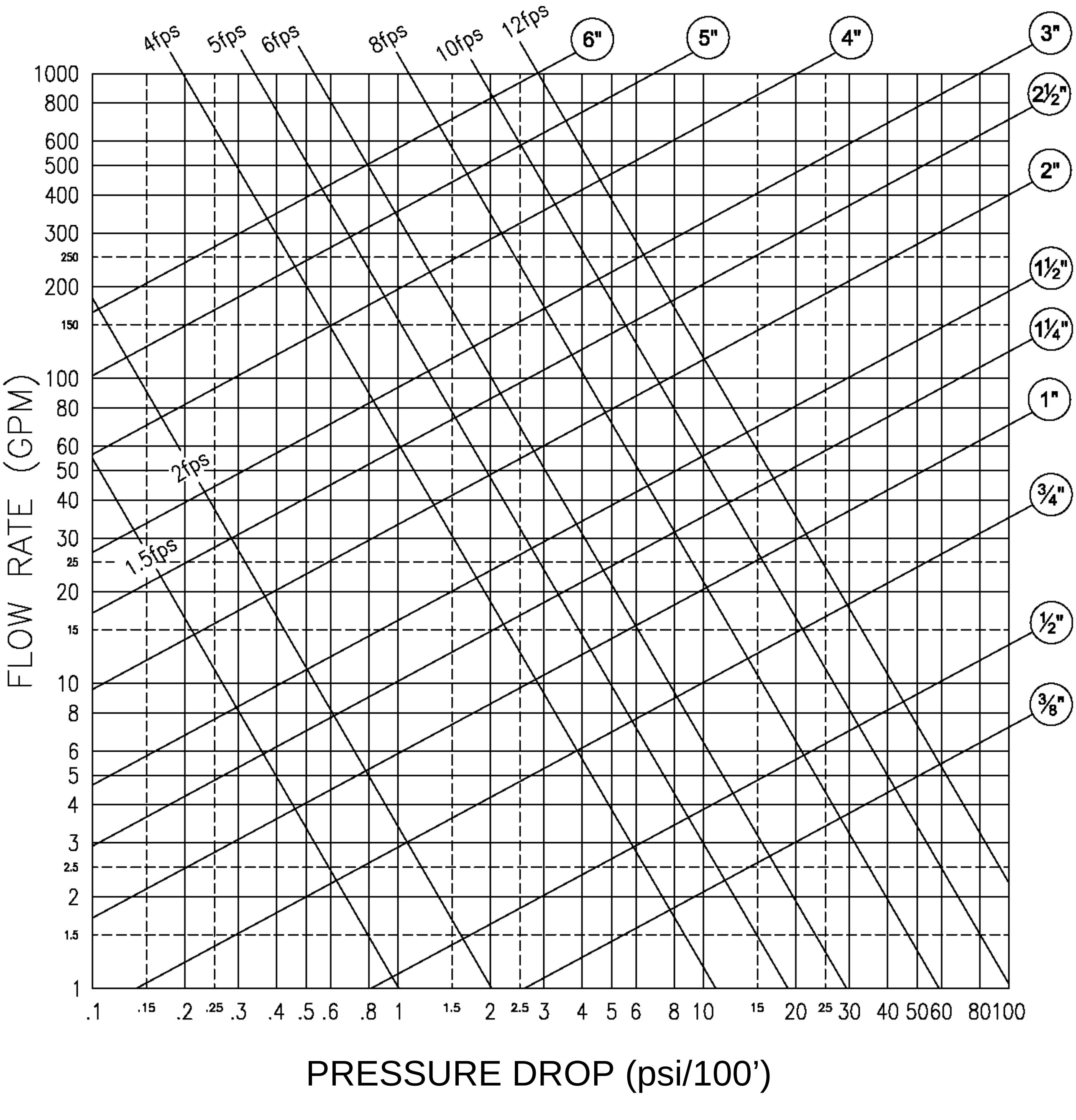
TYPE K
COPPER TUBE



PRESSURE DROP (psi/100')

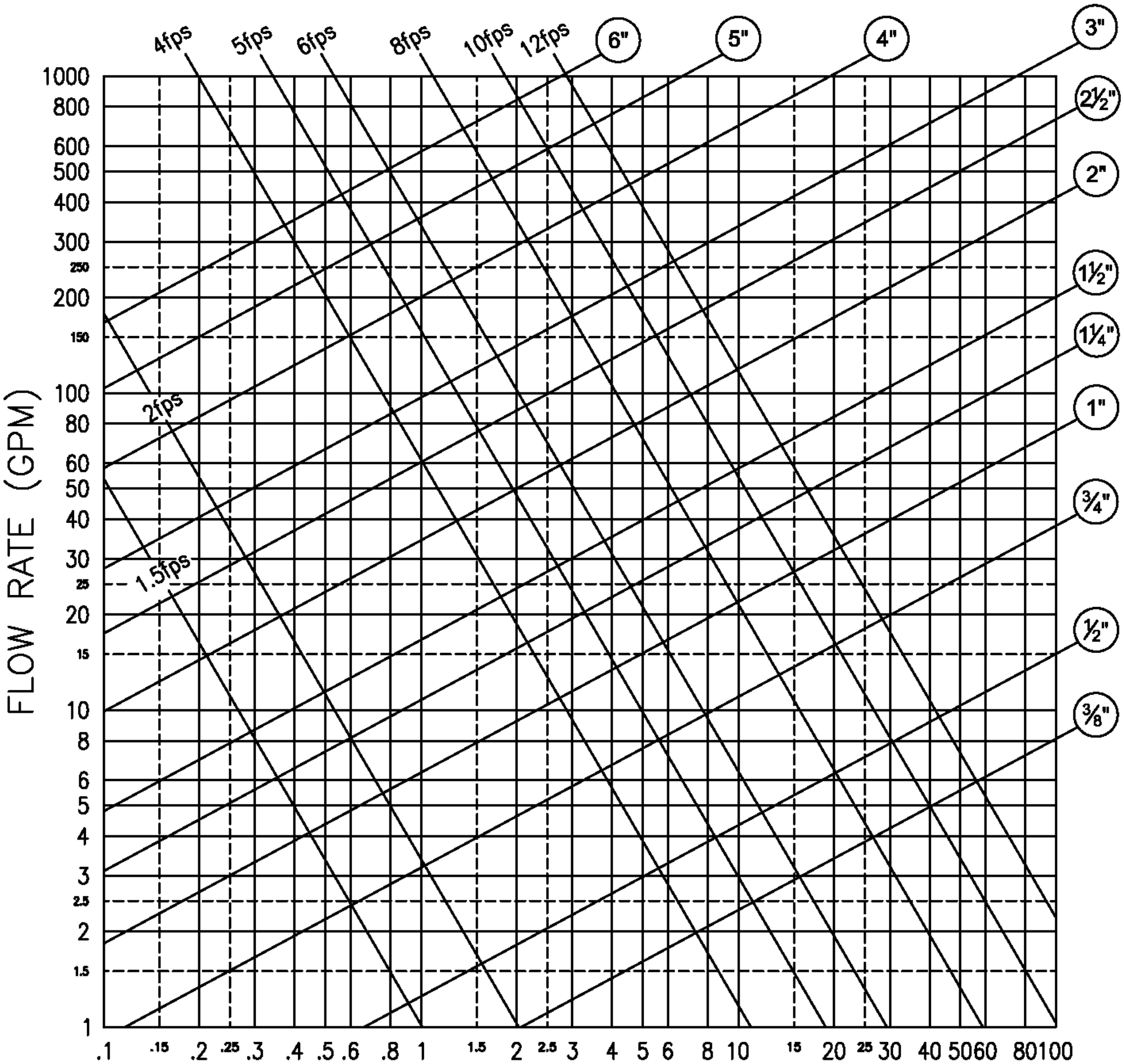
FLOW VS. PRESSURE DROP
CHART B.9.8.2

TYPE L
COPPER TUBE



FLOW VS. PRESSURE DROP
CHART B.9.8.3

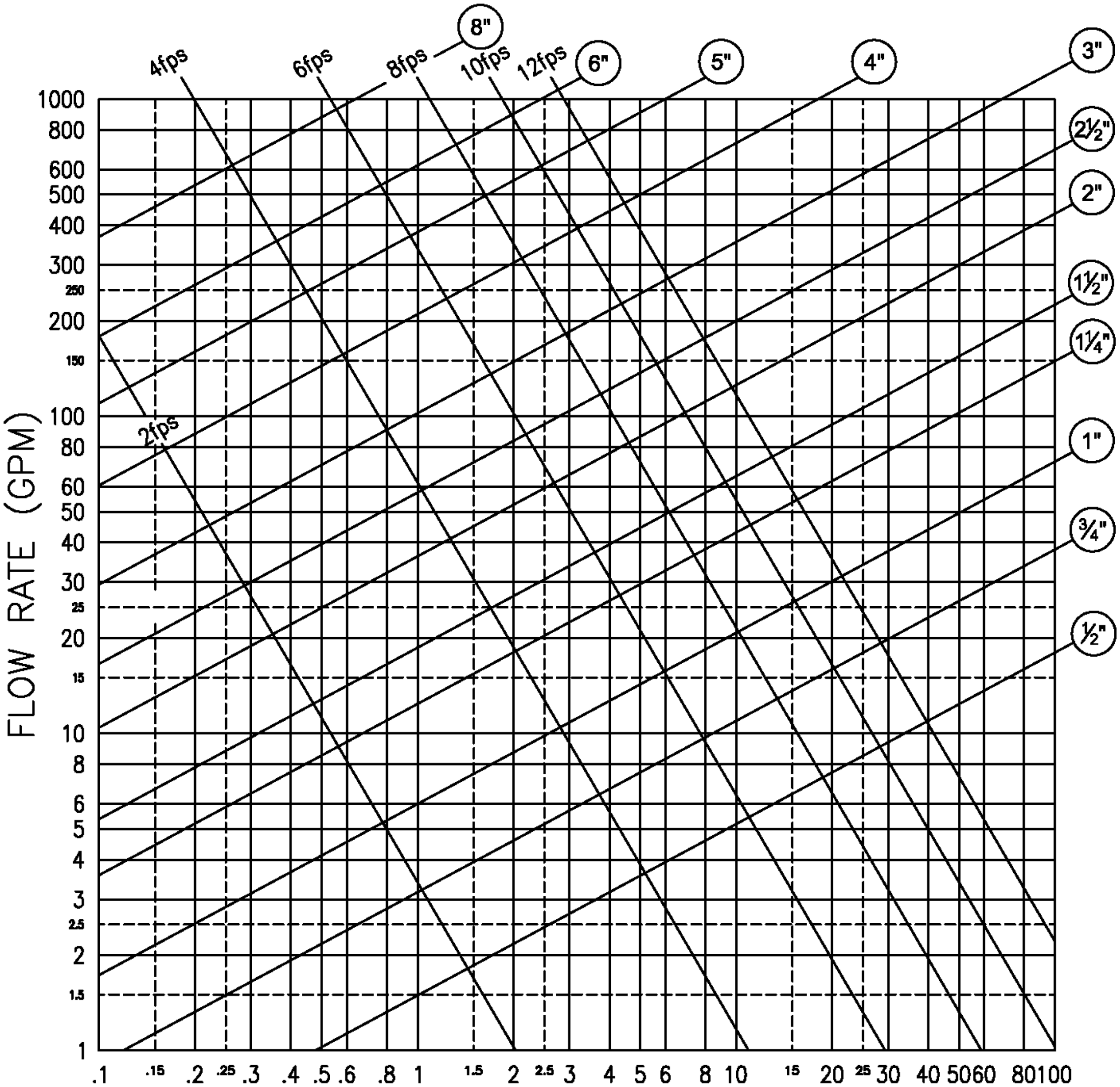
TYPE M
COPPER TUBE



PRESSURE DROP (psi/100')

FLOW VS. PRESSURE DROP
CHART B.9.8.4

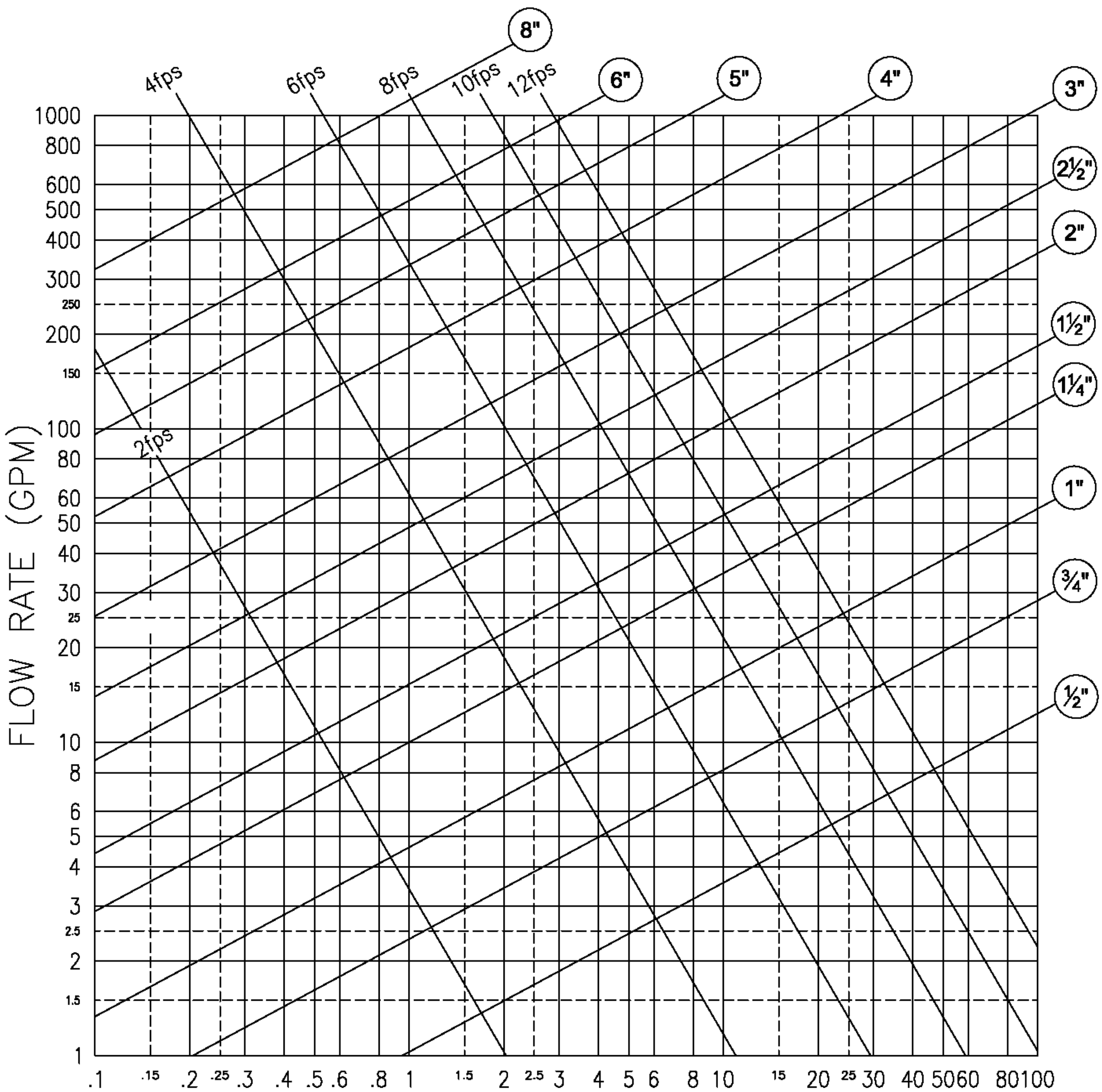
CPVC / PVC / ABS
SCHEDULE 40 PIPE



PRESSURE DROP (psi/100')

FLOW VS. PRESSURE DROP
CHART B.9.8.5

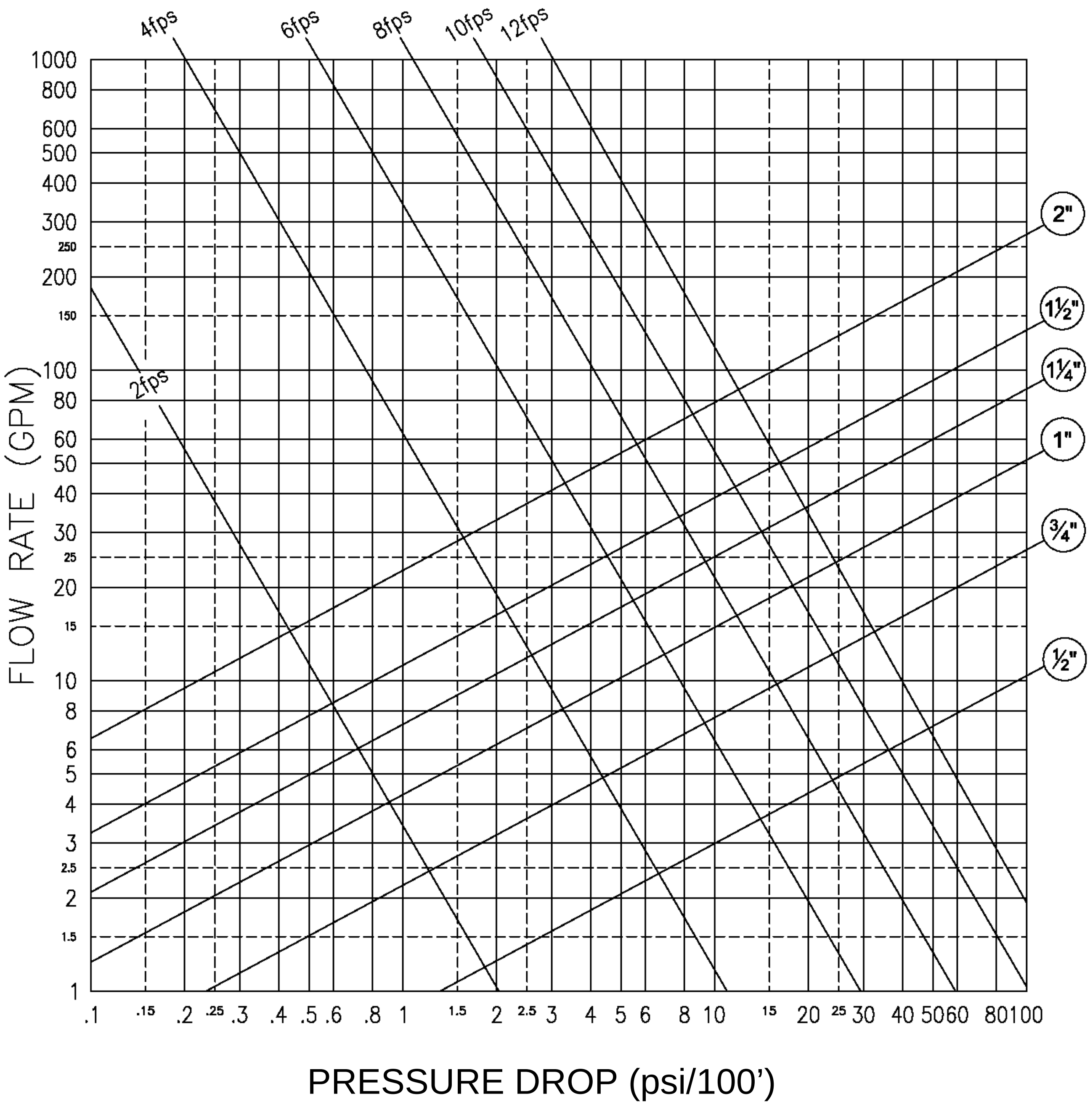
CPVC / PVC / ABS
SCHEDULE 80 PIPE



PRESSURE DROP (psi/100')

FLOW VS. PRESSURE DROP
CHART B.9.8.6

CPV TUBING
COPPER TUBE SIZE - SDR 11



FLOW VS. PRESSURE DROP
CHART B.9.8.7

13. Calculate the permissible uniform pressure loss for friction in piping of the BDC. The amount of pressure available in the circuit for dissipation as friction loss due to pipe, fittings, and valves (determined in Step 11), is divided by the total equivalent length of the circuit (determined in Step 12). This establishes the pipe friction limit for the circuit in terms of pressure loss in psi per foot of total equivalent pipe length. Multiply this value by 100 in order to express the pipe friction limit in terms of psi per 100 feet of length. (See Section B.9.6.)

14. Set up a sizing table showing the rates of flow for various sizes of the kind of piping to be used, corresponding to the permissible uniform pressure loss for pipe friction calculated for the BDC (determined in Step 13). Such rates may be determined from a pipe friction chart appropriate for the piping to be used and for the effects upon the piping of the quality of the water to be conveyed thereby for extended service. (See Sections B.9.8 and B.2.3.)

15. Check the sizes of all parts of the BDC, and all other main lines and risers that supply water upward to the highest water outlets on the system, in accordance with the sizing table set up in Step 14. Where sizes determined in this step are larger than those previously established in Step 7 (based on velocity limitation), the increased size is applicable for limitation of friction.

16. Due consideration must be given to the action of the water on the interior of the piping, and proper allowance must be made where necessary as a design consideration, such as, where the kind of piping selected and the characteristics of the water conveyed are such that an appreciable buildup of corrosion products or hard-water scale may be anticipated to cause a significant reduction in bore of the piping system and inadequate capacity for satisfactory supply conditions during the normal service life of the system. A reasonable allowance in such cases is to select at least one standard pipe size larger than the sizes determined in the preceding steps. Where the water supply is treated in such manner as to avoid buildup of corrosion products or hard-water scale, no allowance need be made in sizing piping conveying such treated water. (See Sections B.2.3 and B.9.8.)

B.11 ILLUSTRATION OF DETAILED SIZING METHOD APPLICATION

B.11.1 Example

A seven-story building is supplied by direct street pressure from a public water main in which the minimum available pressure is 60 psi. The highest fixture supplied is 64'-8" above the public main, and requires 12 psi flow pressure at the fixture for satisfactory supply conditions.

The water supply is to be metered by a meter through which flow at the maximum probable demand rate will produce a pressure drop of 5.6 psi. Copper tubing, Type L, is to be used for the entire system. Quality of the water supply is known to be noncorrosive to copper tubing in the water district, and is recognized as being non-scaling in characteristic.

The entire system has been initially sized in accordance with the simplified method based solely on velocity limitations. Applying these sizes, the total equivalent length of piping from the public main to the highest and most remote fixture outlet has been calculated to be 600'.

B.11.2 Solution

Steps 1-7. The first seven steps of the details sizing method have already been performed. These steps constitute the simplified sizing method based solely on velocity limitations established as the design basis. All that remains is to perform steps 8 through 15 of the detailed sizing method that relate to sizing in accordance with the frictional limitation that must be observed for this particular system, and with allowances that may be necessary in view of the water characteristics.

Step 8. Assuming conditions of no-flow in the system, the amount of excess pressure available at the topmost fixture in excess of the minimum required at the fixture for satisfactory supply conditions is determined as follows:

Excess pressure available = 60 psi - 12 psi - (64.67 x 0.4333 psi/ft) = 20 psi

Step 9. The BDC should be specifically identified on the schematic elevation provided as per step 2.

Step 10. The pressure loss through the water meter selected for this system for flow at maximum probable demand is given in the example as being 5.6 psi. No other items of equipment through which significant friction losses may occur have been noted in the example.

Step 11. The amount of pressure remaining for dissipation as friction loss during peak demand through pipes, valves, and fittings in the basic design circuit is determined as follows:

Pressure available for friction in piping = 20 psi - 5.6 psi = 14.4 psi

Step 12. The total equivalent length of the basic design circuit has been given in the example as being 600 feet, based on the sizes determined in accordance with velocity limitations as per step 7.

Step 13. The permissible uniform pressure loss for friction in piping of the basic design circuit is determined as follows:

Permissible uniform pipe friction loss = 14.4 psi x (100 ft/600 ft)

= 2.4 psi per 100 ft pipe length

Step 14. A sizing table showing the rates of flow through various sizes of copper tubing corresponding to a pipe friction loss rate of 2.4 psi per 100 feet of pipe length is given in Table B.11.2. These flow rates were determined from the chart applicable to such pipe with a “fairly smooth” surface condition after extended service conveying water having the effect stated in the example.

Step 15. All parts of the BDC should be selected in accordance with the flow rates shown in the table established in step 14. Usually, all other parts of the system are sized using the same pressure drop limitation.

Table B.11.2
TYPE L COPPER TUBING, FOR "FAIRLY SMOOTH" CONDITION

Nominal Pipe Size (in)	Flow Rates Corresponding to Friction Loss of 2.4 psi/100' (gpm)
1/2	1.4
3/4	3.9
1	7.5
1-1/4	14.0
1-1/2	21.0
2	47.0
2-1/2	78.0
3	130.0
4	270.0

B.12 MANIFOLD TYPE PARALLEL WATER DISTRIBUTION SYSTEMS

B. 12.1 Manifolds

The total water supply demand for the dwelling shall be determined in accordance with Section 10.14 and Appendix B.5. Manifolds shall be sized according to Table B.12.1 based on the total supply demand.

Table B.12.1
MANIFOLD SIZING[1]

Nominal Size ID Inches	Maximum GPM Available @ Velocity		
	@ 4 fps	@8 fps	@ 10 fps
1/2	2	5	6
3/4	6	11	14
1	10	20	25
1-1/4	15	31	38
1-1/2	22	44	55

[1] Refer to Section 10.14 for maximum velocity permitted.

B.12.2 Distribution Lines

a. The water pressure available for distribution pipe friction shall be determined from the minimum supply pressure available at the source, the developed length and size of the water service, the pressure drop through the water meter (if provided), the pressure drop through the manifold, the pressure drop through any other equipment or appurtenances in the system, the elevation of each distribution line, and the minimum pressure required at each fixture.

b. The water flow required at each fixture shall be in accordance with Section 10.14.2a for both hot and cold water. Distribution line sizes shall be in accordance with the system manufacturer's line sizing procedure.

c. The system manufacturer shall provide sizing data for the individual runs of tubing to each fixture based on the water pressure available for pipe friction and static elevation, the GPM required at each fixture, the tubing material, the tube size, and its maximum allowable length from the manifold to the fixture. Tube sizes for parallel water distribution systems include 3/8" nominal, 1/2" nominal, and 3/4" nominal.

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Appendix C

Conversions: Customary Units to Metric

Square Measure Conversions from Square Inches to Approximate Square Centimeters and Square Feet to Approximate Square Meters

Square Inches	Square Centimeters	Square Feet	Square Meters
1	6.5	1	.0925
2	13.0	2	.1850
3	19.5	3	.2775
4	26.0	4	.3700
5	32.5	5	.4650
6	39.0	6	.5550
7	45.5	7	.6475
8	52.0	8	.7400
9	58.5	9	.8325
10	65.0	10	.9250
25	162.5	25	2.315
50	325.0	50	4.65
100	650.0	100	9.25

Temperature Conversions from Degrees Fahrenheit to Approximate Degrees Celsius

Fahrenheit (°F)	Celsius (°C)
32°	0°
40°	4°
50°	10°
60°	15°
70°	21°
80°	26°
90°	32°
100°	38°
120°	49°
140°	60°
160°	71°
180°	82°
200°	93°
212°	100°

Liquid Volume Time Conversions (Flow-Rate Conversions) From Gallons Per Minute to Approximate Litres Per Minute

GPM	Litres/Minute
1	3.75
2	6.50
3	11.25
4	15.00
5	18.75
6	22.50
7	26.25
8	30.00
9	33.75
10	37.50

Liquid Volume Conversions from Liquid Ounces and U.S. Gallons to Litres

Ounces	Litres	Gallons	Litres
1	.0296	1/4	.9464
2	.0591	1/2	1.893
3	.0887	3/4	2.839
4	.1183	1	3.785
5	.1479	2	7.571
6	.1774	3	11.36
7	.2070	4	15.14
8	.2366	5	18.93
9	.2662	6	22.71
10	.2957	7	26.50
16 (1 pt.)	.4732	8	30.28
20	.5915	9	34.07
30	.8872	10	37.85
32 (1 qt.)	.9464	20	75.71
		30	113.6
		40	151.4
		50	189.3
		100	378.5

Length/Time Conversions from Feet Per Second to Approximate Meters Per Second

Feet Per Second	Meters Per Second
1	.3050
2	.610
3	.915
4	1.220
5	1.525
6	1.830
7	2.135
8	2.440
9	2.754
10	3.05

Mass Conversions from Ounces and Pounds to Kilograms

Ounces	Kilograms	Pounds	Kilograms
1	.028	1	.454
2	.057	2	.907
3	.085	3	1.361
4	.113	4	1.814
5	.142	5	2.268
6	.170	6	2.722
7	.198	7	3.175
8	.227	8	3.629
9	.255	9	4.082
10	.283	10	4.536
11	.312	25	11.34
12	.340	50	22.68
13	.369	75	34.02
14	.397	100	45.36
15	.425		
16 (1 lb.)	.454		

Appendix D

Determining the Minimum Number of Required Plumbing Fixtures

The determination of the minimum number of required plumbing fixtures is a complex issue as many buildings are unique as such the Authority Having Jurisdiction is called upon to use good judgement in applying this procedure.

1. DETERMINE THE SERVICE POPULATION

The population for the building or facility should be given on the plans. In the event the population of the building or service area is not given on the plans, three approaches may be utilized in determining the population to be served by the restroom facility.

(a.) Actual: In some instances the actual population, male and female, of the building service area may be known and this value may be used in the calculations.

(b) Engineering Estimate: The population of many buildings, especially those owner-occupied, may be determined on the basis of population densities. Typically, office building floor areas range from 200 to 400 square feet per person. In the absence of other data, the gender ratio should be 60/60 which allows for a variance.

(c) Legal Limit: Many building codes establish a legal occupancy limit based on the means of egress. Where the occupant load is based on the egress requirements of a building, the number of occupants for plumbing purposes shall be permitted to be reduced to two-thirds of that required for fire or life safety purposes.

2. MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES

The minimum number of required plumbing fixtures shall be determined based on building classification, user group and population as given in Table 7.21.1. The building classifications and user groups are consistent with nationally recognized building codes.

EXAMPLE A

Building classification, use group, total population must be known.

Building classification:	Assembly
Use Group:	A-3, auditorium without permanent seating
Floor area:	20,000 net square feet, 1 story
Population	2,857 based on egress per the Building Code at 7 sq ft per person

1. Determine the Plumbing Population

Since the given population is based on egress requirements, the population for plumbing purposes can be 2/3 of that value (Section 7.21.2.b). The ratio of male and female occupants can be assumed to be 50% each (Section 7.21.2.c).

Population for plumbing purposes = 2857 x 2/3 = 1905
Male population = 1905 x 50% = 953
Female population = 1905 x 50% = 953

2. Determine the Minimum Required Number of Plumbing Fixtures

The minimum required number of plumbing fixtures is determined from Table 7.21.1 under
No. 1 Assembly, Use Group A-3

The number of males and females are greater than the numerical groups listed in Table 7.21.1. To determine the total number of fixtures required, calculate the number of fixtures required by the listed numerical groups and then determine how many additional groups of 300 there are over the first 300.

<u>Male Water Closets</u>
first 50 men (1-50) = 1 water closet
next 100 men (51-150) = add 1 water closet
next 150 men (151-300) = add 0 water closet
add 1 for each additional group of 300 over 300 (or parts thereof)

The listed numerical groups account for the first 300 males
The number of additional groups of 300 = (953 - 300) divided by 300 per group = 2.18 = 3 groups

The total number of male water closets = 1 (first 50)
= 1 (next 100)
= 0 (next 150)
= 3 (3 additional groups of 300 @ 1 each)

Minimum number of water closets for males = 5
Section 7.21.5.a permits urinals to be substituted for up to 50% of the required water closets.
The male toilet room could contain 3 water closets and 2 urinals.

<u>Female Water Closets</u>
first 50 females (1-50) = 1 water closet
next 100 females (51-150) = add 1 water closet
next 150 females (151-300) = add 0 water closet
add 2 for each additional group of 300 over 300 (or parts thereof)

The listed numerical groups account for the first 300 females.
The number of additional groups of 300 = (953 - 300) divided by 300 per group = 2.18 = 3 groups

The total number of female water closets = 1 (first 50)
= 1 (next 100)
= 0 (next 150)
= 6 (3 additional groups of 300 @ 2 each)

Minimum number of water closets for females = 8

Male Lavatories
first 50 males (1-50) = 1 lavatory
next 100 males (51-150) = add 0 lavatories
next 150 males (151-300) = add 0 lavatories
add 1 for each additional group of 300 over 300 (or parts thereof)

The total number of male lavatories	= 1 (first 50
	= 0 (next 100)
	= 0 next 150)
	= 3 (3 additional groups of 300 @ 1 each)

Minimum number of lavatories for males = 4

Female Lavatories
first 50 females (1-50) = 1 lavatory
next 100 females (51-150) = add 1 lavatory
next 150 females (151-300) = add 0 lavatories
add 2 for each additional group of 300 over 300 (or parts thereof)

The total number of female lavatories	= 1 (first 50
	= 1 (next 100)
	= 0 next 150)
	= 6 (3 additional groups of 300 @ 2 each)

Minimum number of lavatories for females = 8

Drinking Water Facilities
Table 7.21.1 requires 1 per 1000 people (or parts thereof)
Number of drinking water facilities = 1905 divided by 1000 per group = 1.905 = 2 groups

Service Sinks
Table 7.21.1 requires a minimum of 1 per floor.

EXAMPLE B

Building classification, use group, total population must be known.

Building classification:	Business
Use Group:	B, office building
Floor area:	48,300 net square feet, 1 story
Population	386 based on expected occupancy

1. Determine the Plumbing Population

Population for plumbing purposes = 386
Male population = 386 x 50% = 193
Female population = 386 x 50% = 193

2. Determine the Minimum Required Number of Plumbing Fixtures

The minimum required number of plumbing fixtures is determined from Table 7.21.1 under
No. 2 Business, Use Group B

The number of males and females are greater than the numerical groups listed in Table 7.21.1. To determine the total number of fixtures required, calculate the number of fixtures required by the listed numerical groups and then determine how many additional groups of 60 there are over the first 75.

<u>Male Water Closets</u>
first 15 men (1-15) = 1 water closet
next 25 men (16-40) = add 1 water closet
next 35 men (40-75) = add 1 water closet
add 1 for each additional group of 60 over 75 (or parts thereof)

The listed numerical groups account for the first 75 males
The number of additional groups of 60 = (193 - 75) divided by 60 per group = 1.97 = 2 groups

The total number of male water closets	= 1 (first 15)
	= 1 (next 25)
	= 1 (next 35)
	= 2 (2 additional groups of 60 @ 1 each)

Minimum number of water closets for males = 5
Section 7.21.5a permits urinals to be substituted for up to 50% of the required water closets.
The male toilet room could contain 3 water closets and 2 urinals.

<u>Female Water Closets</u>
first 15 females (1-15) = 1 water closet
next 25 females (16-40) = add 1 water closet
next 35 females (40-75) = add 1 water closet
add 2 for each additional group of 60 over 75 (or parts thereof)

The listed numerical groups account for the first 75 females.
The number of additional groups of 60 = (193 - 75) divided by 60 per group = 1.97 = 2 groups

The total number of female water closets	= 1 (first 15)
	= 1 (next 25)
	= 1 (next 35)
	= 4 (2 additional groups of 60 @ 2 each)

Minimum number of water closets for females = 7

<u>Male Lavatories</u>
first 15 males (1-15) = 1 lavatory
next 25 males (16-40) = add 0 lavatories
next 35 males (40-75) = add 1 lavatory
add 1 for each additional group of 60 over 75 (or parts thereof)

The total number of male lavatories	= 1 (first 15
	= 0 (next 25)
	= 1 (next 35)
	= 2 (2 additional groups of 60 @ 1 each)

Minimum number of lavatories for males = 4

<u>Female Lavatories</u>
first 15 females (1-15) = 1 lavatory
next 25 females (16-40) = add 2 lavatories
next 35 females (41-75) = add 1 lavatories
add 2 for each additional group of 60 over 75 (or parts thereof)

The total number of female lavatories	= 1 (first 15)
	= 2 (next 25)
	= 1 (next 35)
	= 4 (2 additional groups of 60 @ 2 each)

Minimum number of lavatories for females = 8

<u>Drinking Water Facilities</u>
Table 7.21.1 requires 1 per 1000 people (or parts thereof)
Number of drinking water facilities = 386 divided by 1000 per group = 0.39 = 1 group

<u>Service Sinks</u>
Table 7.21.1 requires a minimum of 1 per floor.

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Appendix E

Special Design Plumbing Systems

E.1 GENERAL REQUIREMENTS

E.1.1 Special design plumbing systems shall include all systems that vary in detail from the requirements of this Code.

E.1.2 The provisions of this Appendix shall control the design, installation, and inspection of special design plumbing systems.

E.1.3 Special design plumbing systems shall conform to the Basic Principles of this Code.

E.1.4 Special design plumbing systems shall be designed by a registered design professional who is licensed to practice in the particular jurisdiction.

E.2 PLANS, SPECIFICATIONS, AND COMPUTATIONS

E.2.1 Plans, specifications, computations, and other related data for special design plumbing systems, prepared by the registered design professional, shall be submitted to the Authority Having Jurisdiction for review and approval prior to installation.

E.2.2 The design plans shall indicate that the plumbing system (or portions thereof) is a special design system.

E.3 INSTALLATION OF SPECIAL DESIGN PLUMBING SYSTEMS

E.3.1 Special design plumbing systems shall be installed according to established, tested and approved criteria, including manufacturer's instructions.

E.3.2 The installation shall comply with Chapter 2 - *General Regulations* and other applicable requirements of this Code.

E.4 CERTIFICATION OF COMPLIANCE

E.4.1 Inspections shall be made by the Authority Having Jurisdiction to ensure conformance with data submitted for approval and the applicable requirements of this Code.

E.4.2 The complete installation and performance of the special design plumbing system shall be certified by the registered design professional as complying with the requirements of the special design.

E.5 VACUUM DRAINAGE SYSTEMS

E.5.1 General Requirement

E.5.1.1 System Design

Vacuum drainage systems shall be designed in accordance with manufacturer's recommendations. The system layout, including piping layout, tank assemblies, vacuum pump assembly and other components/ designs necessary for proper function of the system shall be per manufacturer's recommendations. Plans, specifications and other data for such systems shall be submitted to the Authority Having Jurisdiction for review and approval prior to installation.

E.5.1.2 Fixtures

Gravity type fixtures used in vacuum drainage systems shall comply with Chapter 7 of this Code.

E.5.1.3 Drainage Fixture Units

Fixture units for gravity drainage systems that discharge into or receive discharge from vacuum drainage systems shall be based upon values in Chapter 11 of this Code.

E.5.1.4 Water Supply Fixture Units

Water supply fixture units shall be based upon values in Chapter 10 of this Code with the addition that the fixture unit of a vacuum type water closet shall be one inch.

E.5.1.5 Traps and Cleanouts

Gravity type fixtures shall be provided with traps and cleanouts per Chapter 5 of this Code.

E.5.1.6 Materials

Vacuum drainage pipe, fittings and valve materials shall be as recommended by the vacuum drainage system manufacturer and as permitted by this Code.

E.5.2 Tests and Demonstrations

After completion of the entire system installation, the system shall be subjected to a vacuum test of 19 inches of mercury and shall be operated to function as required by the Authority Having Jurisdiction and the manufacturer. Recorded proof of all tests shall be submitted to the Authority Having Jurisdiction.

E.5.3 Written Instructions

Written instructions for the operation, maintenance, safety and emergency procedures shall be provided to the Building Owner as verified by the Authority Having Jurisdiction.

E.6 ONE-PIPE SANITARY DRAINAGE SYSTEMS EMPLOYING AERATOR AND DEAERATOR STACK FITTINGS

E.6.1 Compliance

a. One-pipe sanitary drainage systems employing aerator and deaerator stack fittings shall be permitted to be installed in accordance with (1) the fitting manufacturer's current piping design manual and technical bulletins, and (2) the applicable requirements of this Code.

b. The requirements of this Code shall supercede the fitting manufacturer's piping design manual with regard to acceptable piping materials, drainage fixture unit (DFU) values, and minimum drainage pipe sizes.

c. Complete detailed layout drawings shall be prepared prior to the installation of such a sanitary drainage system.

E.6.2 Piping Materials

Piping materials for drainage stacks and branches shall be in accordance with Section 3.5 of this Code. Piping materials for vents shall be in accordance with Section 3.6 of this Code.

E.6.3 Drainage Fixture Unit (DFU) Values

Drainage fixture unit values for bathroom groups and individual fixtures shall be in accordance with Table 11.4.1 of this Code.

E.6.4 Drainage Pipe Sizing

Piping in such a sanitary drainage system shall be sized according to the fitting manufacturer's current piping design manual.

EXCEPTION: Drainage pipe sizes shall not be less than those required by Section 11.5 of this Code.

E.6.5 Arrangement of Piping

Piping shall be arranged as illustrated in the fitting manufacturer's current design manual.

E.7 SINGLE STACK VENT SYSTEMS

E.7.1 Where permitted.

A drainage stack shall be permitted to serve as a single stack vent system when sized and installed in accordance with Sections E.7.2 through E.7.9. The drainage stack and branch piping in a single stack vent system shall provide for the flow of liquids, solids, and air without the loss of fixture trap seals.

E.7.2 Stack Size

Drainage stacks shall be sized according to Table E.7.2. A maximum of two water closets shall be permitted to discharge to a 3 inch stack. Stacks shall be uniformly sized based on the total connected drainage fixture unit load with no reductions in size.

Table E.7.2
SINGLE STACK SIZE

Stack Size (inches)	Maximum Connected Drainage Fixture Units		
	Stacks Less than 75 Feet in Height	Stacks 75 Feet to Less than 160 Feet in Height	Stacks 160 Feet or Greater in Height
3	24 (2)	NP	NP
4	225	24	NP
5	480	225	24
6	1015	480	225
8	2320	1015	480
10	4500	2320	1015
12	8100	4500	2320
15	13,600	8100	4500

1. NP = not permitted
2. Not more than two (2) water closets are permitted on a 3" stack.

E.7.3 Branch Size

Horizontal branches connecting to a single stack vent system shall be sized according to Table 11.5.1 B.
EXCEPTIONS:

(1) No more than one water closet within 18" of the stack horizontally shall be permitted on a 3" horizontal branch.

(2) A water closet within 18" of a stack horizontally and one other fixture with up to 1-1/2 inch fixture drain size shall be permitted on a 3" horizontal branch when connected to the stack through a sanitary tee.

E.7.4 Length of Horizontal Branches

a. Water closets shall be no more than four (4) feet horizontally from the stack.

EXCEPTION: Water closets shall be permitted to be up to eight (8) feet horizontally from the stack when connected to the stack through a sanitary tee.

b. Fixtures other than water closets shall be no more than twelve (12) feet horizontally from the stack.

c. The length of any vertical piping from a fixture trap to a horizontal branch shall not be considered it computing the fixture's horizontal distance from the stack.

E.7.5 Maximum Vertical Drops From Fixtures

Vertical drops from fixture traps to horizontal branch piping shall be one pipe size larger than the trap but not less than two (2) inch pipe size. Vertical drops shall be four (4) feet maximum length. Fixture drains that are not increased in size, or have a vertical drop exceeding 4 feet shall be individually vented.

E.7.6 Additional Venting Required

Additional venting shall be provided when more than one water closet is on a horizontal branch and where the distance from a fixture trap to the stack exceeds the limits in Section 12.18.4. Where additional venting is required, the fixture(s) shall be vented by an individual vent, common vent, wet vent, circuit vent, or a combination waste and vent pipe. The dry vent extensions for the additional venting shall connect to a branch vent, vent stack, stack vent, air admittance valve, or be extended outdoors and terminate to the open air.

E.7.7 Stack Offsets

Where there are no fixture drain connections below a horizontal offset in a stack, the offset does not need to be vented. When there are fixture drain connections below a horizontal offset in a stack, the offset shall be vented in accordance with Section 12.3.3. There shall be no fixture connections to a stack within 2 feet above and below a horizontal offset.

E.7.8 Separate Stacks Required

Where stacks are more than two stories high, a separate stack shall be provided for the fixtures on the lower two stories. The stack for the lower two stories may be connected to the branch of the building drain that serves the stack for the upper stories at a point that is at least 10 pipe diameters downstream from the base of the upper stack.

E.7.9 Sizing Building Drains and Sewers

The building drain and branches thereof, and the building sewer in a single stack vent system shall be sized in accordance with Table 11.5.1A.

E.8 AIR ADMITTANCE VALVES

E.8.1 Definition

Air admittance valve: A one-way valve designed to allow air to enter the plumbing drainage system when negative pressures develop in the system. The device closes by gravity, without springs or other mechanical means, and seals the vent terminal at zero differential pressure (no flow conditions) and also under positive internal pressure. The purposes of an air admittance valve are (1) to provide a method of allowing air to enter the plumbing drainage system without the need for a vent extended outdoors to open air, and (2) to prevent sewer gases from escaping into the building.

E.8.2 Where Permitted

E.8.2.1 Branch, circuit, common, continuous, and individual vents shall be permitted to terminate with a connection to an individual or branch type air admittance valve complying with ASSE 1051. Individual and branch type air admittance valves shall only vent fixtures that are on the same floor level and connect to a horizontal branch drain.

E.8.2.2 Vent stacks and stack vents shall be permitted to terminate at a stack type air admittance valve complying with ASSE 1050.

EXCEPTIONS

(1) Vent stacks and stack vents serving drainage stacks that exceed six (6) branch intervals in height.
(2) Vent stacks and stack vents that serve relief vents in Section E.8.3.

E.8.2.3 Air admittance valves shall not be permitted in the following applications:

a. vents for special waste drainage systems (Sections 9.4.1 and 9.4.2).
b. vents for sewage pump or ejector sump pits.
c. vents for pneumatic sewage ejectors.
d. suds pressure zone venting.
e. relief vents required by Section E.8.3.1.

E.8.3 Relief Vents

E.8.3.1 A relief vent shall be provided where a horizontal branch drain that is vented by one or more air admittance valves connects to a drainage stack more than four (4) branch intervals from the top of the stack. The relief vent shall connect vertically to the horizontal branch drain between the drainage stack and the most downstream fixture drain connection on the horizontal branch drain. Relief vents shall extend from the horizontal branch drain to a vent stack, stack vent, or other vent that terminates outdoors in open air.

E.8.3.2 Relief vents shall be the full size of the horizontal branch drain that they serve, up to 3" maximum required size.

E.8.3.3 Relief vents shall be permitted to vent fixtures other than those on the horizontal branch drain being relieved.

E.8.4 Installation

E.8.4.1 Air admittance valves shall be installed in accordance with the manufacturer's instructions and Section E.8.

E.8.4.2 Air admittance valves shall connect to fixture trap arms within the maximum allowable trap arm lengths in Table 12.8.1.

E.8.4.3 Individual and branch type air admittance valves shall be installed at least 4 inches above the top of the trap arm or horizontal branch drain that they serve.

E.8.4.4 Stack type air admittance valves shall be installed at least 6 inches above the flood level rim of the highest fixture served by the valve.

E.8.4.5 Air admittance valves shall be installed in accessible locations having free movement of air to enter the valve.

E.8.4.6 Air admittance valves shall not be installed in HVAC supply or return air plenums or other areas subject to other than atmospheric pressure.

E.8.4.7 Air admittance valves installed in insulated attic or ceiling spaces shall be installed in free air at least six inches above the insulation.

E.8.4.8 Air admittance valves shall be the same size as the vent pipe to which they are connected.

E.8.4.9 Air admittance valves shall not be installed until all required leak tests of the drainage and vent piping are successfully completed.

E.8.5 Vent to Outdoors Required

In each plumbing drainage system vented by one or more air admittance valves, at least one vent shall extend outdoors to open air.

E.8.6 Referenced Standards

E.8.6.1 ASSE 1050-2002 Stack Air Admittance Valves for Sanitary Drainage Systems.

E.8.6.2 ASSE 1051-2002 Individual and Branch Type Air Admittance Valves for Plumbing Drainage Systems.

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Appendix F

Requirements of the Authority Having Jurisdiction

F.1 GENERAL

This Code does not include specific requirements in certain cases where local practices may vary from one jurisdiction to another. This appendix lists those sections of this Code where the Authority Having Jurisdiction must establish requirements. Adopting agencies should review the sections listed under Appendix F.2 and establish appropriate regulations or policies.

F.2 REFERENCES

1.7.2	Penalties
1.9.8	Permit Expiration
1.10.2	Plan Review Fees
1.10.3	Plan Review Expiration
1.10.5	Refunding of Fees
1.11.5	Requests for Inspection
2.16.1:	Minimum earth cover for water service pipe.
2.16.2:	Minimum earth cover for building sewers.
2.19.1:	Distance for required connections to public water supplies and sewers.
2.19.2:	Standards and requirements for private water and sewage disposal systems.
5.3.4:	Need for building traps.
5.4.10.c:	Manhole construction standards.
6.1.7:	Point of discharge for effluent from liquid waste treatment equipment.
7.16.6:	Sloping floors to floor drains.
9.4.3.c:	Points of discharge for air conditioning condensate.
10.9.2:	Disinfecting water piping.
11.7.6:	Use of grinder pumps.
11.7.10:	Use of macerating toilet systems.
15.3.1:	Testing new plumbing work.
15.3.2:	Testing existing sewers and drains.
16.1:	State or local requirements for private sewage disposal systems.
Chapter 18:	Regulations of the AHJ for mobile home and travel trailer parks.

F.3 EXCEPTIONS, WAIVERS, APPROVALS

There are instances where this Code specifically permits exceptions or waivers of its requirements and the approval of alternative materials and methods by the Authority Having Jurisdiction. These occur throughout this Code.

Appendix G

Graywater Recycling Systems

G.1 FOREWORD

In the United States today, regulations concerning water conservation, moratoriums on sewer connections, and restrictions on sewer permits are a clear indication of a growing economy restrained by a lack of available water. Water being a finite resource, these actions serve as a warning that without adequate planning for our future water needs, America is facing a critical water supply shortage.

In virtually all major metropolitan and many suburban areas in the country, water treatment plants are overloaded and many, due to neglect and deferred maintenance, are beginning to fail. Finding additional water sources and supplies and expanding existing water treatment plant capacity is expensive, sometimes impractical, and at best, involves long range planning.

Traditionally, the municipal treatment facility has been the primary source of water disposal for single and multifamily residential buildings and complexes. As long term water shortages increasingly are predicted in several areas across the nation, water conservation becomes more of a national issue. Fortunately, alternative technical solutions are currently available.

Various potentially useful and dependable water treatment and recycling technologies are being explored. One possible source is graywater recycling, an on-site wastewater treatment and recycling system, also known as "Graywater Systems". This promising technology offers a practical solution to the water shortage problem as it applies to plumbing installations. Graywater systems are designed to safely manage wastewater and reduce water consumption. Graywater systems can be used in all types of residential, commercial, institutional, and industrial buildings. Some graywater applications include toilet and urinal flushing, landscape irrigation, supply water for ornamental ponds and make-up water for cooling towers.

G.2 DEFINITIONS

Biological Treatment: A method of wastewater treatment in which bacterial or biochemical action is intensified as a means of producing an oxidized wastewater.

Black Water: Used untreated water that is flushed down toilets and urinals. This water cannot be directly reused.

Effluent: Partially or completely treated liquid waste discharge from a wastewater treatment system.

Graywater: Used untreated water generated by clothes washing machines, showers, bathtubs and lavatories. It shall not include water from kitchen sinks or dishwashers.

Reclaimed Water: Effluent from a wastewater treatment facility that has been subjected to extensive treatment in order to remove organic material, heavy metals, and harmful pathogens (such as bacteria, viruses, and protozoa). Reclaimed water is non-potable.

Septic Tank: A water-tight receptacle that receives the discharge of a building sanitary drainage system or part thereof, and is designed and constructed so as to separate solids from the liquid, 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 or perforated piping, or a seepage pit.

Wastewater: The combination of liquid and water-carried pollutants from residences, commercial buildings, industrial plants, and institutions.

G.3 APPROVED MATERIALS

All materials, fixtures or equipment used in the installation, repair or alteration of graywater systems, shall conform to the standards set forth in Chapter 3 of this Code. Nothing contained herein shall prohibit the Authority Having Jurisdiction from imposing more stringent requirements.

Materials not listed in Chapter 3 of this Code may be used with the approval of the Authority Having Jurisdiction as permitted in Section 3.12.2.

G.4 APPROVED INSTALLATIONS

Prior to construction of a graywater system, the appropriate permits shall be obtained from the Authority Having Jurisdiction having jurisdiction. The applicant shall provide the Authority Having Jurisdiction with complete plans and manufacturers' recommendations of the proposed installation.

All pipe sizing and installation procedures shall conform to the applicable sections of this Code. Nothing shall preclude the Authority Having Jurisdiction from requiring more stringent compliance procedures.

G.5 PROHIBITED INSTALLATIONS

Surface draining graywater shall not be permitted to collect on the surface of the ground or to run off the property. Graywater shall not be permitted to come in direct contact with edible food sources.

G.6 ACCEPTABLE TREATMENT METHODS

G.6.1 Nylon or Cloth Filter

The nylon or cloth filter system typically consists of a filter bag connected to the graywater inlet pipe in a tank. The graywater is passed through the filter media (that collects hair and lint) and proceeds on for further treatment.

G.6.2 Sand Filter

The sand filter system consists of a sand and rock filled tank with an underdrain system. The graywater is poured onto splash plates and then filtered through filter media, while receiving physical and biological treatment. The filtered graywater then is collected and transported via an underdrain system for reuse.

G.6.3 Diatomaceous Earth Filter

Diatomaceous filters are commonly used for filtering water for swimming pools and spas. The use of this type of filter is primarily limited to separating solids in suspension with the use of a recirculating line.

G.6.4 Rack or Grate Filters

The primary function of the rack or grate filter is to remove particle matter from the graywater.

G.6.5 Collection and Settling

Commonly found in septic systems, whereby solids flow into the tank and are permitted to settle to the bottom forming a sludge layer.

G.6.6 Biological Treatment Units

Typically a process in which solids are separated through the use of three chambers. Pre-settling, aeration, and final settling separate the solids while allowing biological treatment prior to reuse. This type of treatment is usually found in large commercial applications.

G.6.7 Reverse Osmosis

A process involving treatment of the graywater by a reverse osmosis unit.

G.6.8 Physical/Chemical Treatment

Graywater is processed through a rapid mix tank in which polymer and activated carbon are added. The treated graywater is then passed through a settling tank in which sludge is removed. The graywater then goes on to numerous filters for further treatment.

G.7 DISINFECTION TECHNIQUES

Ultraviolet Irradiation
Ozone
Chlorine
Iodine

G.8 IRRIGATION METHODS

Mini-Leachfield
Drip Irrigation

G.9 PROTECTION OF THE POTABLE WATER SUPPLY

A graywater system shall be designed, installed and maintained to prevent contamination from non-potable liquids, solids or gases into the potable water supply through cross-connections.

In all buildings where dual water systems are installed, one potable water and one non-potable water, each system shall be identified either by color marking or metal tags, or other appropriate method as approved by the Authority Having Jurisdiction having jurisdiction. Each outlet on the non-potable water line that may be used for drinking or domestic purposes shall be posted: **DANGER—UNSAFE WATER**.

The potable water supply shall be protected from backflow and back-siphonage by an approved method of cross-connection control required by Sections 10.4 and 10.5 of this Code. Nothing contained herein shall prohibit the Authority Having Jurisdiction from requiring more stringent requirements.

G.10 TESTING

All applicable sections of this appendix shall conform to the body of this Code. Installation of the graywater system shall conform in all aspects to the manufacturers recommended installation procedures.

Systems shall be tested and comply with the Authority Having Jurisdiction. Piping, valves, and fittings shall be tested in compliance with Chapter 15 of this Code.

G.11 MAINTENANCE

The graywater system shall be maintained in accordance with the manufacturers recommended maintenance instructions.

Nothing in this Appendix shall preclude the Authority Having Jurisdiction from requiring additional maintenance procedures.

Appendix H

INSTALLATION OF MEDICAL GAS AND VACUUM PIPING SYSTEMS

(Refer to NFPA 99-2005 or NFPA 99C-2005)

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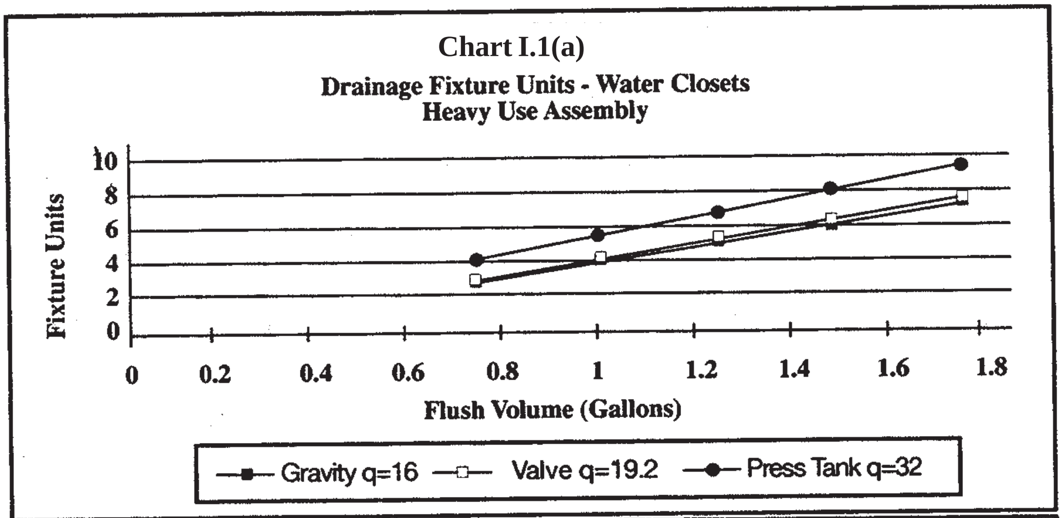
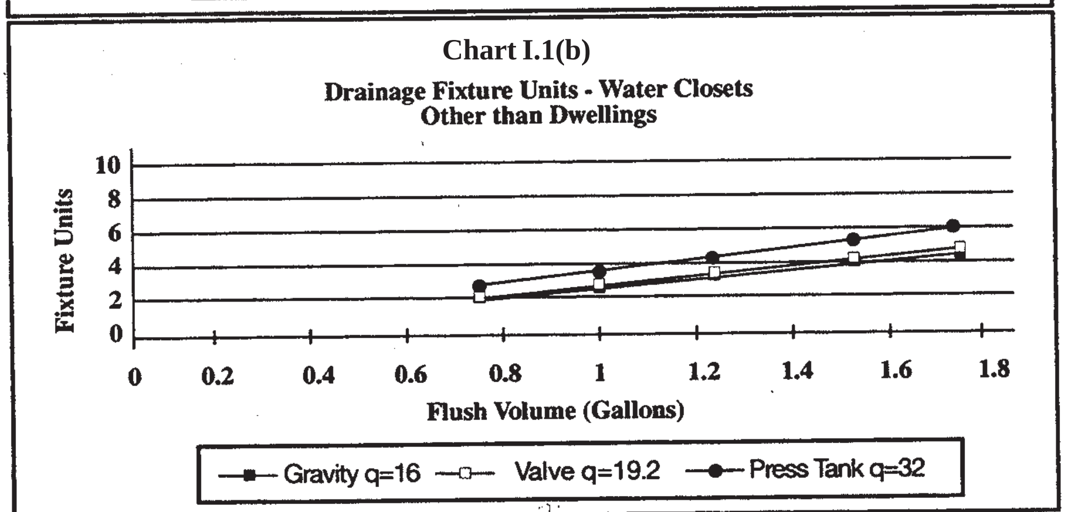
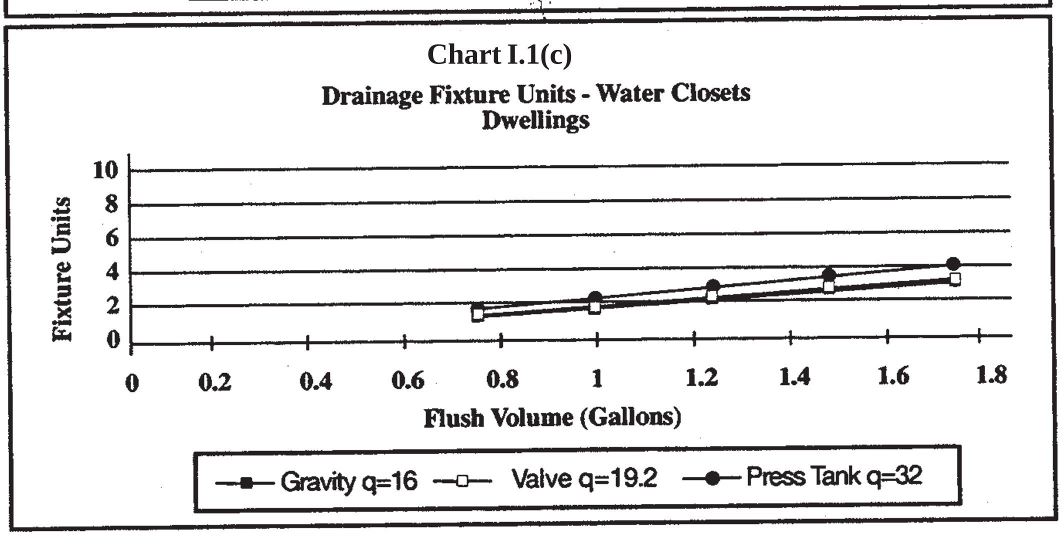
Fixture Unit Value Curves for Water Closets

I.1 DRAINAGE FIXTURE UNITS — WATER CLOSETS







I.2 WATER SUPPLY FIXTURE UNITS — WATER CLOSETS

Chart I.2(a)

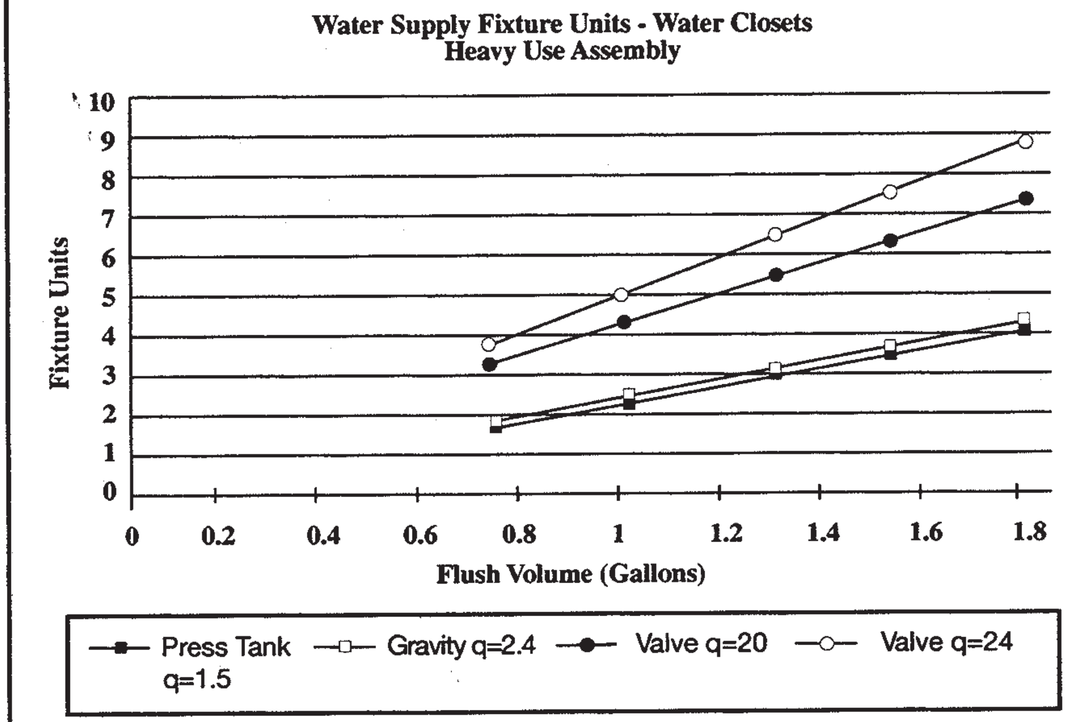
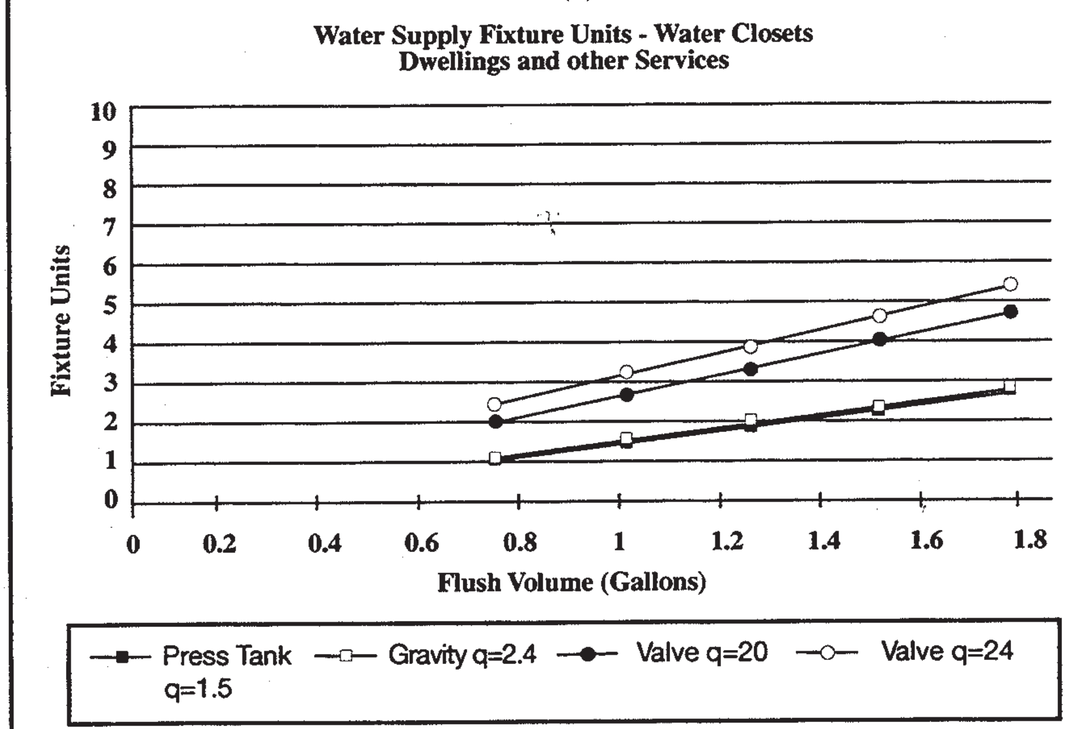


Chart I.2(b)



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Sizing Grease Interceptors

One Acceptable Method of Sizing Grease Interceptors

Waste waters that are not grease laden and do not require separation shall not be discharged into any grease interceptor.

1. Determine the cubic content of the fixture, equipment or sink compartment that will produce the grease laden waste water that will require separation. Length x Width x Depth

2. Determine the capacity in gallons. 1 gallon = 231 cubic inches.

3. Determine the actual drainage load.
   a. The fixture is usually filled to about 75% of capacity with water.
   b. The items being washed displace about 25% of the fixture content.
   c. Actual drainage load = 75% of the fixture, equipment or sink compartment.

4. Determine the drainage rate.
   a. In general, good practices dictate a one minute drainage period.
   b. However where conditions permit, a 2-minute drainage period is acceptable.
   c. Drainage rate = Drainage period is the actual time required to completely drain the unit.

5. Determine the flow rate.
   Flow rate = Actual drainage load (divided by) Drainage rate.

6. Select trap size based on calculated drainage rate and flow rate.

Appendix K

Flow In Sloping Drains

Flow in Sloping Drains

Tables K-1 and K-2 list flow rates in gallons per minute and velocities in feet per second for various size drains at various slopes. Table K-l is based on fairly rough pipe. Table K-2 is based on smooth pipe.

The minimum flow velocity to achieve scouring in horizontal sanitary drain lines is two (2) feet per second. For this reason. based on Table K-2 for smooth pipe. drains that are 2 inches and smaller must be sloped at not less than 1/4 inch per foot. Drains that are 3" size and larger can be sloped at 1/8 inch per foot.

Even at 1/4" per foot slope, the uniform velocity in drains that are 1-1/4", 1-1/2", and 2" size is less than 2 feet per second. Either the slope should be increased or the length of such drains should be kept to a minimum so that the entrance velocity will provide scouring for the short distance involved.

Tables K-I and K-2 are based on the Manning Formula for 1/2 full pipe. For full flow, multiply the flow by 2.00 and the velocity by 1.00. For 1/4 full flow, multiply the flow by 0.274 and the velocity by 0.701. For 3/4 full flow, multiply the flow by 1.82 and the velocity by 1.13.

In Table K-l, which is based on fairly rough pipe with “n” = 0.015, for smoother pipe, multiply the flow and velocity by 0.015 and divide by the “n” value of the smoother pipe.

Horizontal sanitary drain and waste pipes are sized to be one-half (1/2) full under design loads. Horizontal storm drains are sized to run full under design loads.

Table 11.5.1A “Building Drains and Sewers” and the horizontal piping in Table 11.5.1B “Horizontal Fixture Branches and Stacks” is based on Table K-2 for smooth pipe.

Table 13.6.2 “Size of Horizontal Storm Drains” is based on Table K-I for fairly rough pipe, adjusted for full flow.

Table K-1
APPROXIMATE FLOW RATES AND VELOCITIES IN SLOPING DRAINS
(FOR FAIRLY ROUGH PIPE n = 0.015)
Flowing Half Full

	1/16 in./ft. slope		1/8 in./ft. slope		1/4 in./ft. slope		1/2 in./ft. slope	
Actual inside diameter of pipe - inches	Flow gpm	Vel. fps	Flow gpm	Vel. fps	Flow gpm	Vel. fps	Flow gpm	Vel. fps
1.250					2.40	1.25	3.40	1.77
1.375					3.10	1.35	4.38	1.91
1.500					3.90	1.41	5.52	1.99
1.625					4.83	1.50	6.83	2.12
2					8.41	1.73	11.9	2.44
3			17.5	1.60	24.8	2.26	35.0	3.20
4	26.7	1.36	37.7	1.92	53.4	2.72	75.5	3.84
5	48.4	1.58	68.4	2.23	96.8	3.16	137	4.47
6	78.7	1.79	111	2.53	157	3.57	223	5.05
8	169	2.17	240	3.06	339	4.33	479	6.13
10	307	2.51	435	3.55	615	5.02	869	7.10
12	500	2.84	707	4.01	999	5.67	1413	8.02
15	906	3.29	1281	4.66	1812	6.59	2563	9.32

Table K-2
APPROXIMATE FLOW RATES AND VELOCITIES IN SLOPING DRAINS
(FOR SMOOTH PIPE n = 0.011)
Flowing Half Full

Actual inside diameter of pipe - inches	1/16 in./ft. slope		1/8 in./ft. slope		1/4 in./ft. slope		1/2 in./ft. slope	
	Flow gpm	Vel. fps	Flow gpm	Vel. fps	Flow gpm	Vel. fps	Flow gpm	Vel. fps
1.250					3.27	1.71	4.63	2.42
1.375					4.22	1.84	5.97	2.60
1.500					5.32	1.92	7.53	2.72
1.625					6.86	2.04	9.32	2.89
2					11.5	2.35	16.2	3.33
3			23.9	2.18	33.8	3.08	47.8	4.36
4	36.4	1.85	51.5	2.62	72.8	3.71	103	5.24
5	66.0	2.15	93.3	3.05	132	4.31	187	6.09
6	107	2.44	152	3.44	215	4.87	303	6.89
8	231	2.95	327	4.18	462	5.91	654	8.36
10	419	3.42	593	4.84	838	6.84	1185	9.68
12	681	3.87	964	5.47	1363	7.73	1927	10.94
15	1236	4.49	1747	6.35	2471	8.99	3495	12.71

An Acceptable Brazing Procedure for General Plumbing

The following is extracted and edited with permission from Chapter VII of The Copper Tube Handbook published by the Copper Development Association. This brazing procedure is acceptable for general plumbing work. Refer to NFPA 99 or NFPA 99C for brazing medical gas piping.

Introduction

Strong, leak-tight brazed connections for copper tube may be made by brazing with filler metals which melt at temperatures in the range between 1100 F and 1500 F, as listed in Table 12. Brazing filler metals are sometimes referred to as "hard solders" or "silver solders." These confusing terms should be avoided.

The temperature at which a filler metal starts to melt on heating is the solidus temperature; the liquidus temperature is the higher temperature at which the filler metal is completely melted. The liquidus temperature is the minimum temperature at which brazing will take place.

The difference between solidus and liquidus is the melting range and may be of importance when selecting a filler metal. It indicates the width of the working range for the alloy and the speed with which the a1loy will become fully solid after brazing. Filler metals with narrow ranges, with or without silver, solidify more quickly and, therefore, require more careful application of heat. The melting ranges of common brazing metals are shown in Figure 8a.

Brazing Filler Metals

Brazing filler metals suitable for joining copper tube are of two classes:
(1) alloys that contain phosphorus (the BCuP series) and
(2) alloys containing a high silver content (the BAg series)

The two classes differ in their melting, fluxing and flowing characteristics and this should be considered in selection of a filler metal. (See Table 12.) For joining copper tube, any of these filler metals will provide the necessary strength when used with standard solder-type fittings or commercially available short-cup brazing fittings.

Fluxes

The fluxes used for brazing copper joints are different in composition from soldering fluxes. The two types cannot be used interchangeably.

Brazing fluxes are water based, whereas most soldering fluxes are petroleum based. Similar to soldering fluxes, brazing fluxes dissolve and remove residual oxides from the metal surface, protect the metal from re-oxidation during heating and promote wetting of the surfaces to be joined by the brazing filler metal.

Fluxes also provide the craftsman with an indication of temperature. If the outside of the fitting and the heat-affected area of the tube are covered with flux (in addition to the end of the tube and the cup), oxidation will be prevented and the appearance of the joint will be greatly improved.

The fluxes best suited for brazing copper and copper alloy tube should meet AWS Classification FB3-A or FB3-C as listed in Table 4.1 of the AWS Brazing Handbook. Figure 9, illustrates the need for brazing flux with different types of copper and copper-alloy tube, fittings and filler metals when brazing.

Assembling

Assemble the joint by inserting the tube into the socket hard against the stop and turn if possible. The assembly should be firmly supported so that it will remain in alignment during the brazing operation.

Applying Heat and Brazing

Step one: Apply heat to the parts to be joined, preferably with an oxy-fuel flame. Air-fuel is sometimes used on smaller sizes. A neutral flame should be used. Heat the tube first, beginning about one inch from the edge of the fitting, sweeping the flame around the tube in short strokes at right angles to the axis of the tube.

It is very important that the flame be in motion continuously and not remain on anyone point long enough to damage the tube. The flux may be used as a guide as to how long to heat the tube; continue heating the tube until the flux becomes quiet and transparent like clear water. The behavior of flux during the brazing cycle is described in Figure 8b.

Step two: Switch the flame to the fitting at the base of the cup. Heat uniformly, sweeping the flame from the fitting to the tube until the flux on the fitting becomes quiet. Avoid excessive heating of cast fittings.

Step three: When the flux appears liquid and transparent on both the tube and fitting, start sweeping the flame back and forth along the axis of the joint to maintain heat on the parts to be joined, especially toward the base of the cup of the fitting. The flame must be kept moving to avoid melting the tube or fitting.

Step four: Apply the brazing filler metal at a point where the tube enters the socket of the fitting. When the proper temperature is reached, the filler metal will flow readily into the space between the tube and fitting socket, drawn in by the natural force of capillary action.

Keep the flame away from the filler metal itself as it is fed into the joint. The temperature of the tube and fitting at the joint should be high enough to melt the filler metal.

Keep both the fitting and tube heated by moving the flame back and forth from one to the other as the filler metal is drawn into the joint.

When the joint is properly made, a continuous fillet of filler metal will be visible completely around the joint. Stop feeding as soon as you see that fillet. Table 11 is a guide to estimating how much filler metal will be consumed.

For 1-inch tube and larger it may be difficult to bring the whole joint up to heat at one time. It frequently will be found desirable to use a multiple-orifice torch tip to maintain a proper temperature over large areas. A mild preheating of the whole fitting is recommended for larger sizes. Heating then can proceed as outlined in the steps above.

Horizontal and Vertical Joints

When brazing horizontal joints, it is preferable to first apply the filler metal at the bottom, then the two sides, and finally the top, making sure the operations overlap. On vertical joints it is immaterial where the start is made. If the opening of the socket is pointing down, care should be taken to avoid overheating the tube, as this may cause the brazing filler metal to run down the outside of the tube. If this happens, take the heat away and allow the filler metal to set. Then reheat the cup of the fitting to draw up the filler metal.

Removing Residue

After the brazed joint has cooled the flux residue should be removed with a clean cloth, brush or swab using warm water. Remove all flux residue to avoid the risk of the hardened flux temporarily retaining pressure and masking an imperfectly brazed joint. Wrought fittings may be cooled more readily than cast fittings, but all fittings should be allowed to cool naturally before wetting.

General Hints and Suggestions

If the filler metal fails to flow or has a tendency to ball up, it indicates oxidation on the metal surfaces or insufficient heat on the parts to be joined. If the tube or fitting start to oxidize during heating there is too little flux. If the filler metal does not enter the joint and tends to flow over the outside of either member of the joint, it indicates that one member is overheated or the other is under heated.

Testing

Test all completed assemblies for joint integrity. Follow the testing procedure prescribed by applicable codes governing the intended service.

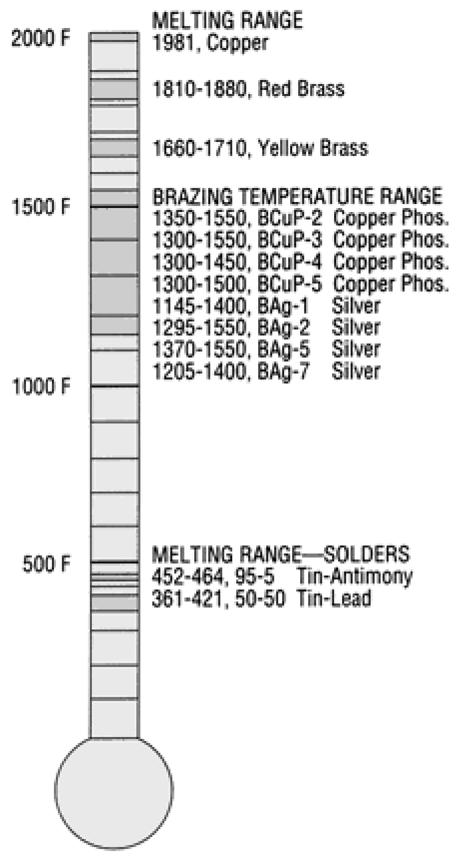
Table 12.Filler Metals for Brazing

AWS Classification[1]	Principal Elements						Temperature F	
	Silver	Phosphorus	Zinc	Cadmium	Tin	Copper	Solidus	Liquidus
BCup-2	–	7.00-7.5	–	–	–	Remainder	1310	1460
BCup-3	4.8-5.2	5.8-6.2	–	–	–	Remainder	1190	1495
BCup-4	5.8-6.2	7.0-7.5	–	–	–	Remainder	1190	1325
BCup-5	14.5-15.5	4.8-5.2	–	–	–	Remainder	1190	1475
BAg-1[2]	44-46	–	14-18	23-25[2]	–	14-16	1125	1145
BAg-2[2]	34-36	–	19-23	17-19[2]	–	25-27	1125	1295
BAg-5	44-46	–	23-27	–	–	29-31	1225	1370
BAg-7	55-57	–	15-19	–	4.5-5.5	21-23	1145	1205

[1]ANSI/AWS A5.8 Specification for Filler Metals for Brazing
[2]WARNING: BAg1 and BAg2 contain cadmium. Heating when brazing can produce highly toxic fumes.
CAUTION: Avoid breathing fumes - use adequate ventilation. Refer to ANSI/ASC Z49.1 *Safety in Welding and Cutting*.

Figure 8. Melting Temperature Ranges for Copper and Copper Alloys, Brazing Filler Metals, Flux and Solders

8a.



8b.

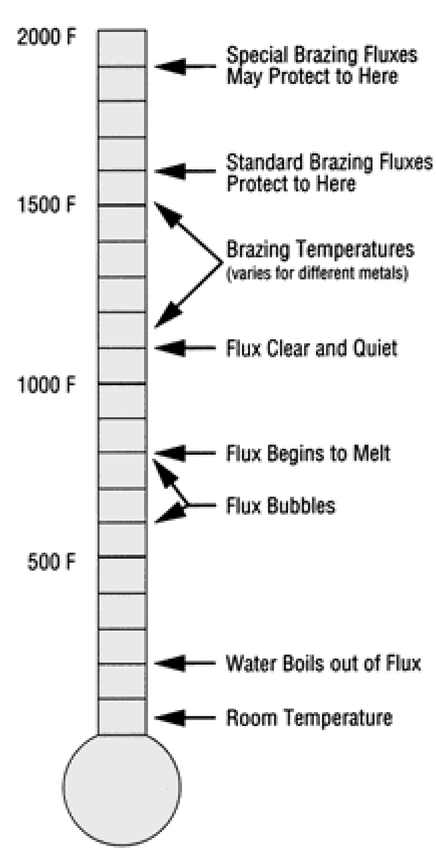


Figure 9. Brazing Flux Recommendations

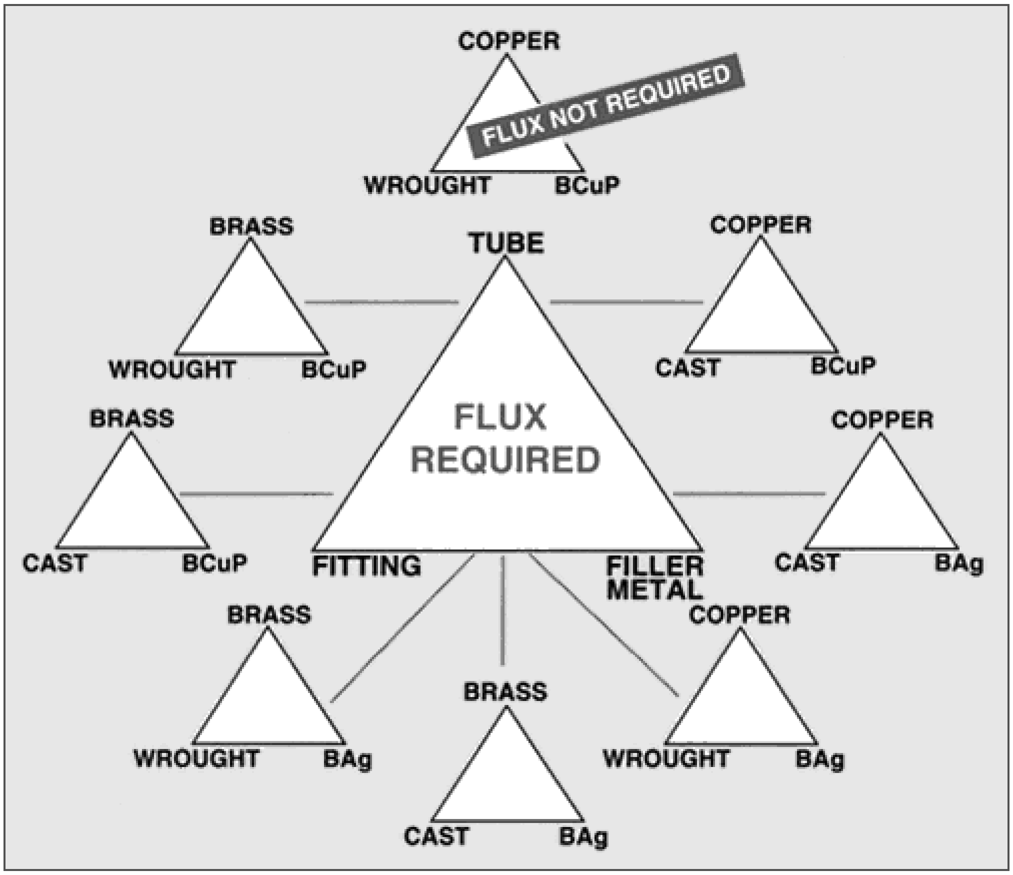


Table 11. Typical Brazing Filler Metal Consumption

Tube, nominal or standard size, inches	Filler Metal Length, inches				Average weight per 100 joints, pounds[1]
	1/16 inch wire	1/8 inch x 0.050 inch rod	3/32 inch wire	1/8 inch wire	
1/4	1/2	1/4	1/4	1/8	.04
3/8	5/8	3/8	3/8	1/4	.06
1/2	1 1/8	5/8	1/2	3/8	.10
5/8	1 5/8	7/8	5/8	1/2	.15
3/4	2 1/4	1 1/8	1	5/8	.21
1	3 1/2	1 3/4	1 5/8	7/8	.32
1 1/4	4 1/2	2 1/4	2	1 1/4	.42
1 1/2	–	3	2 5/8	1 1/2	.56
2	–	4 3/4	4 3/8	2 1/2	.90
2 1/2	–	6 1/2	5 7/8	3 3/8	1.22
3	–	8 5/8	7 7/8	4 1/2	1.64
3 1/2	–	11 1/2	10 1/2	5 7/8	2.18
4	–	14 7/8	13 1/2	7 5/8	2.81
5	–	22 5/8	20 1/2	11 5/8	4.30
6	–	31 1/2	28 1/2	16	5.97
8	–	53 1/2	48 1/2	27 3/8	10.20
10	–	67 1/4	61	34 1/4	12.77
12	–	90 1/2	82	46 1/8	17.20

Footnote 1

The amount of filler material indicated is based on an average two-thirds penetration of the cup and with no provision for a fillet. For estimating purposes, actual consumption may be two to three times the amounts indicated in this table, depending on the size of the joints, method of application and level of workmanship.

NOTE:

1090 inches of 1/16 inch wire = 1 pound
534 inches of 1/8 inch x .050-inch wire = 1 pound
484 inches of 3/32 inch wire = 1 pound
268 inches of 1/8 inch wire = 1 pound

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Alphabetical Index

NOTES