

2015 Minnesota Plumbing Code and Plan Review

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Plan Review - Scope of Plumbing

Inside of Buildings

- Adequate Pipe Sizing
- Proper Pipe Connections
- Approved Pipe Material
- Fixture Specifications
- Backflow Prevention Devices
- Internal Roof Drainage System



Outside of Buildings

- Isolation Distances and Crossings
- Proper Pipe Connections
- Approved Pipe Material and Installation
- Adequate Slope (Sanitary & Storm)
- Stormwater Drainage System



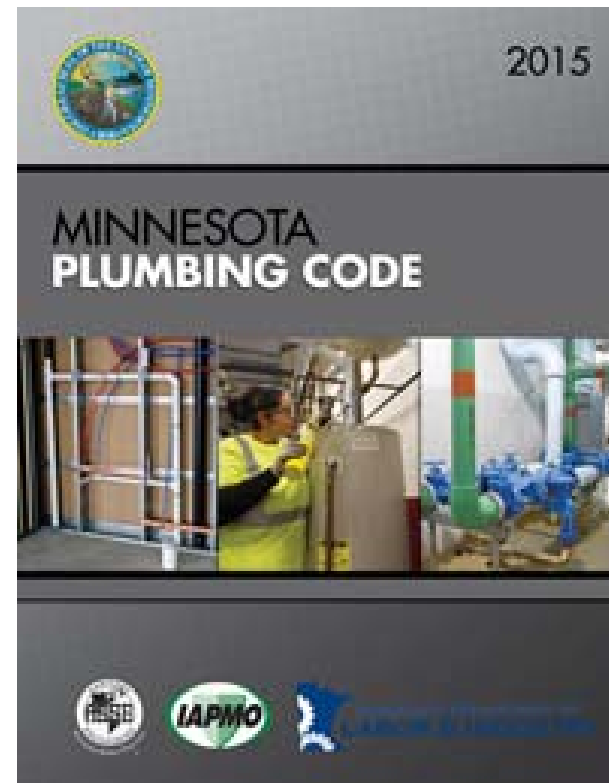


Code Administration

DLI Plumbing Program Overview

Department Website:

www.dli.mn.gov/CCLD/Plumbing



DLI Plumbing Program Overview

- DLI reviews proposed plumbing projects to ensure compliance with the Minnesota Plumbing Code (Minnesota Rules, Chapter 4714)
- Plans and fees must be submitted for installation of plumbing systems that serve the public. This includes all new, additions, extensions and alterations in public and commercial buildings:
 - Restaurants, Grocery Stores, Department Stores, Offices, Warehouses, Churches, Hospitals, Nursing Homes, Assisted Living Facilities, Housing with five units or more (excluding townhomes built to the IRC)
- Plan review includes all interior plumbing, building sewer and water service connections within the property, and stormwater drainage systems
- Plans shall be submitted by a registered engineer or a master plumber for projects where they are performing the installation

DLI Plumbing Program – Minor Remodel

- Minor Remodel – 5 fixtures or less, excluding licensed facilities:

- yes no 3. Scope of work is MORE than 5 plumbing fixtures?
- yes no 4. Consist of new water and/or sewer services?
- yes no 5. Has the plumbing been installed or completed?
- yes no 6. Is the proposed plumbing work for a new building?
- yes no 7. Includes water softener or a water treatment installation?
- yes no 8. Includes a new water heater with capacity greater than 6 gallons?
- yes no 9. Includes a flammable, grease, or any other interceptor?
- yes no 10. Include any fixtures connecting to a chemical waste system or acid neutralization tank?
- yes no 11. Scope includes alternate materials, fixtures or methods?
- yes no 12. Installation or modification of any stormwater piping or roof drains?
- yes no 13. Installation any equipment that will require a pressure or atmospheric vacuum breaker, or a reduced zone pressure (RPZ) backflow preventer on the water supply line?
- yes no 14. Includes any outside plumbing such water and sewer service connections?
- yes no 15. Includes nonconventional venting such as combination waste and vent system?
- yes no 16. Includes a bathtub, combination shower/tub, whirlpool tub, salon sink, or pedicure spa tub?
- yes no 17. Includes nonwater urinal?
- yes no 18. Includes a sump pump or a macerating toilet system?
- yes no 19. Includes a hand sink, three-compartment sink, or food prep sink?
- yes no 20. Unsure if the work may qualify or not?

DLI Plumbing Program – Plan Review Agreements

- Cities with formal plan review agreements with DLI, approx. 35 cities
- Plumbing Plans may be submitted directly to the city, except for the following:
 - Hospitals, nursing homes, supervised living facilities, or other similar state-licensed facilities
 - Public buildings owned by state or state agency
 - Projects of special nature
- Agreement with the municipality:
 - Adopted plumbing code and authorizing ordinances
 - Licensed master plumber or professional engineer
 - Pass a plan review test from our department

DLI Plumbing Program – Application

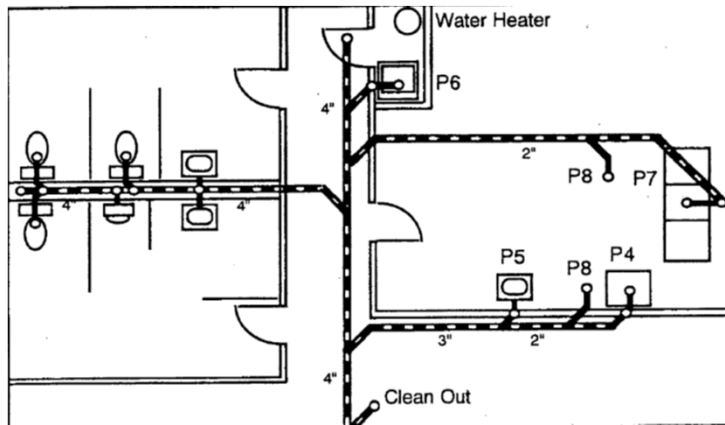
Minnesota Department of Labor and Industry Construction Codes and Licensing Division Plumbing Plan Review and Inspections 443 Lafayette Road N., St. Paul, MN 55155-4343 Phone: (651) 284-5063 Fax: (651) 284-5748 www.dli.mn.gov/CCLD/Plumbing.asp												
Plumbing Plan Review Application Reset												
<i>When e-mail addresses are provided, correspondence will be sent electronically rather than by the USPS.</i>												
Type of Project (check all that apply) <input type="checkbox"/> New Construction <input type="checkbox"/> Addition <input type="checkbox"/> Remodel <input type="checkbox"/> Food service/bar/lodging <input type="checkbox"/> Hospital/Nursing Home												
Building Service Information <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">SEWER</td> <td style="width: 50%;">WATER</td> </tr> <tr> <td><input type="checkbox"/> New municipal</td> <td><input type="checkbox"/> New municipal</td> </tr> <tr> <td><input type="checkbox"/> Existing municipal</td> <td><input type="checkbox"/> Existing municipal</td> </tr> <tr> <td><input type="checkbox"/> New on-site septic system</td> <td><input type="checkbox"/> New private well</td> </tr> <tr> <td><input type="checkbox"/> Existing on-site septic system</td> <td><input type="checkbox"/> Existing private well</td> </tr> </table>			SEWER	WATER	<input type="checkbox"/> New municipal	<input type="checkbox"/> New municipal	<input type="checkbox"/> Existing municipal	<input type="checkbox"/> Existing municipal	<input type="checkbox"/> New on-site septic system	<input type="checkbox"/> New private well	<input type="checkbox"/> Existing on-site septic system	<input type="checkbox"/> Existing private well
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Project Information and Location PROJECT NAME _____ PROJECT STREET ADDRESS _____ CITY _____ TOWNSHIP _____ COUNTY _____ (if not in city limits)												
Plan Review Applicant NAME _____ PHONE NUMBER _____ MAILING ADDRESS _____ EMAIL _____ CITY _____ STATE _____ ZIP CODE _____												
Plumbing System Designer NAME _____ PHONE NUMBER _____ MAILING ADDRESS _____ EMAIL _____ CITY _____ STATE _____ ZIP CODE _____												
Plan Submittal Format (see back) <input type="checkbox"/> Paper <input type="checkbox"/> Electronic												
Fee Schedule												
1. Choose only one of the following:												
<input type="checkbox"/> Building Sanitary Sewer and/or Water Service Only \$ _____ (This fee applies when scope of work does NOT include interior plumbing) \$150 flat rate - OR -												
<input type="checkbox"/> Plumbing System - OR - (This fee applies to interior water distribution and drain/waste/vent systems, and water and/or sewer service connections) Based on total number of drainage fixture units (DFU)												
a. 25 or fewer DFU _____ \$150 b. 26 to 50 DFU _____ \$250 c. 51 to 150 DFU _____ \$350 d. 151 to 249 DFU _____ \$500 e. 250 or more DFU: multiply \$3 times number of DFU to a maximum of \$4,000 Total DFU _____ \$ _____												
<input type="checkbox"/> 2. Interceptors/Separators (grease interceptors, flammable waste interceptors, etc...) \$70 per design \$ _____												

Project Owner	
NAME _____	PHONE NUMBER _____
MAILING ADDRESS _____	EMAIL _____
CITY _____	STATE _____ ZIP CODE _____
Required Information	
Provide one full-size set of plans that include the following:	
<input type="checkbox"/> Utility Site Plan (if new services are to be installed) <input type="checkbox"/> Floor Plan (show fixtures/horizontal waste piping/pipe sizes) <input type="checkbox"/> Roof Plan (if internally piped roof drains are proposed) <input type="checkbox"/> Water Riser Diagrams <input type="checkbox"/> Soil, Waste and Vent Riser Diagrams <input type="checkbox"/> Plumbing Specifications <input type="checkbox"/> Designer's Signature & License No. (on each plan sheet)	
<input type="checkbox"/> 3. Storm Drainage System (\$150 min) a) Roof drains and overflow roof drains Number of roof drains: _____ X \$50 \$ _____ (\$500 max)	
and/or plus	
b) Storm water interceptor, separator, or catch basin designs Number of designs: _____ X \$70 \$ _____ Storm Total: \$ _____ (\$150 min)	
TOTAL (add fees from Items 1, 2, and 3) \$ _____	
Check or money order must be made payable to Minnesota Department of Labor and Industry (DLI). Mail plans and fees to: MN DLI, Plumbing Plan Review and Inspection, 443 Lafayette Road N., St. Paul, Minnesota 55155-4343.	

New Construction – What to Submit

- Utility Site Plan – Include all plumbing (water, sanitary, storm) within the property lines, with the designer's signature and license number
- Roof plan showing the pitch, location and area served by each drain
- Floor plan showing all new plumbing fixtures, waste piping and sizes
- Waste and vent, and water riser diagrams
- Provide specifications, including:
 - A Schedule of fixtures and appurtenances, including manufacturer and model number
 - The type and quality standard (e.g. ASTM, ANSI, etc.) of pipe materials to be used

Remodeling – What to Submit



- Floor Plan with existing piping
- Riser Diagrams
- Materials
- Fixture Specifications

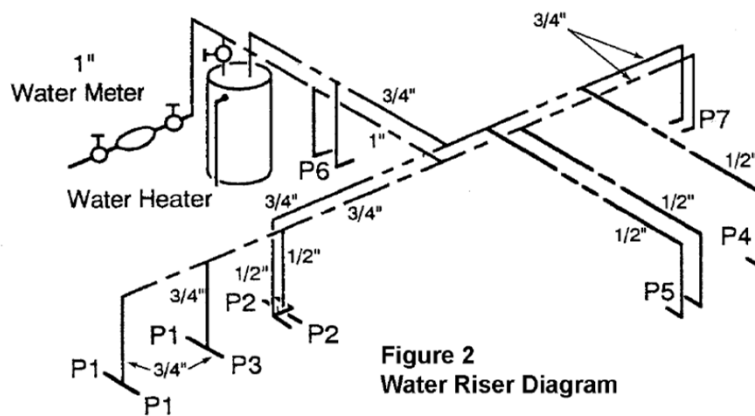
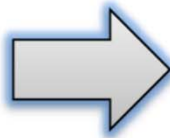


Figure 2
Water Riser Diagram

Electronic Plan Review



Alternate Requests (301.2)

- Code not intended to prevent systems or methods not prescribed
- May be presented and approved by the Authority Having Jurisdiction (AHJ), but shall have no effect on other projects or beyond jurisdictional boundaries
- What to submit:
 - Provide written request from designer and owner requesting an alternate
 - Reasons and benefits, description of impact, description of equivalence
 - Confirmation of acceptance from the local administrative authority
 - Provide nationally recognized standards for support
 - Manufacturer's recommendation or instructions
 - Any other relevant supporting information



Changes in the 2015 Minnesota Plumbing Code

Fixtures

- Lavatories
 - Must have self-closing or self-closing metering faucets limiting flow to 0.26 gallons per use (403.4) at transient public facilities (airports, restaurants, service stations, etc).
 - Public-use lavatories must have an ASSE 1070 mixing valve limiting the hot water temperature to 110 degrees Fahrenheit or less (421.2).
- Showers
 - Waste outlet and tailpiece min. 2 inches (408.4)
 - Shower valves must be adjustable without the user entering the shower spray. Shower heads may not be directed at the shower entrance (408.9)
- Dishwashers
 - Domestic-type dishwashers must discharge indirectly through an ASSE 1021 or IAPMO PS23-2006a listed air gap fitting (see Minnesota Rules, Chapter 4714, Sections 414.3 and 807.4). The discharge may be routed to a waste receptor, to a wye branch fitting on a kitchen sink tailpiece, or to the dishwasher connection of a food waste grinder.

Fixtures – Floor Drains

- All floor drains, trench drains, and floor sinks must be vented (1002.1)
- Location (418.3):
 - Toilet rooms containing two or more water closets or a combination of one water closet and one urinal, except in a dwelling unit
 - Commercial kitchens and laundry rooms in commercial buildings or multi-family dwelling units

- Sizing:

**TABLE 702.2(a)
MAXIMUM DRAINAGE FIXTURE UNITS FOR A
TRAP AND TRAP ARM***

SIZE OF TRAP AND TRAP ARM (inches)	DRAINAGE FIXTURE UNIT VALUES (DFU)
1¼	1 unit
1½	3 units
2	4 units
3	6 units
4	8 units

**TABLE 702.2(b)
DISCHARGE CAPACITY IN GALLONS PER MINUTE FOR
INTERMITTENT FLOW ONLY***

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

- Emergency floor drains receive 0 DFU (restroom, disaster pan, emergency equipment)

Sanitary Drainage - Materials

TABLE 701.1
MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS

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

* For building sewer applications.

Sanitary Drainage – Drainage Fixture Units

TABLE 702.1
DRAINAGE FIXTURE UNIT VALUES (DFU)

PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	MINIMUM SIZE TRAP AND TRAP ARM ⁶ (inches)	PRIVATE	PUBLIC	ASSEMBLY ⁷
Bathtub or Combination Bath/Shower	1½	2.0	2.0	—
Bidet	1¼	1.0	—	—
Bidet	1½	2.0	—	—
Clothes Washer, domestic, standpipe ⁵	2	3.0	3.0	3.0
Dental Unit, cuspidor	1¼	—	1.0	1.0
Dishwasher, domestic, with independent drain ²	1½	2.0	2.0	2.0
Drinking Fountain or Water Cooler	1¼	0.5	0.5	1.0
Food Waste Grinder, commercial	2	—	3.0	3.0
Floor Drain, emergency	2	—	0.0	0.0
Floor Drain (for additional sizes see Section 702.0)	2	2.0	2.0	2.0
Shower, single-head trap	2	2.0	2.0	2.0
Multi-head, each additional	2	1.0	1.0	1.0
Lavatory, single	1¼	1.0	1.0	1.0
Lavatory, in sets of two or three	1½	2.0	2.0	2.0
Washfountain	1½	—	2.0	2.0
Washfountain	2	—	3.0	3.0
Mobile Home, trap	3	12.0	—	—
Receptor, indirect waste ^{1,3}	1½	See footnote ^{1,3}		
Receptor, indirect waste ^{1,4}	2	See footnote ^{1,4}		
Receptor, indirect waste ¹	3	See footnote ¹		
Sinks	—	—	—	—
Bar	1½	1.0	—	—
Bar ²	1½	—	2.0	2.0
Clinical	3	—	6.0	6.0

Sanitary Drainage – Drainage Fixture Units

Commercial with food waste ²	1½	—	3.0	3.0
Commercial pot or scullery	2	—	4.0	4.0
Special Purpose ²	1½	2.0	3.0	3.0
Special Purpose	2	3.0	4.0	4.0
Special Purpose	3	—	6.0	6.0
Kitchen, domestic ² (with or without food waste grinder, dishwasher, or both)	1½	2.0	2.0	—
Laundry ² (with or without discharge from a clothes washer)	1½	2.0	2.0	2.0
Service or Mop Basin	2	—	3.0	3.0
Service or Mop Basin	3	—	3.0	3.0
Service, flushing rim	3	—	6.0	6.0
Wash, each set of faucets	—	—	2.0	2.0
Urinal, integral trap 1.0 GPF ²	2	2.0	2.0	5.0
Urinal, integral trap greater than 1.0 GPF	2	2.0	2.0	6.0
Urinal, exposed trap ²	1½	2.0	2.0	5.0
Water Closet, 1.6 GPF Gravity Tank	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Tank	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Valve	3	3.0	4.0	6.0
Water Closet, greater than 1.6 GPF Gravity Tank ⁶	3	4.0	6.0	8.0
Water Closet, greater than 1.6 GPF Flushometer Valve	3	4.0	6.0	8.0

For SI units: 1 inch = 25 mm

Notes:

- ¹ Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain therein to, in accordance with Table 702.2(b).
- ² Provide a 2 inch (50 mm) minimum drain.
- ³ For refrigerators, coffee urns, water stations, and similar low demands.
- ⁴ For commercial sinks, dishwashers, and similar moderate or heavy demands.
- ⁵ Buildings having a clothes-washing area with clothes washers in a battery of three or more clothes washers shall be rated at 6 fixture units each for purposes of sizing common horizontal and vertical drainage piping.
- ⁶ Trap sizes shall not be increased to the point where the fixture discharge is capable of being inadequate to maintain their self-scouring properties.
- ⁷ Assembly [See Minnesota Rules, chapter 1305, International Building Code].

Sanitary Drainage – Waste & Drain Sizing

TABLE 703.2
MAXIMUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING

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

Notes:

- ¹ Excluding trap arm.
- ² Except sinks, urinals, and dishwashers – exceeding 1 fixture unit.
- ³ Except six-unit traps or water closets.
- ⁴ Only four water closets or six-unit traps allowed on a vertical pipe or stack; and not to exceed three water closets or six-unit traps on a horizontal branch or drain.
- ⁵ Based on ¼ inch per foot (20.8 mm/m) slope. For ⅛ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.
- ⁶ The diameter of an individual vent shall be not less than 1¼ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2(b). Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.2.

Sanitary Drainage

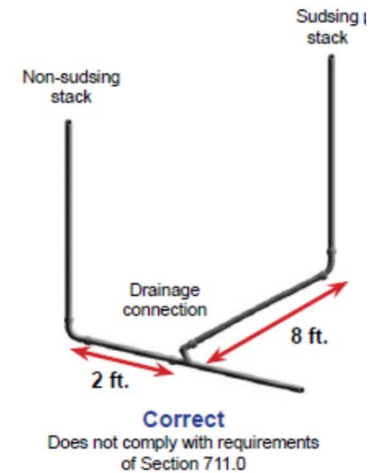
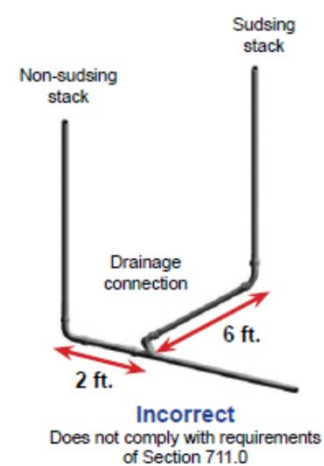
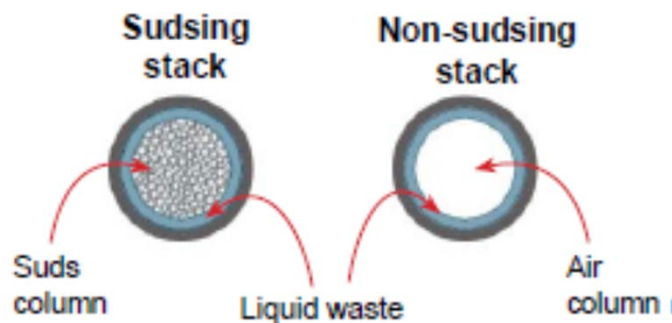
- Sanitary Buildings Sewers and Drains
 - ¼ inch per foot slope unless site or building conditions preclude this slope, approved by Authority Having Jurisdiction (AHJ), and within the max/min DFU count in Table 717.1
- Ejectors & Pumps
 - Only when gravity is not practical
 - Dual alternating pumping equipment is required for public-use occupancy
 - Receiving water closet or urinal (710.3): 2-inch min ball and 3-inch min discharge line
 - Grinder pump ejector – sized for peak flows from all fixtures (Appendix A, Table A2.1)

Sanitary Drainage

- 2-inch Minimum Fixture Drains (Tables 702.1 and 703.2)
 - All sinks, except for lavatories and private-use bar sinks, must be provided with 2-inch minimum vertical fixture drains. Laundry tubs, domestic clothes washers, and urinals also require 2-inch minimum vertical drains.
 - Trap and trap arms may be 1½-inch in diameter.
- 2-inch minimum shower trap and drain (Table 702.1)
- Fixture Connection: Back-to-Back or Side-by-Side fixtures must use approved Double-Fitting with inlet openings at same level

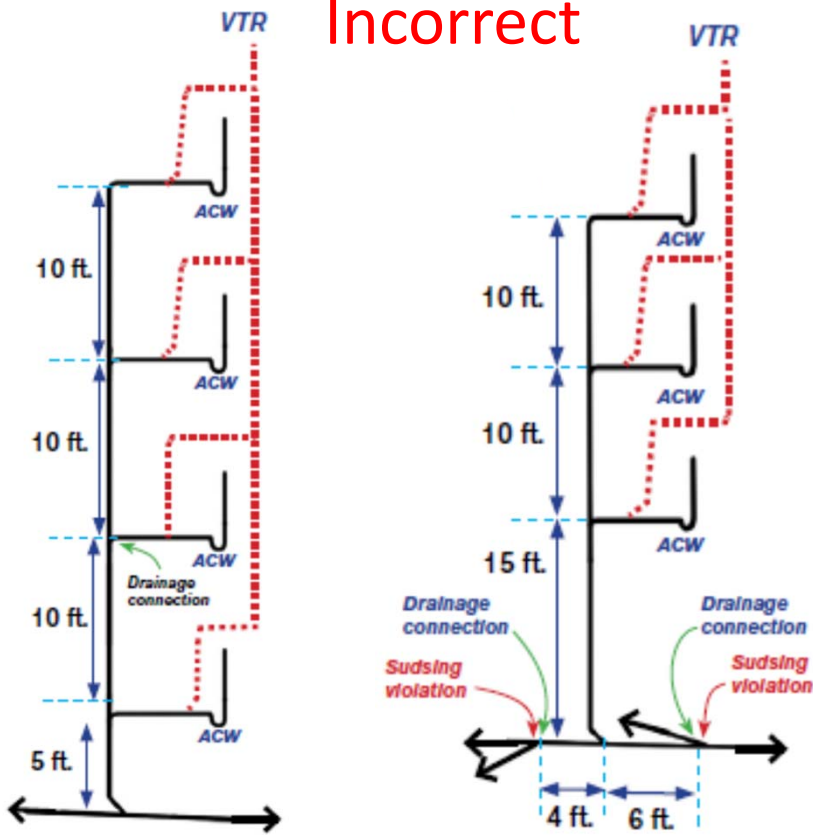
Sanitary Drainage – Suds Producing Stacks

- For stacks serving more than two stories of fixtures, no drainage connection may be made within 8 feet of the base of a stack serving bathtubs, laundry tubs, clothes washers, kitchen sinks, or dishwashers (711.1).
- Includes any other fixture, fixture branch or horizontal drainage branch

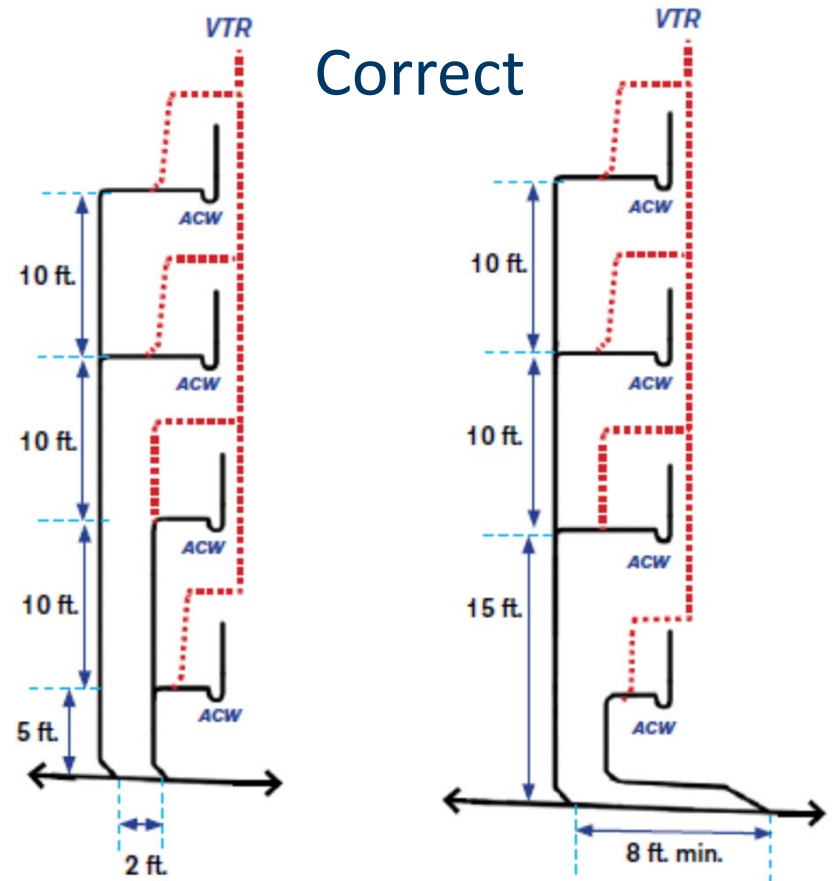


Sanitary Drainage – Suds Producing Stacks

Incorrect



Correct



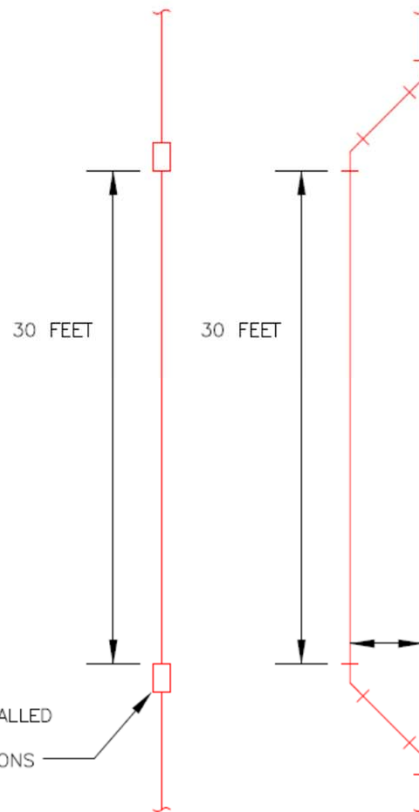
Sanitary Drainage & Vent – Plastic Piping

INSTALLATION STANDARDS IAPMO IS 5-2006 AND 9-2006:
THERMAL EXPANSION AND CONTRACTION MAY BE CONTROLLED BY OFFSETS,
EXPANSION JOINTS, OR RESTRAINTS.

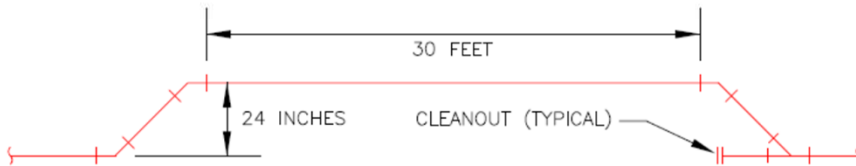
REGARDLESS OF THE METHOD UTILIZED, THE FOLLOWING CONDITIONS MUST BE MET:

1. SUPPORT, BUT DO NOT RIGIDLY RESTRAIN PIPING AT CHANGES OF DIRECTION.
2. DO NOT ANCHOR PIPE RIGIDLY IN WALLS.
3. HOLES THROUGH FRAMING MEMBERS MUST BE ADEQUATELY SIZED TO ALLOW FOR FREE MOVEMENT.

VERTICAL INSTALLATION



HORIZONTAL INSTALLATION



ABOVE GROUND HORIZONTAL PIPES MUST BE SUPPORTED AT EACH HORIZONTAL BRANCH CONNECTION. RESTRAINT FITTINGS OR A MINIMUM 24-INCH OFFSET USING 45 DEGREE FITTINGS SHOULD BE PROVIDED EVERY 30 FEET.

A CLEANOUT MUST BE PROVIDED IN A DRAINAGE PIPE FOR EACH AGGREGATE HORIZONTAL CHANGE OF DIRECTION EXCEEDING 135 DEGREES (SEE M.R., CHAPTER 4714, SECTION 707.4).

CLEANOUTS AND EXPANSION JOINTS MUST BE INSTALLED IN AN ACCESSIBLE LOCATION (SEE M.R., CHAPTER 4714, SECTIONS 705.10.2 AND 707.8).

EXPANSION JOINTS INSTALLED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS

Vents

- Full size 3-inch is no longer required. A building's vent pipes must have total cross-sectional area not less than the area of the largest required building sewer (904.1).
- Horizontal vent pipe length and sizing has significantly changed (Table 703.2):
- No flat vents, must rise within 45 degrees from the vertical at least 6 inches above flood level rim (905.3).
- Outdoor Installations – extend not less than 10 feet above the ground



Sanitary Drainage – Vent Sizing & Lengths

SIZE OF PIPE (inches)	1¼	1½	2	2½	3	4	5	6	8	10	12
Vent Piping											
Horizontal and Vertical ⁶											
Maximum Units	1	8 ³	24	48	84	256	600	1380	3600	—	—
Maximum Lengths, (feet)	45	60	120	180	212	300	390	510	750		

Notes:

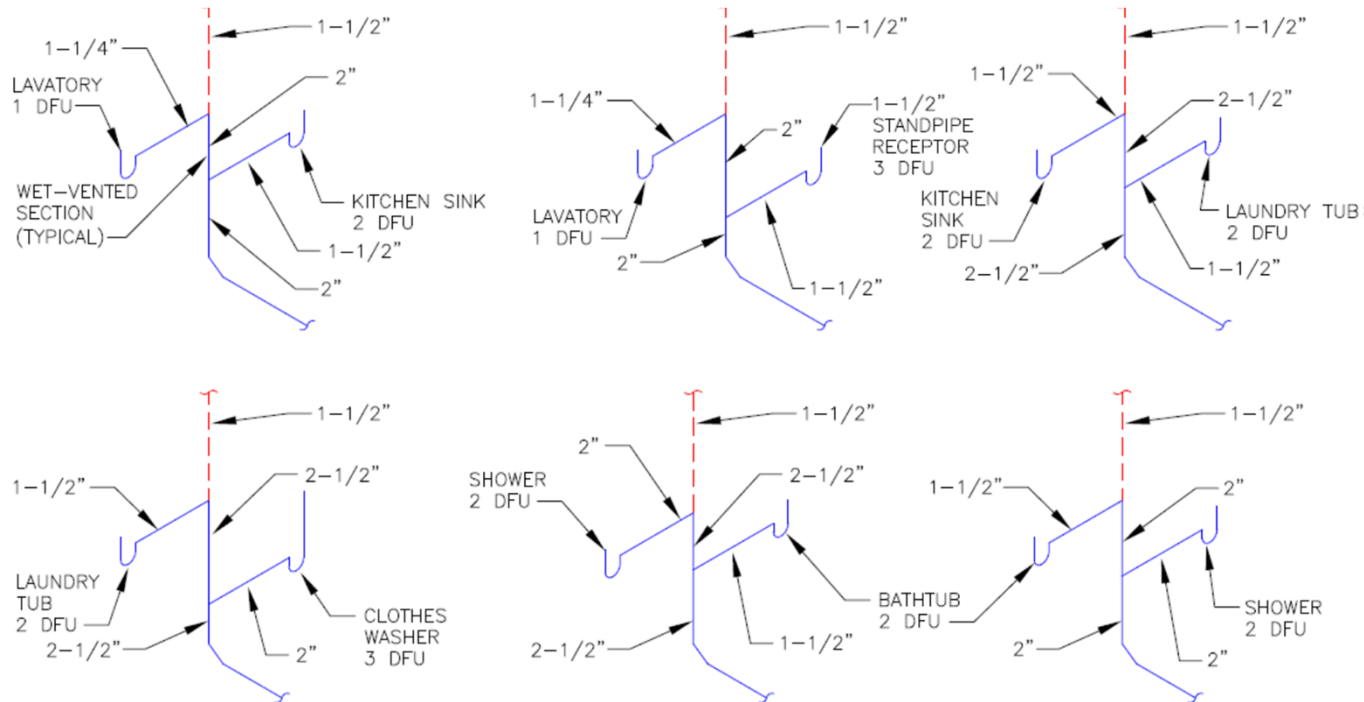
- ¹ Excluding trap arm.
- ² Except sinks, urinals, and dishwashers – exceeding 1 fixture unit.
- ³ Except six-unit traps or water closets.
- ⁴ Only four water closets or six-unit traps allowed on a vertical pipe or stack; and not to exceed three water closets or six-unit traps on a horizontal branch or drain.
- ⁵ Based on ¼ inch per foot (20.8 mm/m) slope. For ⅛ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.
- ⁶ The diameter of an individual vent shall be not less than 1¼ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2(b). Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.2.

Vents

- Combination Waste and Vent Systems (910.0 and Appendix B):
 - Only permitted where structural conditions preclude the installation of conventional systems
 - Must be approved by AHJ
 - Only floor drains and floor sinks
 - Only 1, 2, and 3 DFU fixtures remotely located from the sanitary system shall be able to be connected in a conventional manner
 - No greasy waste or restaurant kitchen equipment
 - A branch exceeding 15 feet in length shall be separately vented in an approved manner
 - Size of waste pipe and trap ***two pipe sizes larger*** than required
- Engineered Vent System (911.0)
 - ALTERNATE by a registered engineer in accordance with 301.4
 - Trap seal protection, pressure less than 1 inch water column of outlet side of trap

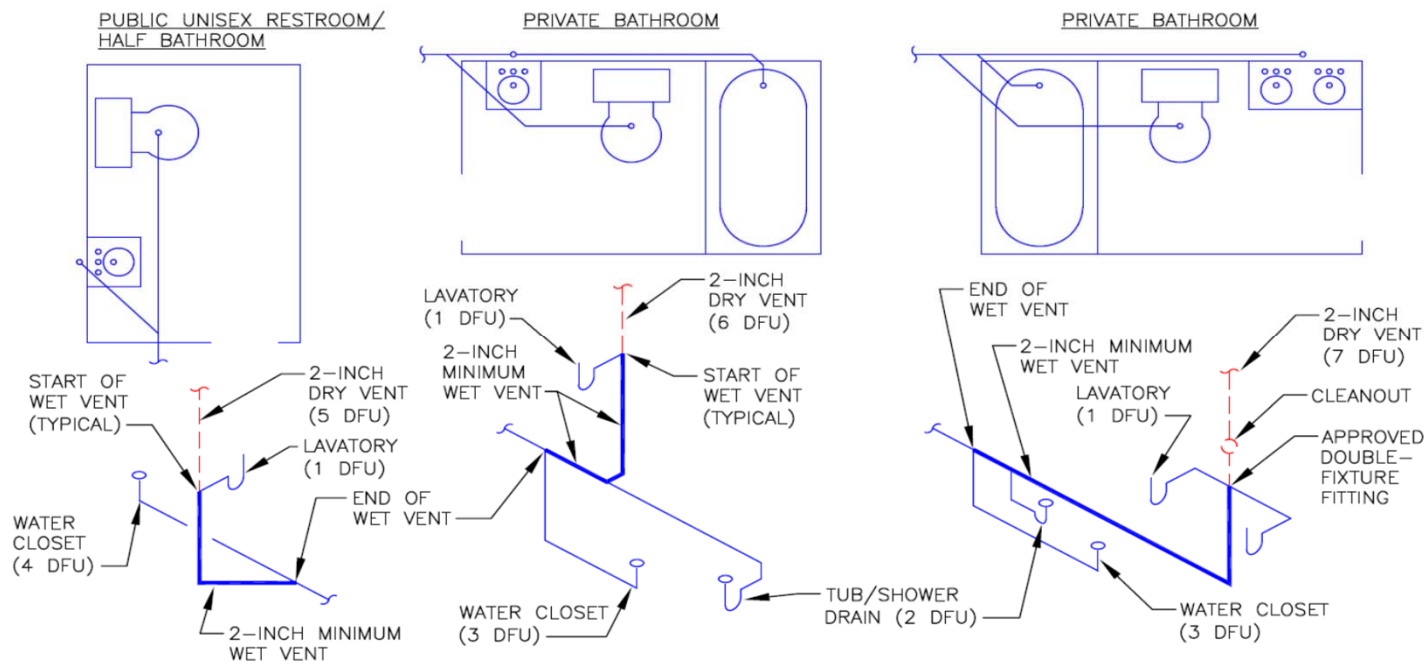
Vents – Vertical Wet Venting

- Limited to vertical drain receiving the discharge from 1 and 2 DFU fixtures, not exceeding four total fixtures
- Limited to same story and the wet vent must not exceed 6 feet in developed length
- The vertical drain must be one size larger than the upper fixture drain(s) required, but not smaller than 2 inches



Vents – Horizontal Wet Venting

- The length of the trap arm must not exceed the limits of Table 1002.2
- The water closet fixture drain connection must be downstream of all fixture drain connections to the horiz. wet vent
- Only one wet-vented fixture drain shall discharge upstream of the dry-vented fixture drain connection
- The dry vent must be sized based on the total DFU discharging into the wet vent
- The wet vent must be at least 2-inch in size for 4 DFU or less and not less than 3-inch in size for 5 DFU or more



Water Supply and Distribution

- Backflow Prevention Devices (603.5.23)
 - Annual testing of Reduced Pressure Zone Backflow Preventers (RPZ), Pressure Vacuum Breakers, Spill-Resistant Pressure Vacuum Breakers, and Double Check Valve Assemblies
 - Administrative Authority notification of installation within 30 days
 - Integral backflow protection shall comply with ASME A112.18.1/CSA B 125.1
- Fire Protection (603.5.15)
 - Low Hazard: Required Double Check Valve Assembly
 - High Hazard: RPZ
 - Fire Department Connection: Potable connection less than 1700 feet from a nonpotable water source, potable connection must be protected by an RPZ

Water Supply and Distribution - Materials

TABLE 604.1
MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS

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

* For building supply or cold-water applications.

Water Supply and Distribution

- Flexible Copper or SS Corrugated Connectors (604.12)
 - Fixture Connectors – 30 inches Washing Machine Connectors – 72 inches
 - Dishwasher & Ice Mancines – 120 inches Water Heaters – 24 inches max, per manufacturer
- Push Fit Fittings (ASSE 1061) – approved for Copper, CPVC
- Cross-link polyethylene (PEX) water distribution and fittings (605.10):
 - Installation per manufacturer’s installation requirements
 - ASTM F876 tubing must be marked with the standard of the fittings to be utilized
 - The fittings shall comply and be marked in accordance with Table 604.1

Water Sizing – Method 1

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

Notes:

1. Size of the cold branch pipe, or both the hot and cold branch pipes.
2. Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.
3. The listed fixture unit values represent their load on the cold water building supply. The separate cold and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as ¾ of the listed value.
4. The listed minimum supply branch pipe sizes for individual fixtures are the nominal pipe size.
5. For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) and add it separately to the demand gpm for the distribution system or portions thereof.
6. Assembly (Public Use), see Minnesota Rules, Chapter 1305, IBC.
7. Where sizing flushometer systems, see 610.10.
8. Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.

Water Sizing – Method 1

TABLE 610.4
FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES

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

TABLE 610.10
FLUSHOMETER FIXTURE UNITS FOR WATER SIZING USING TABLE 610.3

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

Water Sizing – Method 2: Table A 2.1

APPLIANCES, APPURTENANCES, OR FIXTURES ²	MINIMUM FIXTURE BRANCH PIPE SIZE ^{1,4} (inches)	PRIVATE	PUBLIC	ASSEMBLY ⁶
Bathtub or Combination Bath/ Shower (fill)	½	4.0	4.0	–
¾ inch Bathtub Fill Valve	¾	10.0	10.0	–
Bidet	½	1.0	–	–
Clothes Washer	½	4.0	4.0	–
Dental Unit, cuspidor	½	–	1.0	–
Dishwasher, domestic	½	1.5	1.5	–
Drinking Fountain or Water Cooler	½	0.5	0.5	0.75
Hose Bibb	½	2.5	2.5	–
Hose Bibb, each additional ⁷	½	1.0	1.0	–
Lavatory	½	1.0	1.0	1.0
Lawn Sprinkler, each head ⁵	–	1.0	1.0	–
Mobile Home, each (minimum)	–	12.0	–	–
Sinks	–	–	–	–
Bar	½	1.0	2.0	–
Clinic Faucet	½	–	3.0	–
Clinic Flushometer Valve with or without faucet	1	–	8.0	–
Kitchen, domestic	½	1.5	1.5	–
Laundry	½	1.5	1.5	–
Service or Mop Basin	½	1.5	3.0	–
Washup, each set of faucets	½	–	2.0	–
Shower per head	½	2.0	2.0	–
Urinal, 1.0 GPF Flushometer Valve	¾	3.0	4.0	5.0
Urinal, greater than 1.0 GPF Flushometer Valve	¾	4.0	5.0	6.0
Urinal, flush tank	½	2.0	2.0	3.0
Wash Fountain, circular spray	¾	–	4.0	–
Water Closet, 1.6 GPF Gravity Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	1	5.0	5.0	8.0
Water Closet, greater than 1.6 GPF Gravity Tank	½	3.0	5.5	7.0
Water Closet, greater than 1.6 GPF Flushometer Valve	1	7.0	8.0	10.0

Notes:

1. Size of the cold branch pipe, or both the hot and cold branch pipes.
2. Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.
3. The listed fixture unit values represent their load on the cold water building supply. The separate cold and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as ¾ of the listed value.
4. The listed minimum supply branch pipe sizes for individual fixtures are the nominal pipe size.
5. For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) and add it separately to the demand gpm for the distribution system or portions thereof.
6. Assembly (Public Use), see Minnesota Rules, Chapter 1305, IBC.
7. Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.

Water Sizing – Method 2

CHART A 2.1
ESTIMATE CURVES FOR DEMAND LOAD

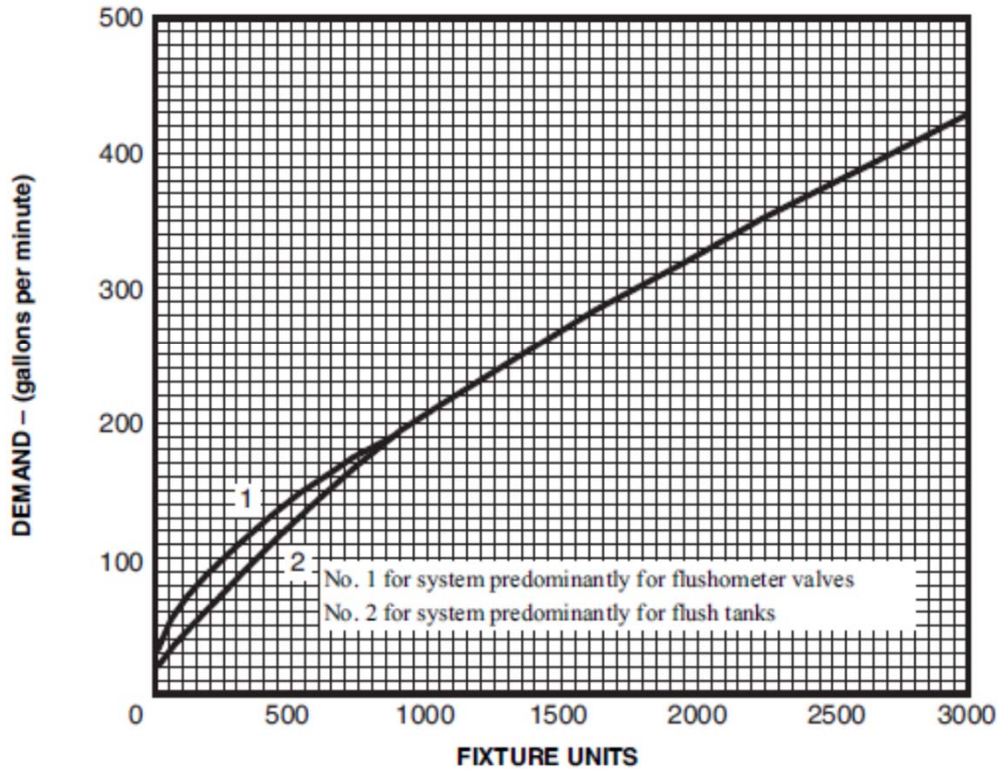
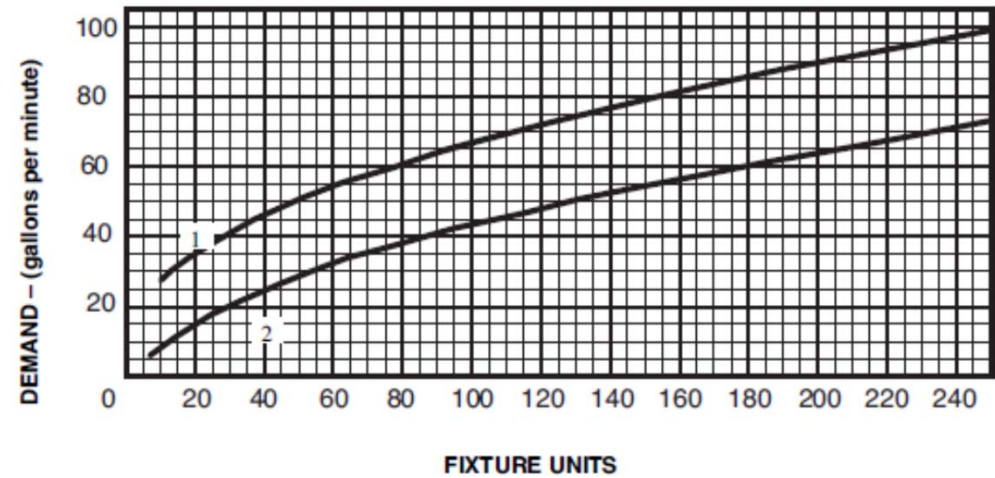
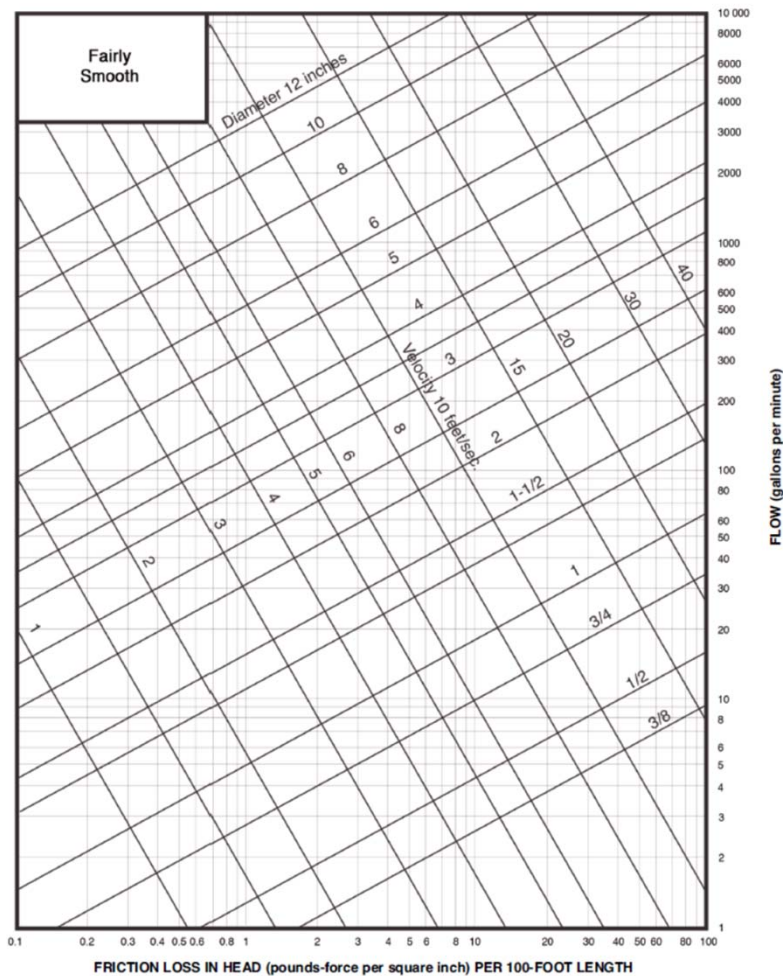


CHART A 2.1(1)
ENLARGED SCALE DEMAND LOAD



Water Sizing – Method 2

CHART A 4.1(1)



- Velocity Limitations

- Copper systems or tubing systems using copper alloy fittings may not exceed 8 feet per second for cold water, or 5 feet per second for hot water (610.12).
- CPVC hot or cold water systems may not exceed 8 feet per second (Installation Standard 20).
- Other systems not utilizing copper alloy fittings may not exceed 10 feet per second (Appendix A, 6.1).

Stormwater Drainage

- Sizing:
 - 4-inch per hour rainfall (1101.11.1 and Table 1101.7)
 - Sizing of roof drains now includes side walls draining onto a roof (1106.4)
- Materials:
 - Inside rainwater leaders (1102.1) – same as drain, waste, and vent piping
 - Building storm sewer = building sewer pipe (sanitary)
- Rainwater sumps
 - Dual pumps required to function alternately



Site Utilities

- Water Service Crossings and Isolation Distances
 - The bottom of the water service crossing a sewer of clay or materials not approved within a building must be at least 12 inches above the top of the sewer (609.2 and 720.1). This applies to sanitary and stormwater drainage piping
 - A minimum horizontal separation of 10 feet should be maintained between the building supply service and any sewer, whenever possible. A building sewer pipe may be in a common trench with water pipe if the sewer pipe material is approved for use within a building.
 - The water service must be installed at least 10 feet horizontally from any manhole, catchbasin, or other source of contamination, measured from the outer edge of the pipe to the outer edge of the contamination source (609.6.1).
- Water Service Materials
 - PEX is now an option
- Stormwater Materials:
 - High-density polyethylene (HDPE) storm sewers must meet ASTM F714 (1102.4 and Installation Standard 1). AASHTO M252 HDPE pipes 4-inch to 10-inch in size or ASTM F2306 HDPE pipes 12-inch to 60-inch with ASTM D3212 fittings may be installed if approved by the local building official as an alternate material prior to installation (301.2).
 - Reinforced concrete (RCP) storm sewers complying with ASTM C76 may be installed if approved by the local building official prior to installation (Section 301.2). Otherwise, concrete sewer pipe shall conform to ASTM C14, Class 2 (Installation Standard 1).

Site Utilities

- Sanitary Sewer Materials

- ASTM F714 HDPE sanitary sewers must be installed per Table 701.1, and Installation Standard 1. Heat fusion joints must be utilized per the manufacturer's installation instructions, and ASTM D2657 or ASTM D3261. Gravity sewers must be installed by open trench on a continuous granular bed per ASTM D2321 (718.1).

- Sanitary Sewer Slope: $\frac{1}{4}$ inch per foot

- Approved by AHJ and meets the table
- Municipal Utility Easement

SIZE OF PIPE (inches)	SLOPE, (inches per foot)		
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$
6 and smaller	(As specified in Table 703.2/ No minimum loading)		
8	1950/1500	2800/625	3900/275
10	3400/1600	4900/675	6800/300
12	5600/1700	8000/725	11 200/325

Opportunities for Reuse

- Rainwater Harvesting System (Chapter 17, Nonpotable Rainwater Catchment Systems)
 - Scope and Applicability
 - Collection from roof surfaces or similar
 - Supply uses such as: water closets, urinals, trap primers, industrial processes, water features, vehicle washing facilities, cooling tower makeup and similar.
 - Combined Uses: Irrigation with a combination of any of the above
 - Excluded:
 - Collection from vehicular parking surfaces, surface water runoff, bodies of standing water, similar nonroof surfaces
 - Rainwater catchment systems used for only lawn irrigation are not covered
- Is Graywater Reuse Allowed?
 - Not allowed in code
 - Must seek approval by a variance request through the Plumbing Board

Nonpotable Rainwater Catchment Systems

- Approved Materials (1702.7)
 - Water Supply/Distribution must meet potable materials (Chapter 6)
 - Drainage must meet roof drainage material (Chapter 11 and Chapter 7)
- Signage/Marking Requirements (1702.8)
- Owner is Responsible for ALL Operation, Maintenance, Monitoring, Testing, and Inspection of the system
- Cross Connection Tests (Table 1702.12)
 - Initial Test
 - Every 5 years thereafter
 - Present of AHJ



FIGURE 1702.9

Nonpotable Rainwater Catchment Systems

- Rainwater Storage Tank Requirements (1702.9.5)
- Overflows from roof-mounted equipment shall not discharge to system
- Minimum Water Quality:

TABLE 1702.9.4	
Measure	Limit
Turbidity (NTU)	<1
E. coli (MPN/100 mL)	2.2
Odor	Non-offensive
Temperature (degrees Celsius)	MR
Color	MR
pH	MR
MR = measure and record only Treatment: 5 micron or smaller absolute filter Minimum .5-log inactivation of viruses	

Nonpotable Rainwater Catchment Systems

TABLE 1702.12	
MINIMUM ALTERNATE WATER SOURCE TESTING, INSPECTION, AND MAINTENANCE FREQUENCY	
DESCRIPTION	MINIMUM FREQUENCY
Inspect and clean filters and screens, and replace.	Every three months
Inspect and verify that required disinfection, filters and water quality treatment devices and systems are operational and maintaining minimum water quality requirements in Table 1702.9.4.	After initial installation and monthly thereafter. Exception: Every 12 months thereafter when electronically monitored.
Inspect and clear debris from rainwater gutters, downspouts, and roof washers.	At the beginning of seasonal usage and monthly during seasonal usage.
Inspect and clear debris from roof or other aboveground rainwater collection surfaces.	At the beginning of seasonal usage and monthly during seasonal usage.
Remove tree branches and vegetation overhanging roof or other aboveground rainwater collection surfaces.	As needed
Inspect pumps and verify operation.	After initial installation and every 12 months thereafter
Inspect valves and verify operation.	After initial installation and every 12 months thereafter
Inspect pressure tanks and verify operation.	After initial installation and every 12 months thereafter
Clear debris from and inspect storage tanks, locking devices, and verify operation.	After initial installation and every 12 months thereafter
Inspect caution labels and marking.	After initial installation and every 12 months thereafter
Cross-connection inspection and test*	After initial installation and thereafter in accordance with Section 1702.11.2.4.

* The cross-connection inspection and test shall be performed in accordance with this chapter by a plumber licensed under Minnesota Statutes, section 326B.46 and certified to ASSE Standard 5120.

Flammable Waste Interceptors (1017.0)

- When Required?
 - Drains in auto repair shops, service stations, and similar factories
 - Drains in commercial garages and car wash facilities
- When Not Required:
 - Residential one and two-family dwelling garages
- Facilities served by private disposal system
 - Flammable waste line must discharge to holding tank
- Discharge line must be served by minimum 2-inch vent

Manufacture Rated vs. Not Rated Interceptors

- Rated Interceptors:
 - Each rated interceptor must be stamped or labeled for full flow discharge rate in GPM
 - Rated units require both:
 - 2-inch minimum overflow line
 - Minimum 550-gallon underground storage tank
- Not Rated Interceptors:
 - Where not more than 3 vehicles are serviced and/or stored, a minimum capacity of 6 cubic feet (45 gallons)
 - 1 cubic foot (7.5 gallon) for each additional vehicle up to 10 vehicles
 - Above 10 vehicles subject to the AHJ

Top 10 Code Deficiencies

1. Unvented Floor drains
2. Vertically Wet vented floor drains with commercial kitchen sinks
3. Island vented floor drains
4. Sanitary sewer slope
5. Sanitary and storm sewer crossing materials
6. Simplex pumps
7. Vent DFU sizing and horizontal distances
8. 8-foot offsets for suds producing stacks
9. Trap to vent distances
10. Fixture DFU values

Thank You!

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