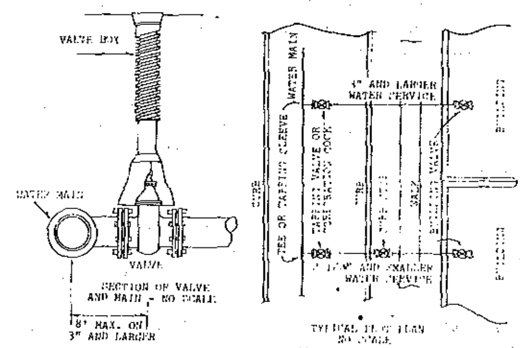
published ordinance or rule approved by the department. See ss. H 62.19 and H 62.24, Wis. Adm. Code for material standards.

(c) *Valve controls.* Water service controls shall include a corporation cock or valve at the main, a curb stop at or near the property line and inside the wall of each building and on the water distribution side of the water meter.

Note: The water service terminates at the meter valve or within 3 feet where the pipe penetrates the building floor or wall.

1. The corporation cock or valve at the main shall be a ground key stop-cock. An approved gate valve may be used for services 3 inches or larger.

2. The curb stop shall be an approved gate valve, ground key stop-cock or a ball valve which shall be installed between the curb and the property line. When a private water supply serves more than one building a curb stop is required for each building. For a water service 3 inches or larger, one valve may serve as the shut off at the main and for the curb stop. See following sketch.



3. Building and meter valves. An approved valve shall be provided at the meter or at a point not more than 3 feet inside where the service penetrates the building floor or wall and another on the water distribution side of the meter. A valved bypass shall be provided for all 1-½-inch or larger water meters. The bypass may be a minimum of one nominal pipe size smaller than the water service. When parallel meters are installed, a bypass may not be required provided the other meter (s) adequately serve the building water distribution requirements.

4. Prohibited valves. Combination stop and waste valves shall not be installed underground in water service piping. Frostproof yard hydrants shall be approved by the department.

(d) *Separation of water service and building sewers.* 1. Except as permitted below, the underground water service pipe and building sewer shall not be less than 8 feet apart horizontally and shall be separated by undisturbed or compacted earth. The water service pipe may be placed in the same trench with the building sewer under the following conditions:

a. The water service and the building sewer are installed concurrently.

b. The bottom of the water service pipe at all points shall be at least 12 inches above the top of the sewer line.

c. The water service pipe shall be placed on the solid shelf excavated at one side of the common trench or the water service be installed at the side of the common trench with the 12 inches of bedding material meeting the following criteria. The initial backfill on the sides of the sewer pipe and to the 12-inch depth above the sewer shall be well tamped prior to installing the water service pipe. The bedding material shall be of medium to coarse sand, pea gravel or rock screenings.

d. The number of joints in the water service pipe shall be kept to a minimum.

e. The water service shall be located a minimum of 10 feet from a septic tank or soil absorption site.

f. The materials and joints of water service pipe shall be installed in such a manner and shall possess the necessary strength and durability to prevent the escape of liquids and gases therefrom under adverse conditions such as corrosion, strain due to temperature changes, settlement, vibrations and superimposed loads.

2. Where the building sewer is existing, the water service pipe shall be installed in a separated trench pursuant to s. H 62.13 (2) (d) 1., excepting a replaced water service may be installed pursuant to s. H 62.13 (2) (d) 1. b. and c.

(3) FIXTURE SUPPLY. (a) *Potable water.* Only potable water shall be used in the processing of food, medical or pharmaceutical products, serving plumbing fixtures, appliances and appurtenances.

(b) *Identification.* Where 2 or more distribution systems are installed, each system shall be identified either by color marking, metal tags or other methods as may be approved by the department. All valves shall be tagged potable or nonpotable water.

1. Color marking. When color marking is used, potable water lines should be painted green and nonpotable water lines should be painted yellow. This requirement may be met by painting 3-inch wide bands at intervals of not more than 25 feet and at points where piping passes through walls, floors or roofs, in which case the bands shall be applied to the piping on both sides of the walls and both above and below the floor or roof. Points of outlets for nonpotable water shall be marked with a tag or color coded.

2. Metal tags. When tags are used, potable waterlines and valves shall be identified by 3-inch diameter metal tags bearing the legend SAFE WATER in letters not less than ½-inch in height. Nonpotable water lines and valves shall be identified by firmly attached metal tags having the shape of a 4-inch equilateral triangle bearing the legend WATER UNSAFE in letters not less than 7/16-inch in height. As in the use of color bands, tags shall be attached to pipes at intervals of not more than 25 feet and at either side of points where pipes pass through walls and above and below points where pipes pass through floors or roofs.

(4) WATER SERVICE AND DISTRIBUTION DESIGN. (a) *Design.* Water distribution piping systems shall be designed and installed so the maximum velocity through the piping shall not exceed 8 feet per second. Sizing of the water service and distribution system may be calculated and designed in accord with section H 62.13 (4) (b) or (c), whichever is applicable. Where street main pressures fluctuate, the water service, water meter and building distribution shall be designed for the minimum pressure available.

(b) *Sizing the water service and water distribution system by tables.* 1. Limitations. Where the total developed length of the water service is 75 feet or less and the total developed length of the water service and water distribution piping is 250 feet or less and the quantity of the water supply demand in total water supply fixture units, as determined from table 13 does not exceed the fixture units listed in tables 13a, 13b or 13c, the minimum size of the water service shall be determined from table 13a, 13b or 13c.

2. The following information is required. a. Pressures and elevations.

1) Maximum and minimum pressure at the water main or other supply source. The minimum pressure at the main is used for design purposes. The maximum design pressure of the water distribution system is 80 p.s.i.g.

2) The difference in elevation between the street main or other source and the highest fixture or outlet and the pressure loss through any equipment such as a water conditioner, water meter, water heater, water filter, pressure regulator, pressure reducing valves, reduced pressure backflow preventer or similar devices.

b. Length. The total developed length of the piping from the water main or other source of supply to the furthermost fixture.

c. Supply demand. The number of total water supply fixture units (s.f.u.) for all fixtures and other water uses as specified in table 13.

Note: See s. H 62.13 (4) (b) 2. d., for sizing and water service and distribution when flush valves are installed.

d. Supply demand; Flush valves. Branches, mains and risers serving water closet or similar flush valves may be sized from table 13a, 13b or 13c, when the following values are assigned to each flushometer valve by beginning with the most remote valve on each branch.

First	flushometer	valve	40	fixture	units
Second	"	"	30	"	"
Third	"	"	20	"	"
Fourth	"	"	15	"	"
Fifth	"	"	10	"	"

Five fixture unit value flushometer valves may be computed at half the above values. After the fifth flushometer valve on any main, branch or riser, fixture loadings may be computed using the values given in table 13. No piping supplying a flushometer valve shall be less than the valve inlet.

3. Sizing the water service. a. Table selection. After determining the minimum water pressure at the source as specified in 2. a. 1), subtract ½

pound per square inch of pressure for each 1 foot of difference in elevation between the source and the highest fixture and any pressure loss through equipment as specified section H 62.13 (4) (b) 2. a. 2). Select table 13a, 13b or 13c with the pressure ranges that contain the calculated pressure.

b. Length column selection. Select the length column that is equal to or greater than the total developed length.

c. Size column selection. Follow down the column to a fixture unit value (s.f.u.) equal to or greater than the total number of fixture units required for the installation. The size of the water service will be found in the column labeled water service.

4. Sizing the water distribution system. Starting at the most remote fixture on the cold water supply and the hot water supply, apply the cold water or hot water fixture supply demand units as applicable from table 13 to the cold water or hot water supply adding the fixture units as additional fixtures are connected. Using table 13a, 13b or 13c, as selected in section H 62.13 (4) (b) 3. a., and the length column selected in section H 62.13 (4) (b) 3. b., select a horizontal line that meets or exceeds the fixture unit demand of that section of piping. Except for the minimum requirements in section H 62.13 (4) (c) 1. e., f. and table 15, the size of the water distribution main, water distribution branch, fixture supply branches and risers will be found in the column labeled building distribution. The water distribution main serving water heaters and the cold water demand shall be sized to deliver the above required hot water demand, plus all required cold water demands but in no case need the piping be larger than that required for the total building supply as computed in s. H 62.13 (4) (b) 4.

Table 13

WATER SUPPLY FIXTURE DEMAND UNITS

Fixture	Occupancy	Type Control	Weight in Fixture Units		
			Hot	Cold	Total
Water Closet	Public	FL. Valve		10.	10.
Water Closet	Public	FL. Tank		5.	5.
Urinal	Public	½" FL. Valve		5.	5.
Urinal	Public	¾" FL. Valve		5.	5.
Lavatory	Public	Faucet	1.5	1.5	2.
Bathtub or Shower Head	Public	Faucet	3.	3.	4.
Service Sink	Offices, etc.	Faucet	2.25	2.25	3.
Kitchen Sink	Hotels-Restaurants	Faucet	3.	3.	4.
Drinking Fountain	Offices, etc.	⅜ Valve		0.25	0.25
Water Closet	Private	FL. Valve		6.	6.
Water Closet	Private	FL. Tank		3.	3.
Lavatory	Private	Faucet	0.75	0.75	1.
Lavatory-Treatment or Clinical	Public	Faucet	1.	1.	1.5
Bathtub or Shower Head	Private	Mixing Valve	1.5	1.5	2.
Kitchen Sink	Private	Faucet	1.5	1.5	2.
Laundry Trays (1 to 3 compartments)	Private	Faucet	2.25	2.25	3.
Combination Fixture	Private	Faucet	2.25	2.25	3.
Dishwashing Machine	Private	Automatic	1.		1.
Emergency Eyewash	Public	Faucet		1.	1.
Laundry Machine (8 lb)	Private	Automatic	1.5	1.5	2.
Laundry Machine (8 lb)	Public or General	Automatic	2.25	2.25	3.

Fixture	Occupancy	Type Control	Weight in Fixture Units		
			Hot	Cold	Total
Laundry Machine (Large)	Refer to Manufacturer's Requirements				
Bathroom Group	Private	FL. Valve	2.25	8.25	9.
Bathroom Group	Private	FL. Tank	2.25	5.25	6.
Bidet	Public	Variable	3.00	3.00	4.
Coffee Urn Stand	Public	Variable		2.	2.
Food Waste Grinder	Public	Variable	Manufacturer's Require.		
Hose-Pre-Rinse	Public	Variable	2.5	2.5	3.
Hose Station	Public	Variable	3.0	3.0	4.
Ice Maker	Public	Variable		1.	1.
Sink - Baker's Pan	Public	Variable	2.5	2.5	3.
Sink - Back Bar	Public	Variable	1.5	1.5	2.
Sink - Barber and Shampoo	Public	Faucet	1.5	1.5	2.
Sink - Cook's	Public	Variable	2.5	2.5	3.
Sink - Cup	Public	Variable		1.	1.
Sink - Diet Kitchen	Public	Variable	1.5	1.5	2.
Sink - Laboratory	Public	Variable	1.5	1.5	2.
Sink - Laboratory and Trough	Public	Variable	1.5	2.5	3.
Sink - Meat Preparation	Public	Variable	2.5	2.5	3.
Sink - Pot and Pan (Per Faucet)	Public	Variable	3.	3.	4.
Sink - Salad Preparation	Public	Variable	2.5	2.5	3.
Sink - Silver Soak	Public	Variable	2.5	2.5	3.
Sink - Treatment or Exam	Public	Variable	1.5	1.5	2.
Sink - Vegetable	Public	Variable	2.5	2.5	3.
Ice Cuber & Flakers	Public	Variable		1.	1.
Hosebibb - Wall Hydrant	Public and Private	Variable		4.	4.
Wall Hydrant C.W. & H.W.	Public and Private	Variable	3.	3.	4.
Wash Fountain - Factory Wash-up (20″ = 1 Lav Space)	Public	Variable	1.5	1.5	2.

"Private" fixtures are those in residential areas not freely accessible, such as in private homes, residential apartments, hotel guest rooms, private rooms or apartments in residential hotels, dormitories or executive suites and the like.

Table 13a

MAXIMUM FIXTURE UNITS (s.f.u.)
WATER SERVICE AND DISTRIBUTION SIZING
CALCULATED PRESSURE RANGE 30 THROUGH 45 PSI

Water Service Not to Exceed 75 Feet	Building Distribution	Maximum Total Developed Allowable Length In Feet					
		75	100	200	250		
¾″	¾″	20	18	15	12	9	
¾″	1″	20	18	16	16	15	
1″	1″	30	27	24	21	20	
1″	1-¼″	39	36	32	30	28	
1-¼″	1″	32	32	32	28	23	
1-¼″	1-¼″	56	49	44	35	32	
1-¼″	1-½″	56	56	56	51	48	
1-½″	1-¼″	56	56	56	56	56	
1-½″	1-½″	109	103	84	63	56	

Water Service Not to Exceed 75 Feet	Building Distribution	Maximum Total Developed Allowable Length In Feet				
		75	100	150	200	250
1-½″	2″	127	123	111	103	86
2″	1-½″	111	111	111	78	66
2″	2″	275	264	186	175	146

Table 13b

MAXIMUM FIXTURE UNITS (s.f.u.)
WATER SERVICE AND DISTRIBUTION SIZING
CALCULATED PRESSURE RANGE 46 THROUGH 60 PSI

Water Service Not to Exceed 75 Feet	Building Distribution	Maximum Total Developed Allowable Length In Feet				
		75	100	150	200	250
¾″	¾″	20	18	18	18	16
¾″	1″	30	28	26	24	22
1″	1″	34	34	34	34	30
1″	1-¼″	58	56	54	49	46
1-¼″	1″	34	34	34	34	34
1-¼″	1-¼″	58	58	58	58	54
1-¼″	1-½″	111	95	86	78	69
1-½″	1-¼″	58	58	58	58	58
1-½″	1-½″	111	111	111	111	99
1-½″	2″	225	220	196	175	170
2″	1-½″	111	111	111	111	111
2″	2″	275	275	275	275	250

Table 13c

MAXIMUM FIXTURE UNITS (s.f.u.)
WATER SERVICE AND DISTRIBUTION SIZING
CALCULATED PRESSURE RANGE OVER 60 PSI
(but not to exceed 80 PSI)

Water Service Not to Exceed 75 Feet	Building Distribution	Maximum Total Developed Allowable Length In Feet				
		75	100	150	200	250
¾″	¾″	20	18	18	18	18
¾″	1″	34	32	30	28	26
1″	1″	34	34	34	34	34
1″	1-¼″	58	58	58	58	54
1-¼″	1″	34	34	34	34	34
1-¼″	1-¼″	58	58	58	58	58
1-¼″	1-½″	111	111	111	111	98
1-½″	1-¼″	58	58	58	58	58
1-½″	1-½″	111	111	111	111	111
1-½″	2″	275	275	250	235	215
2″	1-½″	111	111	111	111	111
2″	2″	275	275	275	275	275

(c) Friction loss method for sizing the water service and distribution system. 1. The supply demand in gallons per minute in the building water distribution system shall be determined on the basis of the load in terms of supply fixture units and of the relationship between load and supply demand as shown in tables 13 and 14. Water supply outlets for items not listed in table 13 shall be computed at their maximum demand but in no case less than:

Fixture	Number of Fixture Units	
	Private Use	Public Use
⅜-inch pipe	1	2
½-inch pipe	2	4
¾-inch pipe	3	6
1 inch pipe	6	10

a. For supply outlets likely to impose continuous demands, estimate continuous supply separately in gallons per minute and add to total demand in gallons per minute for fixtures.

b. The given weights in table 13 are for total demand and for fixtures with both hot and cold water supplies. The weights for maximum separate demands are taken as ¾ the listed total demand for the hot water supply and the cold water supply.

c. Compute flush valve demand separately.

d. Demand (GPM) Corresponding to Fixture Load (WSFU). To determine the demand in gallons per minute corresponding to any given load in water supply fixture units, reference must be made to table 14, Table for Estimating Demand.

Table 14

ESTIMATING DEMAND

Supply Systems Predominantly For Flush Tanks		Supply Systems Predominantly For Flush Valves	
Load (Water Supply Fixture Units)	Demand GPM	Load (Water Supply Fixture Units)	Demand GPM
6	5		
8	6.5		
10	8	10	27
12	9.2	12	28.6
14	10.4	14	30.2
16	11.6	16	31.8
18	12.8	18	33.4
20	14	20	35
25	17	25	38
30	20	30	41
35	22.5	35	43.8
40	24.8	40	46.5
45	27	45	49
50	29	50	51.5
60	32	60	55
70	35	70	58.5
80	38	80	62
90	41	90	64.8
100	43.5	100	67.5
120	48	120	72.5
140	52.5	140	77.5
160	57	160	82.5
180	61	180	87
200	65	200	91.5
225	70	225	97
250	75	250	101
275	80	275	105.5
300	85	300	110
400	105	400	126
500	125	500	142
750	170	750	178
1,000	208	1,000	208
1,250	240	1,250	240
1,500	267	1,500	267
1,750	294	1,750	294
2,000	321	2,000	321
2,250	348	2,250	348
2,500	375	2,500	375
2,750	402	2,750	402
3,000	432	3,000	432
4,000	525	4,000	525
5,000	593	5,000	593
6,000	643	6,000	643
7,000	685	7,000	685
8,000	718	8,000	718
9,000	745	9,000	745
10,000	769	10,000	769

e. Size. The diameter of any pipe serving more than one plumbing fixture or appliance shall not be less than ¾-inch inside diameter.

f. Minimum size. The minimum size of a water distribution branch serving no more than one fixture shall be as shown in table 15. The water distribution branch shall be extended to within at least 18 inches of the point of connection to the fixture.

Table 15

MINIMUM SIZES OF WATER DISTRIBUTION BRANCHES

Type of Fixture or device	I.D. Pipe Size (Inches)	Type of Fixture or device	I.D. Pipe Size (Inches)
Bathtubs	½	Shower (single head)	½
Combination sink and tray	½	Sinks (service, mop)	½
Drinking fountain	⅜ (1′ max)	Sinks (flushing rim)	¾
Dishwasher (domestic)	½	Urinal (direct flush valve)	¾
Electric drinking water cooler	⅜ (1′ max)	Urinal (direct flush valve)	½ (1′ max)
		Water closet (tank type)	⅜ (1′ max)
Kitchen sink, residential	½	Water closet (flush valve type)	1 (1′ max)
Kitchen sink, commercial	¾	Hose bibb	½
Lavatory	⅜ (1′ max)	Wall hydrant	½
Laundry tray 1, 2 or 3 compartments	½		

g. Minimum hydrostatic pressure. Based on the minimum hydrostatic pressure available, pipe sizes shall be selected so that under conditions of peak demand a minimum flow pressure at the point of discharge shall be not less than required to maintain minimum flow rates listed in table 16. Pipe sizes for flush valve water closets and urinals shall be adequate to maintain flow pressures of 20 pounds per square inch for blowout action and jet action fixtures. For fixtures other than those supplied by flush valves, a minimum pressure of 8 pounds per square inch at the highest fixture shall be included in the calculations.

Table 16

MINIMUM AND MAXIMUM FLOW RATES TO FIXTURES AND APPURTENANCES

Fixture	Flow Rate Minimum GPM	Flow Rate Maximum GPM
Lavatory - Residential		3
Lavatory - Public		1 after handle release
Sink	4	4
Bathtub	6	
Laundry tray	5	
Shower except for safety - each head		3
Water closets		
Tank type		4 gal. per flush
Blowout action		4 gal. per flush
Jet action		4 gal. per flush
Drinking fountain	0.75	
Wall hydrant	5	
Urinal		1.5 gal. per flush

h. Variable street pressures. Where street water main pressures fluctuate, the building water distribution system shall be designed for the minimum pressure available.

i. 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.

j. Elevations. The relative elevations of the source of water supply and the highest water supply outlets 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 must be obtained from the local water authority.

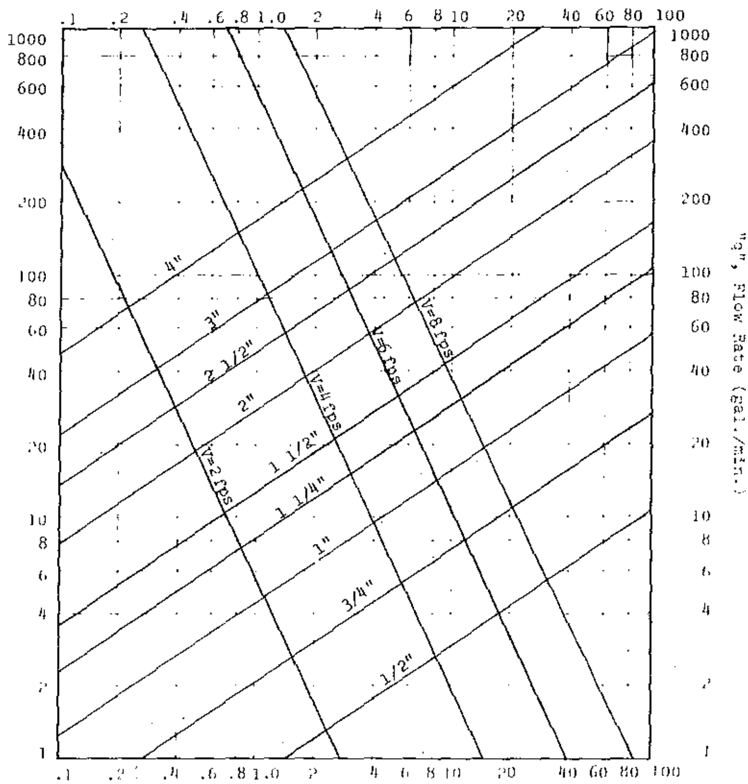
k. Maximum total developed length of system. Information shall be obtained regarding the total developed length of the water service piping from the source of water supply to the water service control valve of the building. Determine the total developed length of the distribution piping from the service control valve to the highest and most remote water outlet on the system.

l. Friction loss. Calculate the permissible uniform pressure loss for friction in the system. The amount of pressure available for dissipation as friction loss due to pipe, fittings, valves and appurtenances or devices in the system, must be divided by the maximum total developed length of the water service and water distribution system. This establishes the pipe friction limit for the circuit or system in terms of pressure loss, in psi, per foot of total pipe length. Multiply this value by 100 in order to express the pipe friction unit in terms of psi per 100 feet of length. If specifications for pressure loss due to fittings and valves are not furnished, add 50% of the maximum total developed length for friction loss.

m. Size all parts of the basic design circuit or system, and all other main lines in accordance with tables 16a, 16b, 16c, 16d or 16e. The table selected shall correspond with the type of material approved for the water service, water distribution or both.

TABLE 16a

PRESSURE LOSS DUE TO FRICTION—
COPPER WATER TUBE, TYPE K (ASTM B88)
Surface Condition: "Fairly Smooth"
$q = 4.57\ p^{0.546}\ d^{2.64}$



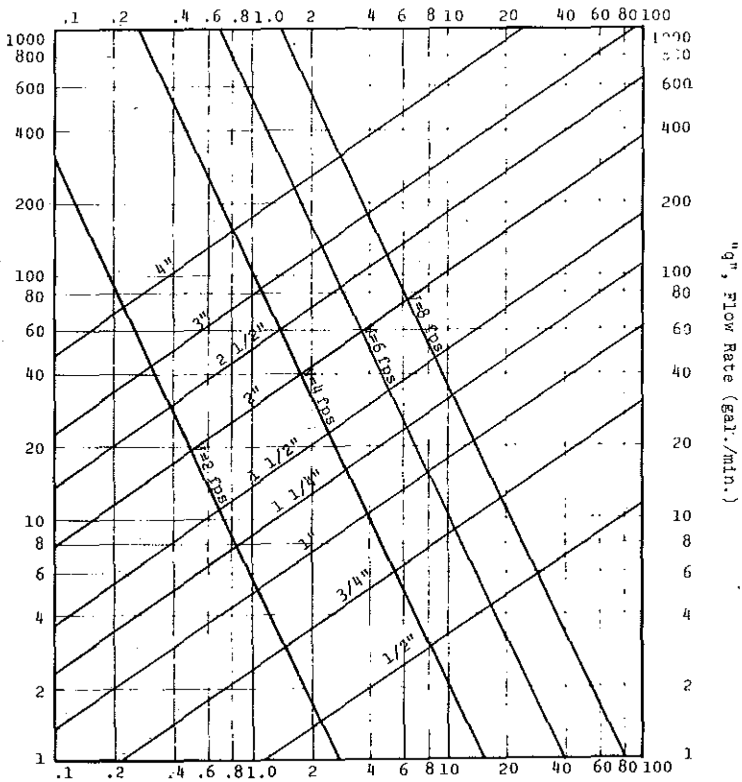
"p", Pressure Loss Due To Friction (psi/100 ft. of pipe)

TABLE 16b

PRESSURE LOSS DUE TO FRICTION— COPPER WATER TUBE, TYPE L (ASTM B88)

Surface Condition: "Fairly Smooth"

$q = 4.57\ p^{0.526}\ d^{2.64}$



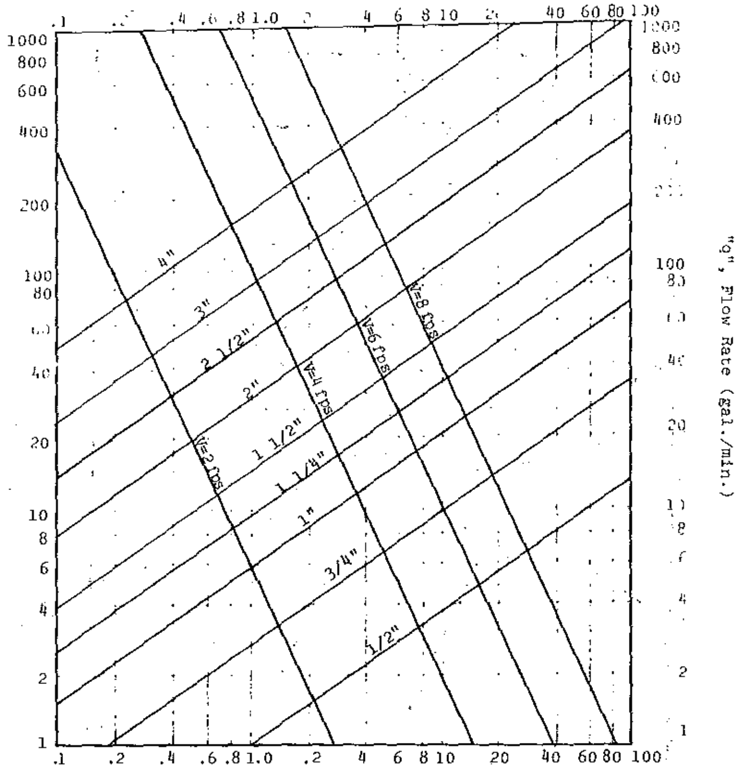
"p", Pressure Loss Due To Friction (psi/100 ft. of pipe)

TABLE 16c

PRESSURE LOSS DUE TO FRICTION— COPPER WATER TUBE, TYPE M (ASTM B88)

Surface Condition: "Fairly Smooth"

q = 4.57 p0.546 d2.64



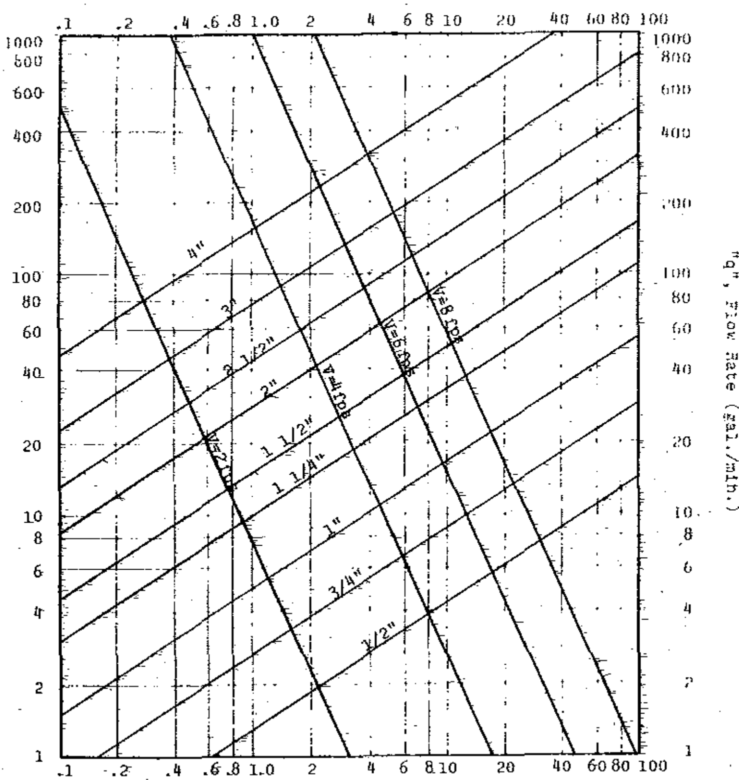
"p", Pressure Loss Due To Friction (psi/100 ft. of pipe)

TABLE 16d

PRESSURE LOSS DUE TO FRICTION— GALV. IRON & STEEL STANDARD WEIGHT PIPE (ASTM A72, A120)

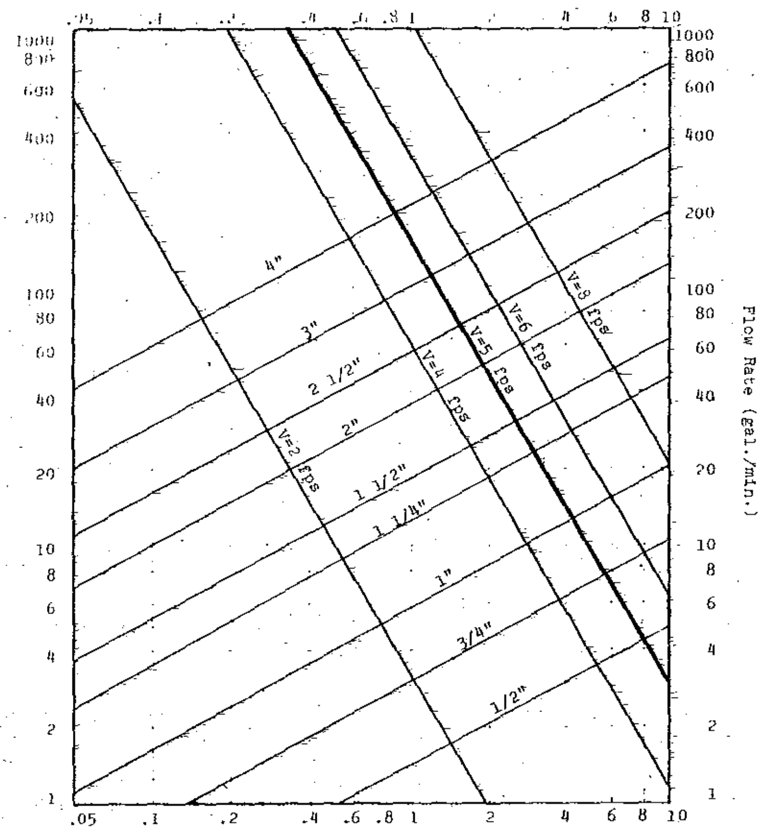
Surface Condition: "Fairly Rough"

q = 4.29 p0.521 d2.562



"p", Pressure Loss Due To Friction (psi/100 ft. of pipe)

TABLE 16e
FLOW DATA FOR THERMOPLASTIC PIPE
SCHEDULE 40



n. Hot water distribution. In residences, buildings serving the public and places of employment, hot water shall be supplied to all plumbing fixtures and equipment used for personal hygiene, bathing, washing, culinary purposes, cleansing, laundry or building maintenance.

2. Excessive pressures. Water pressure at any fixture, appliance or appurtenance shall not exceed 80 psi for a period not to exceed 60 minutes in any 24-hour period under no flow conditions. When the water pressure in a part of or the entire water distribution system serving a fixture (s), appliance (s), or appurtenance (s) exceeds 80 psi for a period of more than 60 consecutive minutes, an approved type pressure reducing valve, preceded by a strainer, shall be installed and the pressure reduced to 80 psi or less for that part or all of the system that serves a fixture (s), appliance (s) or an appurtenance (s). Outside wall hydrants, sill cocks, water supply directly to a water pressure booster system, elevated water gravity tank or to pumps provided in connection with a hydropneumatic or elevated gravity water supply system may be left at full pressure.

3. Design methods. The methods utilized in designing and sizing the water distribution system may vary and recognized engineering practices meeting the criteria established in sections H 62.01 (4) and H 62.13 (4) will be acceptable to the department. When submitting plans and specifications to the department for plan examination include all calculations and data relating to the sizing of the water distribution system.

(d) *Materials and installation.* 1. Materials. All water distribution pipes (within a building) shall be of galvanized steel, brass, or cast iron (piping) with brass or galvanized malleable iron fittings; type K, L or M copper water tube with copper or brass fittings or other materials approved by the department.

2. Frost protection. All water pipe, storage tanks, fixtures, appliances and appurtenances subject to low temperatures shall be, so far as practical, effectively protected against freezing.

3. Bending of pipe. Bending of water distribution piping except fixture supply tubing is prohibited. See section H 62.19 (2) (a) 7., Wis. Adm. Code.

(e) *Supports.* All piping shall be supported to prevent undue strains upon connections or fixtures and shall be so aligned and graded that the entire system or parts thereof can be controlled and drained. The formation of traps or sags in water piping shall be avoided where possible. When unavoidable such sags, traps or inverts shall have provisions for properly draining same.

(f) *Water-temperature control - public buildings.* Temperature of mixed water to multiple or gang showers shall be controlled by a master thermostatic blender or such showers may be individually regulated by pressure balance mixing valves. Individual showers in commercial and public buildings shall have pressure balance mixing valves in addition to flow regulation as indicated in table 16.

1. Return circulation where required. Hot water supply risers in buildings 5 or more stories in height or in buildings where developed length of hot water piping from the source of the hot water supply to the farthest fixture exceeds 100 feet, shall be of the return circulation type and no uncirculated branch line shall exceed 25 feet in length. Valves shall be

provided on the inlet and outlet of all circulating return lines and on the inlet and outlet of the return circulation pump.

2. Insulation - storage tanks. Heat loss from unfired hot water storage tanks shall be limited to 15 BTU per hour per square foot of external tank surface area. The design ambient temperature shall be no higher than 65°F.

3. Insulation - piping. Piping heat loss for recirculation systems shall be limited to a maximum of 25 BTU per hour per square foot of external pipe surface for aboveground piping and a maximum of 35 BTU per hour per square foot of external pipe surface for underground piping. Maximum heat loss shall be determined at a Δ T equal to the maximum water temperature minus a design ambient temperature no higher than 65°F.

(g) *Water heaters and hot water storage tanks.* 1. General. All water heaters either for domestic or industrial use shall be of an approved type and shall connect to the water distribution system in an approved manner. All heaters except electric heaters shall be provided with a flue of rust resistant material connected to a chimney or gas vent stack. All water heaters shall be permanently marked with the rated input of the heater in B.T.U. or watts. Such marking shall be in an accessible position on the outside of the heater for inspection purposes.

2. Safety devices. All safety devices, except mixing valves, shall meet the current requirements of one or more of the following: American Gas Association, Underwriters Laboratories, Inc., American Society of Mechanical Engineers or National Board of Boiler and Pressure Vessel Inspectors. Test and certification by a laboratory in accordance with one of the above applicable standards shall also be considered acceptable. All water safety devices shall be of the temperature and pressure type installed in accordance with this code.

Note: The above standards are on file in the offices of health and social services, secretary of state, and revisor of statutes, and may also be obtained for personal use as follows:

1) Approval requirements for gas water heaters, volume I, Seventeenth Edition, 1965.

Approval requirements for gas water heaters, volume II, effective January 1, 1963.

Approval requirements for gas water heaters, volume III, third edition, 1965. Listing requirements for relief valves and automatic gas shutoff devices for hot water supply systems, effective January 1, 1965 and addenda effective January 1, 1966.

The above standards are available from American Gas Association, Inc., 605 Third Avenue, New York, New York 10016.

2) Standards for safety, household electric storage-tank water heaters, UL 174, third edition, May 1, 1970, and revision pages dated June 16, 1971, January 18, 1971.

The above standards are available from:

Underwriters' Laboratories, Inc.
207 E. Ohio Street, Chicago, IL 60611
333 Pfingsten Road, Northbrook, IL 60062
1655 Scott Boulevard, Santa Clara, CA 95050
1285 Walt Whitman Road, Melville, L.I., NY 11746

3) ASME Boiler and Pressure Vessel Codes, Heating Boilers, section IV, 1971, available from American Society of Mechanical Engineers, 29 West 39th Street, New York, NY 10018.

4) Relieving capacities of safety valves and relief valves, January 1, 1970.

The above standards are available from The National Board of Boiler and Pressure Vessel Inspectors, 1155 North High Street, Columbus, OH 43201.

3. Tank construction. Storage tanks for direct fired storage type water heaters shall be constructed to withstand a minimum of 300 psi test pressure without leakage or permanent distortion and shall bear the manufacturers' marking showing test and working pressure, except that in lieu thereof, pressure markings appearing on AGA or UL listed water heater units will be considered acceptable.

4. Hot water storage tank and heater drain valves. a. Location. A drain valve shall be installed at the lowest point of each hot water storage tank and be readily accessible.

b. The drain valve shall be hand-operable without the use of tools.

c. The drain valve inlet shall be a minimum ¾-inch nominal iron pipe size and the outlet end shall be equipped with a minimum standard ¾-inch hose thread.

5. Water heaters, storage tanks and boilers. a. Combination domestic water heating/space heating boilers. Space heating boilers shall not be used for service water heating from May 1 to September 30 unless the service water heating load equals or exceeds 30% of the net boiler load.

b. Temperature controls. Service water heating systems shall be equipped with automatic temperature controls capable of adjusting from the lowest to the highest acceptable temperature setting for the intended use.

c. Shut down. A separate means shall be provided to permit turning off the energy supplied to service water heating systems.

(h) *Relief valves.* 1. Pressure relief valves. Pressure relief valves shall meet the A.S.M.E. standards. The valves shall have a relief rating adequate to meet the pressure conditions in the equipment served. The relief valve shall be installed either directly in a top tank tapping or in the hot water outlet line close to the tank. In a tankless-type heater, the relief valve shall be installed in the hot water outlet line as close as possible to the unit. There shall be no shut-off valve between the pressure relief valve and the tank. The pressure relief valve must 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 building water pressure regulating valve. The setting shall not exceed the tank rated working pressure.

2. Temperature relief valves. Temperature relief valves shall be of adequate relief rating expressed in B.T.U./hr for the equipment served. They shall be installed so that the temperature sensing element is immersed within the top 6 inches of the tank. The valve shall be set to open when the stored water temperature is 210°F. (or less).

3. Combination pressure temperature relief valves. Combination pressure temperature relief valves shall comply with all the requirements of the separate pressure and temperature relief valves.

4. Energy cut-off devices. Energy cut-off devices shall be of adequate performance rating for the equipment served. Immersion type energy cut-off devices shall be located so that the temperature sensing element is immersed in the water within the tank and controls the temperature of the water within the top 6 inches of the tank. When approved by the department, contact types shall be installed so that the sensing element is responsive to the highest water temperature within the equipment

served and is securely fastened in place. When an energy cut-off device is used, it shall be factory applied by the heater manufacturer and comply fully with the appropriate standards of A.N.S.I. or U.L. They shall be installed in a manner that will isolate them from ambient flue gas temperatures and other conditions not indicative of the temperature of the water within the heater.

5. Installation of relief valve discharge. Every relief valve shall have a discharge pipe the same size as the outlet drain on the relief valve which shall terminate not more than 10 inches above the floor as close as possible to a drain properly connected to the building drain or sewer. Such discharge pipe shall be galvanized steel, copper or brass, installed with approved fittings. The relief valve discharge pipe shall be pointed and drained downward in such a manner to allow the drain and discharge pipe to drain dry. The base or end of such discharge pipe shall not be threaded. No discharge pipe shall terminate into an open fixture such as a sink, laundry tub, bathtub, bathtub overflow, urinal, fixture tailpiece or supply tank, etc., or installed in a freezing area. No check valve or shut-off valve shall be installed between any safety device and the hot water equipment used, nor shall there be any valve in the discharge pipe from the relief valve.

6. Vacuum relief valves. Where a hot water storage tank or direct or indirect water heater is located at an elevation of 20 feet from the bottom of the heater or more above the lowest fixture outlets in the hot water system, a vacuum relief valve shall be installed on the storage tank or heater.

7. 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.

(i) *Water hammer suppressors.* 1. Water hammer suppressors. All water supply systems, water distribution systems and components connected thereto, subject to water hammer, shall be provided with approved shock absorbing devices located and sized to suppress water hammer. All appliances, devices, equipment, fixtures and appurtenances with quick closing valves or which may create water hammer, shall be provided with shock absorbing devices. When copper air chambers are used, the minimum size shall be ½″ x 1″ x 14″.

2. Mechanical suppressors. The size and location of the suppressors shall be in accord with the hydraulic design of the piping system served and to the manufacturer's recommendations. All mechanical water hammer suppressors shall be accessible.

Note: The water hammer suppressor may be eliminated provided the appliance, appurtenance, device, equipment or fixture has a slow closing or manually closed valve and does not create water hammer.

(j) *Water distribution control valves.* 1. Single family dwellings. Controls within a single family dwelling unit shall include a valve for each lawn sprinkler faucet, water heater, water closet, point of entrance of the water service, discharge side of the water meter and each appliance or appurtenance.

2. Multiple dwellings and public buildings. a. In all public buildings and multiple dwelling units, each hot and cold water distribution main,

riser and branch main shall be valved. All fixtures, appliances, appurtenances, lawn sprinkler faucets and wall hydrants shall be valved. The meter valve on the discharge side of the meter may serve as the water distribution main valve. See following sketch.