

Section 2.6. Potable Water Systems

2.6.1. Arrangement of Piping

2.6.1.1. Design

- 1) *Fixtures* supplied with separate hot and cold water controls shall have the hot water control on the left and the cold on the right.
- 2) In a hot *water distribution system* of a *developed length* of more than 30 m or supplying more than 4 *storeys*, the water temperature shall be maintained by
 - a) recirculation, or
 - b) a self-regulating heat tracing system.

2.6.1.2. Drainage

- 1) A *water distribution system* shall be installed so that the system can be drained or blown out with air.

2.6.1.3. Shut-off Valves

- 1) *Water service pipes* shall be provided with an accessible shut-off valve located as close as possible to where the *water service pipe* enters the *building*.
- 2) Pipes that convey water from a gravity water tank or from a *private water supply system* shall be fitted with a shut-off valve at the source of supply.
- 3) Except for *risers* that serve only one *dwelling unit*, *risers* shall be provided with a shut-off valve located at the source of supply.
- 4) Every *fixture* shall be fitted with a shut-off valve, located on each water supply serving the *fixture*.
- 5) In *buildings* of residential *occupancy* that contain more than one *dwelling unit*, a shut-off valve shall be installed where the water supply enters each *dwelling unit*, so that, when the water supply to one *suite* is shut off, the water supply to the remainder of the *building* is not interrupted. (See Note A-2.6.1.3.(5).)
- 6) Deleted.
- 7) Pipes that supply water to a hot water tank shall be provided with a shut-off valve located close to the tank.

2.6.1.4. Protection for Exterior Water Supply

- 1) Pipes that pass through an exterior wall to supply water to the exterior of the *building* shall be provided with
 - a) a frost-proof hydrant, or
 - b) a stop-and-waste cock located inside the *building* and close to the wall.

2.6.1.5. Check Valves

- 1) A *check valve* shall be installed at the *building* end of a *water service pipe* where the pipe is made of plastic that is suitable for cold water use only.

2.6.1.6. Flushing Devices

- 1) Flushing devices that serve water closets or urinals shall have sufficient capacity and be adjusted to deliver at each operation a volume of water that will thoroughly flush the *fixture* or *fixtures* they serve.
- 2) Where a manually operated flushing device is installed, it shall serve only one *fixture*.
- 3) Except as provided in Sentence (4), water closets and urinals shall have an integral means of limiting the maximum amount of water used in each flush cycle to that specified in Table 2.6.1.6.

Table 2.6.1.6.
Water Usage per Flush Cycle
 Forming Part of Sentence 2.6.1.6.(3)

Fixtures	Maximum Water Usage per Flush Cycle, Lpf
Water closets ⁽¹⁾	4.8
Urinals	1.9

Notes to Table 2.6.1.6.:

(1) The full flush mode of a dual-flush toilet shall not exceed 4.8 L.

4) A maximum flush cycle of 6.0 L may be permitted for a water closet where, in the opinion of the *Chief Building Official*, the existing *plumbing system* cannot accommodate and cannot be updated to accommodate the required flush cycle.

5) Except where installed in *buildings* not intended to be occupied year-round, flush-tank-type urinals shall be equipped with a device capable of preventing flush cycles when they are not in use. (See Note A-2.6.1.6.(5).)

2.6.1.7. Relief Valves

1) In addition to the requirements in Sentence (2), the hot water tank of a *storage-type service water heater* shall be equipped with a pressure-relief valve

- a) designed to open when the water pressure in the tank reaches the rated working pressure of the tank, and
- b) so located that the pressure in the tank shall not exceed the pressure at the relief valve by more than 35 kPa under any condition of flow within the distribution system.

2) The hot water tank of a *storage-type service water heater* shall be equipped with a temperature-relief valve with a temperature-sensing element

- a) located within the top 150 mm of the tank, and
- b) designed to open and discharge sufficient water from the tank to keep the temperature of the water in the tank from exceeding 99°C under all operating conditions.

3) A pressure-relief valve and temperature-relief valve may be combined where Sentences (1) and (2) are complied with.

4) *Indirect service water heaters* shall be equipped with

- a) a pressure-relief valve, and
- b) a temperature-relief valve on every storage tank that forms part of the system.

5) Pipes that convey water from a temperature-relief, pressure-relief or combined temperature- and pressure-relief valve shall

- a) be of a *size* at least equal to the *size* of the outlet of the valve,
- b) be rigid, slope downward from the valve, and terminate with an indirect connection above a floor drain, sump, or other safe location, with an *air break* of not more than 300 mm,
- c) have no thread at its outlet, and
- d) be capable of operating at a temperature of not less than 99°C.

(See Note A-2.6.1.7.(5).)

6) The temperature-relief valve required in Clause (4)(b) shall

- a) have a temperature-sensing element located within the top 150 mm of the tank, and
- b) be designed to open and discharge sufficient water to keep the temperature of the water in the tank from exceeding 99°C under all operating conditions.

7) No shut-off valve shall be installed on the pipe between any tank and the relief valves or on the discharge lines from such relief valves.

8) A vacuum-relief valve shall be installed when any tank may be subject to *back-siphonage*.

9) *Storage-type service water heaters* that are located in a ceiling or roof space, or over a floor of wood construction, shall be installed within a corrosion-resistant watertight drain pan, as described in Sentence (10).

- 10) The drain pan referred to in Sentence (9) shall
 - a) be not less than 50 mm larger than the tank and have side walls not less than 25 mm high,
 - b) be drained by a pipe two *sizes* larger than the relief valve discharge pipe, and
 - c) have a drain that is located directly under the relief valve discharge pipe and that discharges directly to a floor drain or other acceptable location.

2.6.1.8. Solar Domestic Hot Water Systems

1) Systems for solar heating of *potable* water shall be installed in conformance with CAN/CSA-F383, “Installation of Packaged Solar Domestic Hot Water Systems.”

2.6.1.9. Water Hammer

1) Provision shall be made to protect the *water distribution system* from the adverse effects of water hammer. (See Note A-2.6.1.9.(1).)

2.6.1.10. Mobile Home Water Service

- 1) A *water service pipe* intended to serve a mobile home shall
 - a) be not less than $\frac{3}{4}$ inch in *size*,
 - b) terminate above ground, and
 - c) be provided with
 - i) a tamperproof terminal connection that is capable of being repeatedly connected, disconnected and sealed,
 - ii) a protective concrete pad,
 - iii) a means to protect it from frost heave, and
 - iv) a curb stop and a means of draining that part of the pipe located above the frost line when not in use.

2.6.1.11. Thermal Expansion

1) Protection against thermal expansion shall be required when a *check valve* is required by Article 2.6.1.5., a *backflow preventer* by Article 2.6.2.6., or a pressure-reducing valve by Article 2.6.3.3. (See Note A-2.6.1.11.(1).)

2.6.1.12. Service Water Heaters

1) *Storage-type service water heaters* shall operate at a temperature not lower than 60°C. (See Note A-2.6.1.12.(1).)

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2.6.2. Protection from Contamination

2.6.2.1. Connection of Systems

- 1) Except as provided in Sentence (2), connections to *potable water systems* shall be designed and installed so that non-*potable* water or substances that may render the water non-*potable* cannot enter the system.
- 2) A water treatment device or apparatus shall not be installed unless it can be demonstrated that the device or apparatus will not introduce substances into the system that may endanger health. (See Article 2.2.10.17.)
- 3) *Backflow preventers* shall be selected, maintained and field tested in conformance with the Water Works By-law.

2.6.2.2. Back-Siphonage

- 1) *Potable* water connections to *fixtures*, tanks, vats or other devices not subject to pressure above atmospheric and containing other than *potable* water shall be installed so as to prevent *back-siphonage* in conformance with Sentence (2).
- 2) Except as provided in Sentence 2.6.2.10.(2), *back-siphonage* shall be prevented by the installation of
 - a) an *air gap*,
 - b) an atmospheric *vacuum breaker*,
 - c) a pressure *vacuum breaker*,
 - d) a spill-resistant pressure *vacuum breaker*,

- e) a hose connection *vacuum breaker*,
- f) a dual *check valve backflow preventer* with atmospheric port,
- g) a double *check valve* assembly,
- h) a reduced pressure principle *backflow preventer*,
- i) a dual *check valve backflow preventer*,
- j) a laboratory faucet type *vacuum breaker*, or
- k) a dual *check valve backflow preventer* with vent.

2.6.2.3. Backflow Caused by Back Pressure

1) *Potable* water connections to *fixtures*, tanks, vats, boilers or other devices containing other than *potable* water and subject to pressure above atmospheric shall be arranged to prevent *backflow* caused by *back pressure* in conformance with Sentences (2) and (3).

2) Except as provided in Article 2.6.2.4., *backflow* caused by *back pressure* of non-toxic substances into a *potable water system* shall be prevented by the installation of

- a) an *air gap*,
- b) a dual *check valve backflow preventer* with atmospheric port,
- c) a dual *check valve backflow preventer*,
- d) a dual *check valve backflow preventer* with vent,
- e) a double *check valve* assembly, or
- f) a reduced pressure principle *backflow preventer*.

3) *Backflow* caused by *back pressure* of toxic substances into a *potable water system* shall be prevented by the installation of

- a) an *air gap*, or
- b) a reduced pressure principle *backflow preventer*.

2.6.2.4. Backflow from Fire Protection Systems

1) *Backflow* caused by *back-siphonage* or *back pressure* from fire *sprinkler systems* where water treatment is not added shall be prevented by the installation of a double *check valve* assembly or an *approved* dual *check valve* when the *building* is sprinklered to NFPA 13D, “Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes” and a flow through system is installed.

2) *Backflow* caused by *back-siphonage* or *back pressure* from fire sprinkler or standpipe systems where water treatment is added shall be prevented by the installation of a reduced pressure principal *backflow preventer*. (See Note A-2.6.2.4.(2).)

3) Deleted.

4) Deleted.

2.6.2.5. Separation of Water Supply Systems

1) No *private water supply system* shall be interconnected with a public water supply system.

2.6.2.6. Premise Isolation

1) In addition to the *backflow preventer* required by this Subsection for *buildings* or facilities where a potentially severe health hazard may be caused by *backflow*, the *potable water system* shall be provided with premise isolation by the installation of a reduced pressure principle *backflow preventer*. (See Note A-2.6.2.6.(1).)

2.6.2.7. Hose Bibb

1) Where a hose bibb is installed outside a *building*, inside a garage or in an area where there is an identifiable risk of contamination, the *potable water system* shall be protected against *backflow* through the hose bibb.

2.6.2.8. Cleaning of Systems

1) A newly installed part of a *potable water system* shall be cleaned and then flushed with *potable* water before the system is put into operation.

2.6.2.9. Air Gap

- 1) *Air gaps* shall not be located in a noxious environment.
- 2) *Air gaps* shall be not less than 25 mm high and at least twice the diameter of the opening of the water supply outlet in height. (See Note A-2.6.2.9.(2).)

2.6.2.10. Vacuum Breakers

- 1) Where the *critical level* is not marked on an atmospheric *vacuum breaker*, pressure *vacuum breaker*, or spill-resistant pressure *vacuum breaker*, the *critical level* shall be taken as the lowest point on the device.
- 2) Where an atmospheric *vacuum breaker* is installed, it shall be located on the downstream side of the *fixture* control valve or faucet so that it will be subject to water supply pressure
 - a) only when the valve or faucet is open, and
 - b) for periods of continuous use not exceeding 12 h.(See Note A-2.6.2.10.(2).)
- 3) An atmospheric *vacuum breaker* shall be installed so that the *critical level* is at least the distance specified by the manufacturer at which the device will operate safely but not less than 25 mm above
 - a) the *flood level rim* of a *fixture* or tank, or
 - b) the highest point open to atmosphere in an irrigation system.
- 4) A pressure *vacuum breaker* or spill-resistant pressure *vacuum breaker* shall be installed so that the *critical level* is not less than 300 mm above
 - a) the *flood level rim* of a *fixture* or tank, or
 - b) the highest point open to atmosphere in an irrigation system.

2.6.2.11. Tank-Type Water Closets

- 1) Tank-type water closets shall be provided with a *back-siphonage preventer* in conformance with Sentence 2.2.10.10.(2).

2.6.2.12. Backflow Preventers

- 1) No bypass piping or other device capable of reducing the effectiveness of a *backflow preventer* shall be installed in a water supply system.

2.6.3. Size and Capacity of Pipes

(See Note A-2.6.3.)

2.6.3.1. Design, Fabrication and Installation

(See Note A-2.6.3.1.)

- 1) *Water distribution systems* shall be designed to provide peak demand flow when the flow pressures at the supply openings conform to the plumbing supply fitting manufacturer's specifications.
- 2) *Potable water systems* shall be designed, fabricated and installed in accordance with good engineering practice, such as that described in the ASHRAE Handbooks and ASPE Data Books. (See Note A-2.6.3.1.(2).)
- 3) In one- and two-family *dwelling units* and manufactured homes, multi-purpose systems that combine *potable water systems* and residential fire sprinkler systems shall be designed, fabricated and installed in accordance with NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes."

2.6.3.2. Hydraulic Load

- 1) Except as provided in Sentence (3), the hydraulic load of a *fixture* or device that is listed in Table 2.6.3.2.-A shall be the number of *fixture units* given in the Table.
- 2) Except as provided in Sentences (1) and (3), the hydraulic load of a *fixture* that is not listed in Table 2.6.3.2.-A is the number of *fixture units* listed in Table 2.6.3.2.-D.

- 3) Where *fixtures* are supplied with both hot and cold water, the hydraulic loads for maximum separate demands shall be 75% of the hydraulic load of the *fixture units* given in Tables 2.6.3.2.-A and 2.6.3.2.-D when using a detailed engineering design method.
- 4) The hydraulic load of urinals and water closets with direct flush valves shall be the number of *fixture units* listed in Tables 2.6.3.2.-B and 2.6.3.2.-C. (See Note A-2.6.3.2.(4).)

Table 2.6.3.2.-A
Sizing of Water Distribution Systems⁽¹⁾⁽²⁾
 Forming Part of Sentences 2.6.3.2.(1), (2) and (3), and 2.6.3.4.(2), (3) and (5)

Fixture or Device	Minimum Size of Supply Pipe, inches	Private Use Hydraulic Load, fixture units			Public Use Hydraulic Load, fixture units		
		Cold	Hot	Total	Cold	Hot	Total
Bathroom group with 6 LPF flush tank ⁽³⁾	n/a	2.7	1.5	3.6	–	–	–
Bathroom group with greater than 6 LPF flush tank ⁽³⁾	n/a	4	3	6	–	–	–
Bathroom group with more than 3 fixtures	–	–	–	⁽⁴⁾	–	–	–
Bathtub with or without shower head	½	1	1	1.4	3	3	4
Bathtub with ¾ inch spout	¾	7.5	7.5	10	7.5	7.5	10
Bedpan washer	1	–	–	–	7.5	7.5	10
Bidet	¾	1.5	1.5	2	–	–	–
Clothes washer 3.5 kg	½	1	1	1.4	2.25	2.25	3
Clothes washer 6.8 kg	½	–	–	–	3	3	4
Clothes washer, commercial ⁽⁶⁾	–	–	–	–	–	–	–
Dental lavatory	¾	–	–	–	1.5	1.5	2
Dental unit, cuspidor	¾	–	–	–	1	–	1
Dishwasher, commercial ⁽⁶⁾	–	–	–	–	–	–	–
Dishwasher, domestic	¾	–	1.4	1.4	–	–	–
Drinking fountain or water cooler	¾	–	–	–	0.25	–	0.25
Hose bibb	½	2.5	–	2.5	2.5	–	2.5
Hose bibb	¾	3	–	3	6	–	6
Hose bibb, combination hot and cold	½	1.9	1.9	2.5	1.9	1.9	2.5
Lavatory, 8.3 LPM or less	¾	0.5	0.5	0.7	1.5	1.5	2
Lavatory, greater than 8.3 LPM	¾	0.75	0.75	1	1.5	1.5	2
Sink, bar	¾	0.75	0.75	1	1.5	1.5	2
Sink, clinic service faucet	½	–	–	–	2.25	2.25	3
Sink, clinic service with direct flush valve	1	–	–	–	6	–	6
Sink, kitchen commercial, per faucet	½	–	–	–	3	3	4
Sink, kitchen domestic, 8.3 LPM	¾	1	1	1.4	1	1	1.4
Sink, kitchen domestic, greater than 8.3 LPM	¾	1.5	1.5	2	1.5	1.5	2
Sink, laboratory	¾	–	–	–	1.5	1.5	2
Sink, laundry (1 or 2 compartments)	¾	1	1	1.4	1	1	1.4

Table 2.6.3.2.-A (continued)
Sizing of Water Distribution Systems⁽¹⁾⁽²⁾
 Forming Part of Sentences 2.6.3.2.(1), (2) and (3), and 2.6.3.4.(2), (3) and (5)

Fixture or Device	Minimum Size of Supply Pipe, inches	Private Use Hydraulic Load, fixture units			Public Use Hydraulic Load, fixture units		
		Cold	Hot	Total	Cold	Hot	Total
Sink, service or mop basin	½	–	–	–	2.25	2.25	3
Sink, washup, per faucet	½	–	–	–	1.5	1.5	2
Shower head, 9.5 LPM or less per head	½	1	1	1.4	3	3	4
Shower head, greater than 9.5 LPM per head	½	1.5	1.5	2	3	3	4
Shower, spray, multi-head, <i>fixture unit</i> per head	⁽⁵⁾	1	1	1.4	3	3	4
Urinal, with direct flush valve	¾	⁽⁶⁾	–	⁽⁶⁾	⁽⁶⁾	–	⁽⁶⁾
Urinal, with flush tank	¾	3	–	3	3	–	3
Urinal, with self-closing metering valve	½	2	–	2	4	–	4
Water closet, 6 LPF or less with flush tank	¾	2.2	–	2.2	2.2	–	2.2
Water closet, greater than 6 LPF with flush tank	¾	3	–	3	5	–	5
Water closet, with direct flush valve	1	⁽⁶⁾	–	⁽⁶⁾	⁽⁶⁾	–	⁽⁶⁾

Notes to Table 2.6.3.2.-A:

- (1) The *fixture unit* values in this Table are not applicable in certain assembly *occupancies* because of surges in use by the occupants. For such *occupancies*, refer to specific design information.
- (2) For *fixtures* not indicated in this Table, refer to Table 2.6.3.2.-D.
- (3) *Bathroom group* is based on a ½-inch size bathtub supply pipe.
- (4) Add additional *fixture* to the *fixture* load for *bathroom group*.
- (5) Refer to manufacturer's recommendations.
- (6) For *fixture unit* values for *fixtures* with direct flush valves, see Sentence 2.6.3.2.(4) and Tables 2.6.3.2.-B and 2.6.3.2.-C.

Table 2.6.3.2.-B
Sizing of Water Distribution Systems for Urinals with Direct Flush Valves
 Forming Part of Sentences 2.6.3.2.(4) and 2.6.3.4.(5)

Number of Valves	Individual <i>Fixture Unit</i> Assigned in Decreasing Values	<i>Fixture Units</i> in Accumulative Values ⁽¹⁾
1	20	20
2	15	35
3	10	45
4	8	53
5 or more	5 each	58, plus 5 for each additional <i>fixture</i> in excess of 5

Notes to Table 2.6.3.2.-B:

- (1) The accumulative *fixture unit* values are the total values to be used in conjunction with Table 2.6.3.2.-A.

Table 2.6.3.2.-C
Sizing of Water Distribution Systems for Water Closets with Direct Flush Valves
 Forming Part of Sentences 2.6.3.2.(4) and 2.6.3.4.(5)

Number of Valves	Individual <i>Fixture Unit</i> Assigned in Decreasing Values	<i>Fixture Units</i> in Accumulative Values ⁽¹⁾
1	40	40
2	30	70
3	20	90
4	15	105
5 or more	10 for each <i>public use</i> and 6 for each <i>private use</i>	115, plus 10 for each <i>public use</i> additional <i>fixture</i> in excess of 5 and 111, plus 6 for each <i>private use</i> additional <i>fixture</i> in excess of 5

Notes to Table 2.6.3.2.-C:

(1) The accumulative *fixture unit* values are the total values to be used in conjunction with Table 2.6.3.2.-A.

Table 2.6.3.2.-D
Hydraulic Loads of Fixtures Not Listed in Table 2.6.3.2.A.
 Forming Part of Sentences 2.6.3.2.(2) and (3) and 2.6.3.4.(5)

Size of Supply Pipe, inches	Hydraulic Load, <i>fixture units</i>	
	<i>Private Use</i>	<i>Public Use</i>
3/8	1	2
1/2	2	4
3/4	3	6
1	6	10

2.6.3.3. Static Pressure

(See Sentence 2.2.11.2.(2))

1) Where the static pressure at any *fixture* may exceed 550 kPa, a pressure-reducing valve shall be installed to limit the maximum static pressure at the *fixture* to 550 kPa.

2.6.3.4. Size

1) *Water service pipes* shall be sized according to the peak demand flow but shall not be less than 3/4 inch *size*.

2) Except as provided in Sentence (3), the *size* of a supply pipe that serves a *fixture* shall conform to Table 2.6.3.2.-A.

3) For *fixtures* listed in Table 2.6.3.2.-A that are permitted to have a supply pipe 3/8 inch in *size*, a connector not more than 750 mm long and not less than 6.3 mm inside diameter may be used to supply water to the *fixture*.

4) Reserved.

5) Where both hot and cold water is supplied to *fixtures* in residential *buildings* containing one or two *dwelling units* or row houses with separate *water service pipes*, the *water system* may be sized in accordance with Table 2.6.3.4., where

- the hydraulic loads for maximum separate demands on *water distribution system* piping are not less than 100% of the total hydraulic load of the *fixture units* given in Table 2.6.3.2.-A, 2.6.3.2.-B, 2.6.3.2.-C or 2.6.3.2.-D for *private use*,
- the minimum water pressure at the entry to the *building* is 200 kPa, and
- the total maximum length of *water system* is 90 m.

(See Note A-2.6.3.4.(5).)

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Table 2.6.3.4.
Water Pipe Sizing for Buildings Containing One or Two Dwelling Units or
Row Houses with Separate Water Service Pipes
 Forming Part of Sentence 2.6.3.4.(5)

Size of Water Pipe, inches	Water Velocity, m/s ⁽¹⁾		
	3.0	2.4	1.5
	Hydraulic Load, fixture units		
½	8	7	4
¾	21	16	9
1	43	31	18
1¼	83	57	30

Notes to Table 2.6.3.4.:

(1) Table 2.6.3.4. is not intended to limit water velocities that are permitted by Sentence 2.6.3.5.(1).

2.6.3.5. Velocity

- 1) The maximum permitted water velocities shall be those recommended by the pipe and fitting manufacturer.