

CHAPTER 7

WATER RESOURCE CONSERVATION AND EFFICIENCY

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SECTION 701 GENERAL

701.1 Scope. The provisions of this chapter establish the means of conserving potable and nonpotable water used in and around a building.

SECTION 702 FIXTURES, FITTINGS, EQUIPMENT AND APPLIANCES

702.1 General. The maximum water consumption of fixtures and fittings shall comply with all of the following:

1. The maximum flow rates of fixtures and fittings shall comply with the flow rates specified in Sections 702.2 through 702.8.
2. The aggregate consumption of all fixtures and fittings shall be at least 20 percent reduction of the calculated total daily water use in accordance with Tables 702.1.3(1) and 702.1.3(2).

702.1.1 Water savings calculation.

702.1.2 Purpose. The purpose of this section is to provide a means of estimating the water savings when installing plumbing and fixture fittings that use less water than the maximum required by the Energy Policy Act of 1992 and 2005 and the *Plumbing Code*.

702.1.3 Calculation of water savings. Tables 702.1.3(1) and 702.1.3(2) shall be used to establish the aggregate consumption of all fixtures and fittings. Table 702.1.3(1) shall be used to establish the baseline water use and Table 702.1.3(2) shall be used to calculate the required reduction according to Section 702.1.

Water consumption shall be determined by the following equation:

$$\text{Consumption} = (\text{Flow rate}) \times (\text{Duration}) \times (\text{Occupants}) \times (\text{Daily uses})$$

702.2 Water closets. No water closet shall have a flush volume exceeding 1.6 gallons per flush (gpf) (6.1 Lpf).

**TABLE 702.1.3(1)
WATER USE BASELINE^e**

FIXTURE TYPE	MAXIMUM FLOW-RATE CONSUMPTION ^b	DURATION	ESTIMATED DAILY USES PER PERSON	OCCUPANTS ^{c,d}	DAILY WATER USES (gallons)
Showerheads	2.5 gpm @ 80 psi	8 minutes	1		
Private or private use lavatory faucets	2.2 gpm @ 60 psi	0.25 minutes	4		
Residential kitchen faucets	2.2 gpm @ 60 psi	4 minutes	1		
Wash fountains	2.2 gpm/20 [rim space (inches) @ 60 psi]	—	—		
Lavatory faucets in other than residences, apartments, and private bathrooms in lodging facilities (see Section 402.4.2)	0.5 gpm	0.25 minutes	4		
Metering faucets	0.25 gallons/cycle	0.25 minutes	3		
Metering faucets for wash fountains	0.25 gpm/20 [rim space (inches) @ 60 psi]	0.25 minutes	—		
Water closets	1.6 gallons per flush	1 flush	1 male ^a		
			3 female		
Urinals	1.0 gallons per flush	1 flush	2 male		
				Total Daily Volume	
				Annual Work Days	
				Total Annual Usage	

For SI: 1 gallon per minute = 0.06 L/s, 1 pound-force per square inch = 6.89 kPa, 1 gallon = 3.785 L

- a. The daily use number shall be increased to three if urinals are not installed in the room.
 - b. The maximum flow rate or consumption is from the Energy Policy Act.
 - c. For residential occupancies, the number of occupants shall be based on two persons for the first bedroom, and one additional person for each additional bedroom.
 - d. For nonresidential occupancies, refer to the plumbing code, for occupant load factors.
 - e. When determining calculations, assume one use per person for metering or self-closing faucets.
5. When determining calculations, assume one use per person for metering or self closing faucets.

TABLE 702.1.3(2)
WATER SAVINGS CALCULATOR

FIXTURE TYPE	CONSUMPTION (gallons per minute)	DURATION (minutes)	DAILY USES	OCCUPANTS ^{b,c}	DAILY WATER USES (gallons)
Showerheads		8 minutes	1		
Private or private use lavatory faucets		0.25 minutes	4		
Residential kitchen faucets		4 minutes	1		
Wash fountains		—	—		
Lavatory faucets in other than residences, apartments and private bathrooms in lodging facilities (see Section 402.4.2)		0.25 minutes	4		
Metering faucets		0.25 minutes	1 Cycle		
Metering faucets for wash fountains		0.25 minutes	—		
Water closets		1 flush	1 male ^a		
			3 female		
Urinals		1 flush	2 male		
			Total Daily Volume		
			Annual Work Days		
			Total Annual Usage		
			Annual Savings		
			% Reduction ^d		

For SI: 1 gallon per minute = 0.06 L/s, 1 gallon = 3.785 L

- a. The daily use number shall be increased to three if urinals are not installed in the room.
- b. For residential occupancies, the number of occupants shall be based on two persons for the first bedroom, and one additional person for each additional bedroom.
- c. For nonresidential occupancies, refer to the plumbing code, for occupant load factors.
- d. To calculate % Reduction use: $[(TDVB - TDVS) / TDVB] \times 100$ Where: TDVB = Baseline Total Daily Volume and TDVS = Water Savings Total Daily Volume.

702.2.1 Gravity, pressure-assisted and electro-hydraulic tank-type water closets. Gravity, pressure-assisted and electro-hydraulic tank type water closets shall have a maximum effective flush volume of not more than 1.28 gallons (4.84 L) of water per flush in accordance with ASME A112.19.2/CSA B45.1 or ASME A112.19.14 and shall also be listed to the EPA WaterSense Tank-Type High Efficiency Toilet Specification. The effective flush volume for dual-flush toilets is defined as the composite, average flush volume of two reduced flushes and one full flush.

702.2.2 Flushometer-valve activated water closets. Flushometer-valve activated water closets shall have a maximum flush volume of not more than 1.6 gallons (6.1 L) of water per flush in accordance with ASME A112.19.2/CSA B45.1.

702.3 Urinals. Urinals shall have a maximum flush volume of not more than 0.5 gallon (1.9 L) of water per flush in accordance with ASME A112.19.2/CSA B45.1 or IAPMO Z124.9. Flushing urinals shall be listed to the EPA WaterSense Specification for Flushing Urinals.

702.3.1 Nonwater urinals. Nonwater urinals shall be listed and comply with the applicable standards referenced in Table 14-1 of the *Plumbing Code*. Nonwater urinals shall have a barrier liquid sealant to maintain a trap seal.

Nonwater urinals shall permit the uninhibited flow of waste through the urinal to the sanitary drainage system. Where nonwater urinals are installed, they shall have a water distribution line rough-in to the urinal location to allow for the installation of an approved backflow prevention device in the event of a retrofit. A rough-in is not required where nonwater urinals are installed with at least one water supplied fixture rated at not less than one water drainage fixture unit (WDFU) installed upstream on the same drain line to facilitate drain line flow and rinsing.

702.4 Lavatory faucets. The maximum water flow rate of faucets shall be in accordance with Sections 702.4.1 through 702.4.2.

702.4.1 Lavatory faucets in residences, apartments and private bathrooms in lodging facilities, hospitals and patient care facilities. The flow rate for lavatory faucets installed in residences, apartments and private bathrooms in lodging, hospitals and patient care facilities (including skilled nursing and long-term care facilities) shall not exceed 1.5 gallons per minute (gpm) (0.09 L/s) at 60 pounds-force per square inch (psi) (414 kPa) in accordance with ASME A112.18.1/CSA B125.1 and shall be listed to the EPA WaterSense High-Efficiency Lavatory Faucet Specification.

702.4.2 Lavatory faucets in other than residences, apartments and private bathrooms in lodging facilities. Lavatory faucets installed in bathrooms of buildings or occupancies other than those specified in Section 702.4.1 shall be in accordance with Section 702.4.2.1 or 702.4.2.2.

702.4.2.1 Maximum flow rate. The flow rate shall not exceed 0.5 gpm (0.03 L/s) at 60 psi (414 kPa) in accordance with ASME A112.18.1/CSA B125.1.

702.4.2.2 Metering faucets. Metering faucets shall deliver not more than 0.25 gallons (0.95 L) of water per cycle.

702.5 Showers.

702.5.1 Showerheads. Showerheads shall comply with the requirements of the Energy Policy Act of 1992, except that the flow rate shall not exceed 2.0 gpm (0.13 L/s) at 80 psi (552 kPa), when listed to ASME A112.18.1/CSA B125.1.

702.5.2 Multiple showerheads serving one shower compartment. The total allowable flow rate of water from multiple showerheads flowing at any given time, with or without a diverter, including rain systems, waterfalls, bodysprays and jets, shall not exceed 2.0 gpm (0.13 L/s) per shower compartment, where the floor area of the shower compartment is less than 1800 square inches (1.161 m²). For each increment of 1800 square inches (1.161 m²) of floor area thereafter or part thereof, additional showerheads are allowed, provided the total flow rate of water from all flowing devices shall not exceed 2.0 gpm (0.13 L/s) for each such increment.

Exceptions:

1. Gang showers in nonresidential occupancies. Singular showerheads or multiple shower outlets serving one showering position in gang showers shall not have more than 2.0 gpm (0.13 L/s) total flow.
2. Where provided, accessible shower compartments shall not be permitted to have more than 4.0 gpm (0.25 L/s) total flow, where one outlet is the hand shower. The hand shower shall have a control with a nonpositive shutoff feature.

702.5.3 Bath and shower diverters. The rate of leakage out of the tub spout of bath and shower diverters while operating in the shower mode shall not exceed 0.1 gpm (0.006 L/s) in accordance with ASME A112.18.1/CSA B125.1.

702.5.4 Shower valves. Shower valves shall meet the temperature control performance requirements of ASSE 1016 or ASME A112.18.1/CSA B125.1 when tested at 2.0 gpm (0.13 L/s).

702.6 Commercial pre-rinse spray valves. The flow rate for a pre-rinse spray valve installed in a commercial kitchen to remove food waste from cookware and dishes prior to cleaning shall not be more than 1.6 gpm (0.10 L/s) at 60 psi (414 kPa). Where pre-rinse spray valves with maximum flow rates of 1.3 gpm (0.08 L/s) or less are installed, the static pressure shall be not less than 30 psi (207 kPa). Commercial kitchen pre-rinse spray valves shall be equipped with an integral automatic shutoff.

702.7 Emergency safety showers and eye wash stations. Emergency safety showers and emergency eye wash stations shall not be limited in their water supply flow rates.

702.8 Drinking fountains. Drinking fountains shall be self-closing.

702.9 Installation. Water-conserving fixtures and fixture fittings shall be installed in accordance with the manufacturers' instructions to maintain their rated performance.

SECTION 703 WATER PRESSURE

703.1 Maximum. Where static water pressure in the water supply piping is in excess of 85 psi (586 kPa) in single pressure zone systems, pressure regulators preceded by an adequate strainer shall be installed at points in the system to reduce the static pressure to 80 psi (552 kPa) or less.

SECTION 704 WATER SOFTENERS AND TREATMENT DEVICES

704.1 Water softeners. Actuation of regeneration of water softeners shall be by demand initiation. Water softeners shall be listed to NSF/ANSI Standard 44. Water softeners shall have a rated salt efficiency exceeding 3400 grains (gr) (0.2200 kg) of total hardness exchange per pound (lb) (0.5 kg) of salt, based on sodium chloride (NaCl) equivalency, and shall not generate more than 5 gallons (19 L) of water per 1000 grains (0.0647 kg) of hardness removed during the service cycle.

704.2 Water softener limitations. In residential buildings, where the supplied potable water hardness is equal to or less than 8 grains per gallon (gr/gal) (137 mg/L) measured as total calcium carbonate equivalents, water softening equipment that discharges water into the wastewater system during the service cycle shall not be allowed, except as required for medical purposes.

704.3 Point-of-use reverse osmosis water treatment systems. Reverse osmosis water treatment systems installed in residential occupancies shall be equipped with automatic shutoff valves to prevent discharge when there is no call for producing treated water. Reverse osmosis water treatment systems shall be listed to meet NSF/ANSI Standard 58 or WQA S-300-2000.

SECTION 705 OCCUPANCY SPECIFIC WATER EFFICIENCY REQUIREMENTS

705.1 Commercial food service.

705.1.1 Ice makers. Ice makers shall be air cooled and shall be in accordance with ENERGY STAR for commercial ice machines.

Exception: Where ice makers are cooled with nonpotable water, water cooling shall be allowed.

705.1.2 Food steamers. Food steamers shall not use more than 2.0 gallons per hour (gph) (7.6 L/h) per compartment.

705.1.3 Combination ovens. Combination ovens shall not consume more than 10 gph (38 L/h) in the full operational mode.

705.1.4 Grease interceptors. Grease interceptor maintenance procedures shall not include post-pumping/cleaning refill using potable water. Refill shall be by connected appliance accumulated discharge only.

705.2 Medical and laboratory facilities.

705.2.1 Steam sterilizers. Controls shall be installed to limit the discharge temperature of condensate or water from steam sterilizers to 140°F (60°C) or less. Venturi-type vacuum system shall not be utilized with vacuum sterilizers.

705.2.2 X-ray film processing units. Processors for X-ray film exceeding 6 inches (152 mm) in any dimension shall be equipped with water recycling units.

705.2.3 Exhaust hood liquid scrubber systems. Liquid scrubber systems for exhaust hoods and ducts shall be of the recirculation type. Liquid scrubber systems for perchloric acid exhaust hoods and ducts shall be equipped with a timer-controlled water recirculation system. The collection sump for perchloric acid exhaust systems shall be designed to automatically drain after the wash down process has completed.

SECTION 706

FOUNTAINS AND OTHER WATER FEATURES

706.1 Use of alternate water source for special water features. Special water features such as ponds and water fountains shall be required to comply with Department of Health Services rules and regulations.

SECTION 707

METERS

707.1 Required. A water meter shall be required for buildings connected to a public water system, including municipally supplied reclaimed (recycled) water. In other than single-family houses, multifamily structures of three stories or fewer above grade and modular houses, a separate meter or sub-meter shall be installed in the following locations:

1. The water supply to an irrigation system for irrigated landscape with an accumulative area exceeding 15,000 square feet (1394 m²).
2. The makeup water supply to cooling towers, evaporative condensers and fluid coolers.
3. The makeup water supply to one or more boilers collectively exceeding 1,000,000 per hour (Btu/h) (293 kW).
4. The water supply to a water-using process where the consumption exceeds 1,000 gallons per day (gal/d) (0.0438 L/s), except for manufacturing processes.
5. The water supply to each building on a property with multiple buildings where the water consumption exceeds 500 gal/d (0.021 L/s).

6. The water supply to an individual tenant space on a property where any of the following applies:
 - a. Water consumption exceeds 500 gal/d (0.021 L/s) for that tenant.
 - b. Tenant space is occupied by a commercial laundry, cleaning operation, restaurant, food service, medical office, dental office, laboratory, beauty salon or barbershop.
 - c. Total building area exceeds 50,000 square feet (4645 m²).
7. The makeup water supply to a swimming pool.
8. The makeup water supply to an evaporative cooler having an airflow exceeding 30,000 cubic feet per minute (ft³/min) (14 158.2 L/s).

707.2 Consumption data. A means of communicating water consumption data from submeters to the water consumer shall be provided.

707.3 Access. Meters and sub-meters shall be accessible.

SECTION 708

HVAC WATER EFFICIENCY

708.1 Once-through cooling. Once-through cooling using potable water is prohibited.

708.2 Cooling towers and evaporative coolers. Cooling towers and evaporative coolers shall be equipped with makeup water and blow down meters, conductivity controllers and overflow alarms. Cooling towers shall be equipped with efficiency drift eliminators that achieve drift reduction to 0.002 percent of the circulated water volume for counterflow towers and 0.005 percent for cross-flow towers.

708.3 Cooling tower makeup water. Not less than five cycles of concentration are required for air-conditioning cooling tower makeup water having a total hardness of less than 11 gr/gal (188 mg/L) expressed as calcium carbonate. Not less than 3.5 cycles of concentration are required for air-conditioning cooling tower makeup water having a total hardness equal to or exceeding 11 gr/gal (188 mg/L) expressed as calcium carbonate.

Exception: Air-conditioning cooling tower makeup water having a discharge conductivity range not less than 7 gr/gal (120 mg/L) to 9 gr/gal (154 mg/L) of silica measured as silicon dioxide.

708.4 Use of reclaimed (recycled) and on-site treated nonpotable water for cooling. RESERVED.

708.4.1 Drift eliminator. RESERVED.

708.4.2 Disinfection. RESERVED.

SECTION 709

WATER-POWERED SUMP PUMPS

709.1 Sump pumps. Sump pumps powered by potable or reclaimed (recycled) water pressure are not permitted.

**SECTION 710
WATER HEATING DESIGN,
EQUIPMENT AND INSTALLATION**

710.1 Maximum volume of hot water. The maximum volume of water contained in hot water distribution lines between the water heater and the fixture stop or connection to showers, kitchen faucets, and lavatories shall be determined in accordance with Section 710.1.1, 710.1.2 or 710.1.3. The water volume shall be calculated using Table 710.1.

710.1.1 Central core/remote manifold. Central core and remote manifold plumbing system hot water distribution line volume to each qualified fixture shall not exceed a volume of 32 ounces (oz) (946 mL).

710.1.2 Central manifold. Central manifold plumbing system hot water system (also referred to as parallel piping or home run), including the supply line from the hot water source to the manifold, the internal volume of the manifold and the lines to each qualified fixture, shall not exceed a volume of 32 oz (946 mL).

710.1.3 Recirculation loop. Run out lines from the hot water recirculation loop shall not exceed a volume of 16 oz (473 mL). Residential hot water recirculation systems are limited to those that utilize on-demand activation of the circulating pump.

**SECTION 711
HOT WATER CIRCULATING SYSTEMS**

711.1 Pump operation.

711.2 Demand controlled.

711.3 Recirculation system balancing. Systems with multiple recirculation zones shall be balanced to uniformly distribute hot water, or they shall be operated with a pump for each zone.

Exception: Systems with multiple recirculation zones that are designed to distribute hot water with differing temperatures.

711.4 Flow balancing valves. Flow balancing valves shall be factory preset automatic flow control valves, flow-regulating valves, or balancing valves with memory stop.

711.5 Air Elimination. Provision shall be made for the elimination of air from the return line of a recirculation system.

711.6 Maximum volume of hot water. The maximum volume of water contained in hot water distribution lines between the water heater and the fixture stop or connection to showers, kitchen faucets and lavatories shall be determined in accordance with Section 710.1.

**SECTION 712
SERVICE WATER HEATING SYSTEM CONTROLS**

712.1 Temperature controls.

712.2 Temperature maintenance controls. Systems designed to maintain usage temperatures in hot water pipes, such as recirculating hot water systems or heat trace, shall be equipped with automatic time switches or other controls that can be set to switch off the usage temperature maintenance system during extended periods when hot water is not required. [ASHRAE 90.1:7.4.4.2]

712.3 Outlet temperature controls. Temperature controlling means shall be provided to limit the maximum temperature of water delivered from lavatory faucets in public facility restrooms to 110°F (43°C). [ASHRAE 90.1:7.4.4.3]

712.4 Circulating pump controls. When used to maintain storage tank water temperature, recirculating pumps shall be equipped with controls limiting operation to a period from the start of the heating cycle to a maximum of 5 minutes after the end of the heating cycle. [ASHRAE 90.1:7.4.4.4]

**SECTION 713
INSULATION**

713.1 Insulation. Hot water supply and return piping shall be thermally insulated. The wall thickness of the insulation shall be equal to the nominal diameter of the pipe up to 2 inches (50 mm). The wall thickness shall be not less than 2 inches (51 mm) for nominal pipe diameters exceeding 2 inches (50 mm). The

**TABLE 710.1
WATER VOLUME FOR DISTRIBUTION PIPING MATERIALS**

Nominal size (inch)	OUNCES OF WATER PER FOOT LENGTH OF PIPING							
	Copper M	Copper L	Copper K	CPVC CTS SDR 11	CPVC SCH 40	PEX-AL-PEX	PE-AL-PE	PEX CTS SDR 9
3/8	1.06	0.97	0.84	NA	1.17	0.63	0.63	0.64
1/2	1.69	1.55	1.45	1.25	1.89	1.31	1.31	1.18
3/4	3.43	3.22	2.90	2.67	3.38	3.39	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	5.56	5.56	3.91
1 1/4	8.70	8.36	8.09	6.61	9.66	8.49	8.49	5.81
1 1/2	12.18	11.83	11.45	9.22	13.20	13.88	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	21.48	21.48	13.86

For SI: 1 foot = 304.8 mm, 1 ounce = 29.573 mL

conductivity of the insulation [k-factor [Btu · in/(h · ft² · °F)], measured radially, shall be less than or equal to 0.28 [Btu · in/(h · ft² · °F)] [0.04 W/(m · k)]. Hot water piping to be insulated shall be installed such that insulation is continuous. Pipe insulation shall be installed to within 1/4 inch (6.4 mm) of all appliances, appurtenances, fixtures, structural members or a wall where the pipe passes through to connect to a fixture within 24 inches (610 mm). Building cavities shall be large enough to accommodate the combined diameter of the pipe plus the insulation, plus any other objects in the cavity that the piping must cross. Pipe supports shall be installed on the outside of the pipe insulation.

Exceptions:

1. Where the hot water pipe is installed in a wall that is not of sufficient width to accommodate the pipe and insulation, the insulation thickness shall be permitted to have the maximum thickness that the wall can accommodate and not less than 1/2 inch (12.7 mm) thick.
2. Hot water supply piping exposed under sinks, lavatories and similar fixtures.
3. Where hot water distribution piping is installed within attic, crawl space, or wall insulation.
 - a. In attics and crawl spaces, the insulation shall cover the pipe not less than 5 1/2 inches (140 mm) further away from the conditioned space.
 - b. In walls, the insulation must completely surround the pipe with not less than 1 inch (25.4 mm) of insulation.
 - c. If burial within the insulation will not completely or continuously surround the pipe, then these exceptions do not apply.

**SECTION 714
HOT WATER SUPPLY AND RETURN**

714.1 General. Section 709 contains *project electives* related to water conservation and efficiency. *Project electives* shall not be mandatory unless selected by the owner or *registered design professional* and indicated in the Project Elective Checklist required by Section 303.1.

714.1 Appliances. Project Elective. Where a building owner opts for the plumbing appliances project elective, and the building is an occupancy listed under Section 613.5.2, then Sections 714.1.2 and 714.1.3 apply.

714.1.2 Dishwashers. Residential and commercial dishwashers shall be in accordance with the ENERGY STAR program requirements.

714.1.3 Clothes washers. Residential clothes washers shall be in accordance with the ENERGY STAR program requirements. Commercial clothes washers shall be in accordance with ENERGY STAR program requirements, where such requirements exist.

714.2 Indoor water use. This section contains *project electives* related to indoor water use.

714.2.1 Water conservation tier project elective. RESERVED.

714.3 On-site waste water treatment project elective. RESERVED.

714.4 Nonpotable outdoor water supply project elective. RESERVED.

714.4.1 Labeling and signage. RESERVED.

714.5 Nonpotable water for plumbing fixture flushing water project elective. Where projects are intended to qualify for a *nonpotable* water for plumbing fixture flushing *project elective* in accordance with Section 303.1, *nonpotable* water shall be used for flushing water closets and urinals.

714.5.1 Water quality. *Nonpotable* water for water closet and urinal flushing shall meet the requirements of Statewide Alternate Method(s) 080-1, 08-2, 08-3 or 08-4, as applicable.

714.5.2 Filtration required. RESERVED.

714.5.3 Labeling and signage. RESERVED.

714.6 Automatic fire sprinkler system project elective. RESERVED.

714.6.1 Emergency power. RESERVED.

714.6.2 Source volume indication. RESERVED.

714.7 Nonpotable water supply to fire pumps project elective. RESERVED.

714.7.1 Labeling and signage. RESERVED.

714.8 Nonpotable water for industrial process makeup water project elective. Where projects are intended to qualify for a *nonpotable* water for industrial process makeup water *project elective* in accordance with Section 303.1, industrial processes requiring makeup water shall meet the requirements of Statewide Alternate Method 08-4.

714.8.1 Labeling and signage. RESERVED.

714.9 Efficient hot water distribution system project elective. RESERVED.

714.9.1 Volume calculation. RESERVED.

714.10 Nonpotable water for cooling tower makeup water project elective. RESERVED.

714.11 Gray water collection project elective. Where projects are intended to qualify for a *gray water* collection *project elective* in accordance with Section 303.1, waste water from lavatories, showers, bathtubs, and clothes washers and laundry trays shall be collected for reuse on site in accordance with the requirements of Statewide Alternate Method 08-2.