

CHAPTER 4 (CW/RW)

WATER USE EFFICIENCY

This chapter applies to both commercial and residential buildings.

SECTION 401 GENERAL

401.1 (IgCC 601.1) (6.1) Scope. This chapter specifies requirements for *potable water* and *nonpotable water* use efficiency for commercial and residential buildings. [Remaining IgCC text for this section has been omitted because it is not applicable to the IWCCP.]

SECTION 402 POTABLE AND NONPOTABLE WATER USE EFFICIENCY

402.1 (IgCC 601.3.1) (6.3.1) Site water use reduction.

402.1.1 (IgCC 601.3.1.1) (6.3.1.1) Landscape design. A minimum of 60% of the area of the *improved landscape* shall be in *biodiverse planting of native plants* and *rainfall- ET_c compatible plants*.

Exceptions:

1. The area of dedicated athletic fields, golf courses, driving ranges, and areas dedicated for production of food for human consumption shall be excluded from the calculation of the *improved landscape* for schools, residential common areas, or public recreational facilities.
2. Landscape areas irrigated solely with *alternate on-site sources of water* shall be exempt from these requirements.
3. Where average annual rainfall is less than 12 in. (300 mm), *plants* other than *turfgrass*, with an annual ET_c of 15 in. (380 mm) or less, shall be deemed equivalent to *rainfall- ET_c compatible plants*.

402.1.2 (IgCC 601.3.1.2) (6.3.1.2) Irrigation. For landscaped areas, not greater than one-third of *improved landscape* area is allowed to be irrigated with *potable water*. The area of dedicated athletic fields shall be excluded from the calculation of the *improved landscape* for schools, residential common areas, and public recreational facilities. All other irrigation shall be provided from alternate sources of water.

Exception: *Potable water* is allowed to be used on such newly installed landscape for the *landscape establishment period*. The amount of *potable water* allowed to be applied to the newly planted areas during the *landscape establishment period* shall not exceed 70% of ET_o for *turfgrass* and 55% of ET_o for other plantings.

402.1.2.1 (IgCC 601.3.1.2.1) (6.3.1.2.1) Irrigation system design. The design of the irrigation system shall be performed by an accredited or certified irrigation professional and shall be in accordance with the following:

- a. Irrigation systems:
 1. Shall be based on *hydrozones*. *Turfgrass* areas shall be on their own *irrigation stations*.
 2. Shall have backflow prevention in accordance with the plumbing code (**Informative note:** e.g., *International Plumbing Code*).
 3. [JO] Shall have a master valve on municipally supplied water sources that allows pressurization of the irrigation mainline only when irrigation is scheduled.
 4. [JO] Shall have a flow sensor and monitoring equipment that will shut off the control valve if the flow exceeds normal flow from an *irrigation station*.
 5. Shall prevent piping from draining between irrigation events.
- b. Irrigation emission devices shall comply with ASABE/ICC 802, *Landscape Irrigation Sprinkler and Emitter Standard*.
- c. Irrigation sprinklers:
 1. Shall not spray water directly on *buildings* or *hardscape* area.
 2. Shall have matched precipitation rate nozzles within an *irrigation station*.
 3. Shall be prohibited on landscape areas having any dimension less than 4 ft (1.2 m).
 4. Shall have an application rate less than or equal to 0.75 in. (19 mm) per hour on slopes greater than 1 unit vertical in 4 units horizontal.

5. Shall be limited to use with *turfgrass* or *ground cover* areas with vegetation maintained at 8 in. (200 mm) or less in height.
 6. Where of the pop-up configuration, shall have a pop-up height of not less than 4 in. (100 mm).
- d. Microirrigation zones:
1. Shall be equipped with pressure regulators, filters, and flush assemblies.
 2. Shall have indicators that allow confirmation of operation by visual inspection.
 3. Drip emitters shall be of pressure-compensating type.

402.1.2.2 (IgCC 601.3.1.2.2) (6.3.1.2.2) Controls.

Where any irrigation system for the project site uses an automatic controller, the system shall be controlled by a qualifying *smart controller* that uses evapotranspiration (ET) and weather data to adjust irrigation schedules and complies with the minimum requirements. Alternatively, the system shall be controlled by an on-site rain or moisture sensor that automatically shuts off the system after a predetermined amount of rainfall or sensed moisture in the soil. Qualifying *smart controllers* shall be labeled according to USEPA *WaterSense Specification for Weather-Based Irrigation Controllers* or tested in accordance with Irrigation Association SWAT Climatologically Based Controllers, 8th Testing Protocol. *Smart controllers* that use *ET* data shall provide the following irrigation amounts:

- a. *Irrigation adequacy*—80% minimum *ET_c*.
- b. *Irrigation excess*—not to exceed 10% of *ET_c*.

Exception: A temporary irrigation system used exclusively for the establishment of new landscape shall be exempt from this requirement. Temporary irrigation systems shall be removed or permanently disabled at such time as the *landscape establishment period* has expired.

402.1.2.2.1 (IgCC 601.3.1.2.2.1) (6.3.1.2.2.1) Posted settings.

The following settings and schedule for the irrigation control system shall be posted on or adjacent to the controller:

- a. Precipitation rate of each *irrigation station*.
- b. *Plant* factors for each *hydrozone*.
- c. Soil type.
- d. Rain sensor settings.
- e. Soil moisture sensor settings, where installed.

- f. Peak demand schedule, including run times, cycle starts, and soak times.
- g. Maximum runtimes to prevent water run-off.

402.1.2.3 (IgCC 601.3.1.2.3) (6.3.1.2.3) Irrigation of rainfall-*ET_c* compatible plants. The use of *potable water* or *reclaimed water* for irrigation of *adapted plants* is prohibited after the *landscape establishment period*. In-ground irrigation systems for *rainfall-*ET_c* compatible plants* using *potable water* or off-site treated *reclaimed water* are prohibited. After the *landscape establishment period* of *adapted plants*, the irrigation system using *potable water* or *reclaimed water* shall be permanently disabled or removed from site.

Exception: *Plants* deemed equivalent to *rainfall-*ET_c* compatible plants* by Section 402.1.1 (IgCC 601.3.1.1) (6.3.1.1), Exception 3, shall be exempt from the requirements of Section 402.1.2.3 (IgCC 601.3.1.2.3) (6.3.1.2.3).

402.2 (IgCC 601.3.2) (6.3.2) Building water use reduction.

402.2.1 (IgCC 601.3.2.1) (6.3.2.1) Plumbing fixtures and fittings. *Plumbing fixtures* (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following requirements, as shown in Table 402.2.1 (IgCC Table 601.3.2.1) (Table 6.3.2.1):

- a. **Water closets (toilets)—flushometer valve type.** For single-flush, maximum flush volume shall be determined in accordance with ASME A112.19.2/CSA B45.1 and shall not exceed 1.28 gal (4.8 L). For dual-flush, the full-flush volume shall not exceed 1.28 gal (4.8 L) per flush. Dual-flush fixtures shall also comply with the provisions of ASME A112.19.14.
- b. **Water closets (toilets)—tank-type.** Tank-type water closets shall be certified to the performance criteria of the USEPA WaterSense Tank-Type High-Efficiency Toilet Specification and shall have a maximum full-flush volume of 1.28 gal (4.8 L). Dual-flush fixtures shall also comply with the provisions of ASME A112.19.14.
- c. **Urinals.** Maximum flush volume, when determined in accordance with ASME A112.19.2/CSA B45.1, shall not exceed 0.5 gal (1.9 L). Flushing urinals shall comply with the performance criteria of the USEPA WaterSense Specification for Flushing Urinals. Nonwater urinals shall comply with ASME A112.19.19 (vitreous china) or IAPMO Z124.9 (plastic) as appropriate.
- d. **Public lavatory faucets.** Maximum flow rate shall not exceed 0.5 gpm (1.9 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1.
- e. **Public metering self-closing faucet.** Maximum water use shall not exceed 0.25 gal (1.0 L) per metering cycle when tested in accordance with ASME A112.18.1/CSA B125.1.

- f. **Residential bathroom lavatory sink faucets.** Maximum flow rate shall not exceed 1.5 gpm (5.7 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1. Residential bathroom lavatory sink faucets shall comply with the performance criteria of the USEPA WaterSense High-Efficiency Lavatory Faucet Specification.
- g. **Residential kitchen faucets.** Maximum flow rate shall not exceed 1.8 gpm (6.8 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1. Kitchen faucets shall be permitted to temporarily increase the flow greater than 1.8 gpm (6.8 L/min) but shall not exceed 2.2 gpm (8.3 L/min) and must automatically revert to the established maximum flow rate of 1.8 gpm (6.8 L/min) upon physical release of the activation mechanism or closure of the faucet valve.
- h. **Residential showerheads.** Maximum flow rate shall not exceed 2.0 gpm (7.6 L/min) when tested in accordance with ASME A112.18.1/CSA B125.1. *Residential* showerheads shall comply with the performance requirements of the USEPA WaterSense Specification for Showerheads.
- i. **Residential shower compartment (stall) in dwelling units and guest rooms.** The allowable flow rate from all shower outlets (including rain systems, waterfalls, bodysprays, and jets) that can operate simultaneously shall be limited to a total of 2.0 gpm (7.6 L/min).

Exception: Where the area of a shower compartment exceeds 2600 in.² (1.7 m²), an additional flow of 2.0 gpm (7.6 L/min) shall be permitted for each multiple of 2600 in.² (1.7 m²) of floor area or fraction thereof.
- j. **Water-bottle filling stations.** *Water-bottle filling stations* shall be an integral part of, or shall be

installed adjacent to, not less than 50% of all drinking fountains installed indoors on the premises.

402.2.2 (IgCC 601.3.2.2) (6.3.2.2) Appliances.

- a. Clothes washers and dishwashers installed within *dwelling units* shall comply with the ENERGY STAR® Program Requirements for Clothes Washers and ENERGY STAR Program Requirements for Dishwashers. Maximum water use shall be as follows:
 1. Clothes washers (residential)—Maximum *water factor (WF)* of 5.4 gal/ft³ of drum capacity (0.72 L/L of drum capacity).
 2. Dishwashers—Standard-size dishwashers shall have a maximum *WF* of 3.8 gal/full operating cycle (14.3 L/full operating cycle). Compact sizes shall have a maximum *WF* of 3.5 gal/full operating cycle (13.2 L/full operating cycle). Standard and compact size shall be defined by ENERGY STAR criteria.

[See also the energy efficiency requirements in Section 701.4.7.3 (7.4.7.3) of the *International Green Construction Code*.]
- b. Clothes washers installed in publicly accessible spaces (***Informative Note:*** e.g., multifamily and hotel common areas), and coin- and card-operated clothes washers of any size used in laundromats, shall have a maximum *WF* of 4.0 gal/ft³ of drum capacity normal cycle (0.53 L/L of drum capacity normal cycle). [See also the energy efficiency requirements in Section 701.4.7.3 (7.4.7.3) of the *International Green Construction Code*.]
- c. Commercial dishwashers in commercial food-service facilities shall meet all ENERGY STAR requirements as listed in the ENERGY STAR Pro-

**TABLE 402.2.1 (IgCC TABLE 601.3.2.1) (TABLE 6.3.2.1)
PLUMBING FIXTURES AND FITTINGS REQUIREMENTS**

PLUMBING FIXTURE	MAXIMUM
Water closets (toilets)—flushometer single-flush valve type	Single-flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—flushometer dual-flush valve type	Full-flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—single-flush tank-type	Single-flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—dual-flush tank-type	Full-flush volume of 1.28 gal (4.8 L)
Urinals	Flush volume 0.5 gal (1.9 L)
Public lavatory faucets	Flow rate—0.5 gpm (1.9 L/min)
Public metering self-closing faucet	0.25 gal (1.0 L) per metering cycle
<i>Residential</i> bathroom lavatory sink faucets	Flow rate—1.5 gpm (5.7 L/min)
<i>Residential</i> kitchen faucets	Flow rate—1.8 gpm (6.8 L/min) ^a
<i>Residential</i> showerheads	Flow rate—2.0 gpm (7.6 L/min)
<i>Residential</i> shower compartment (stall) in <i>dwelling units</i> and guest rooms	Flow rate from all shower outlets total of 2.0 gpm (7.6 L/min)

a. With provision for a temporary override to 2.2 gpm (8.3 L/min) as specified in Section 402.2.1(g) (IgCC 601.3.2.1(g)) (6.3.2.1(g)).

gram Requirements for Commercial Dishwashers, Version 2.0.

402.2.3 (IgCC 601.3.2.3) (6.3.2.3) HVAC systems and equipment.

- a. *Once-through cooling* with *potable water* is prohibited.
- b. The design of open-circuit cooling towers for air-conditioning systems, including the materials used to construct them and their water treatment systems, shall not allow water exchange (blowdown) until one or more of the parameters in Table 402.2.3 (IgCC Table 601.3.2.3) (Table 6.3.2.3) reaches 90% or more of the maximum value specified in Table 402.2.3 (IgCC Table 601.3.2.3) (Table 6.3.2.3). The system shall be tolerant of pH levels between 7.0 and 9.2.
- c. The materials of construction for the water cooling system that comes in contact with cooling tower water shall be of the type that can operate and be maintained within the limits set in Table 402.2.3 (IgCC Table 601.3.2.3) (Table 6.3.2.3).
- d. Open-circuit cooling towers, closed-circuit cooling towers, and evaporative condensers shall be equipped with makeup and water meters, conductivity controllers, and overflow alarms in accordance with the thresholds listed in Table 402.4.1B (IgCC Table 601.3.5.1B) (Table 6.3.5.1B). Cooling towers shall be equipped with drift eliminators that reduce drift to 0.002% or less of the recirculated water flow for counterflow towers and 0.005% or less of the recirculated water flow for cross-flow towers.
- e. *Building projects* located in regions where the ambient mean coincident wet-bulb temperature at 1% design cooling conditions is greater than or equal to 72°F (22°C) shall have a system for collecting condensate from air-conditioning units with a capacity greater than 65,000 Btu/h (19 kW), and the condensate shall be recovered for reuse.

**TABLE 402.2.3 (IgCC TABLE 601.3.2.3) (TABLE 6.3.2.3)
RECIRCULATING WATER PROPERTIES FOR OPEN-CIRCUIT
COOLING-TOWER CONSTRUCTION**

RECIRCULATING WATER PARAMETERS	MAXIMUM VALUE
Conductivity (micro-ohms)	3300
Total dissolved solids (ppm)	2050
Total alkalinity as CaCO ₃ (ppm) excluding galvanized steel	600
Total alkalinity as CaCO ₃ (ppm) galvanized steel (passivated)	500
Calcium hardness as CaCO ₃ (ppm)	600
Chlorides as Cl (ppm)	300
Sulfates (ppm)	250
Silica (ppm)	150
<i>Langelier Saturation Index (LSI)</i>	+2.8

402.2.4 (IgCC 601.3.2.4) (6.3.2.4) Roofs.

- a. The use of *potable water* or *reclaimed water* for roof spray systems to thermally condition the roof shall be prohibited.

Exception: Where *approved*, on-site treated *reclaimed water* may be used for roof spray systems.

- b. In-ground irrigation systems on vegetated roofs using *potable water* or off-site treated *reclaimed water* shall be prohibited.
- c. The use of *potable water* or *reclaimed water* for irrigation of vegetated (green) roofs is prohibited after the vegetation establishment period or 18 month after the initial installation, whichever is less. After the landscape *plants* are established, the irrigation system using *potable water* or *reclaimed water* shall be removed from site.

Exception: Where *approved*, on-site treated *reclaimed water* may be used for vegetated roof irrigation systems during and after the vegetation establishment period.

402.2.5 (IgCC 601.3.2.5) (6.3.2.5) Commercial food service operations. (Informative Note: e.g., restaurants, cafeterias, food preparation kitchens, caterers, etc.). Commercial food service operations:

- a. Shall use high-efficiency prerinse spray valves (i.e., valves that function at 1.3 gpm [4.9 L/min] or less and comply with a 26 second performance requirement when tested in accordance with ASTM F2324),
- b. Shall use dishwashers that comply with the requirements of the ENERGY STAR Program for Commercial Dishwashers,
- c. Shall use boilerless/connectionless food steamers that consume no more than 2.0 gal/h (7.5 L/h) in the full operational mode,
- d. Shall use combination ovens that consume not more than 10 gal/h (38 L/h) in the full operational mode,
- e. Shall use air-cooled ice machines that comply with the requirements of the ENERGY STAR Program for Commercial Ice Machines, and
- f. Shall be equipped with hands-free faucet controllers (foot controllers, sensor activated, or other) for all faucet fittings within the food preparation area of the kitchen and the dish room, including pot sinks and washing sinks.

402.2.6 (IgCC 601.3.2.6) (6.3.2.6) Medical and laboratory facilities. Medical and laboratory facilities, including clinics, hospitals, medical centers, physician and dental offices, and medical and nonmedical laboratories of all types shall:

- a. Use only water-efficient steam sterilizers equipped with (1) water-tempering devices that allow water to flow only when the discharge of condensate or hot water from the sterilizer exceeds 140°F

(60°C), and (2) mechanical vacuum equipment in place of venturi-type vacuum systems for vacuum sterilizers.

- b. Use film processor water-recycling units where large-frame X-ray films of more than 6 in. (150 mm) in either length or width are processed. Small dental X-ray equipment is exempt from this requirement.
- c. Use digital imaging and radiography systems where the digital networks are installed.
- d. Use a dry-hood scrubber system or, if the applicant determines that a wet-hood scrubber system is required, the scrubber shall be equipped with a water recirculation system. For perchlorate hoods and other applications where a hood wash-down system is required, the hood shall be equipped with self-closing valves on those wash-down systems.
- e. Use only dry vacuum pumps unless fire and safety codes (**Informative Note:** e.g., *International Fire Code*) for explosive, corrosive, or oxidative gases require a liquid ring pump.
- f. Use only efficient water treatment systems that comply with the following criteria:
 - 1. For all filtration processes, pressure gages shall determine and display when to backwash or change cartridges.
 - 2. For all ion exchange and softening processes, recharge cycles shall be set by volume of water treated or based on conductivity or hardness.
 - 3. For reverse osmosis and nanofiltration equipment with capacity greater than 27 gal/h (100 L/h), reject water shall not exceed 60% of the feed water and shall be used as scrubber feed water or for other beneficial uses on the project site.
 - 4. Simple distillation is not acceptable as a means of water purification.
- g. With regard to food service operations within medical facilities, comply with Section 402.2.5 (IgCC 601.3.2.5) (6.3.2.5).

402.3 [JO] (IgCC 601.3.4) (6.3.4) Special water features.

Water use shall comply with the following:

- a. Ornamental fountains and other ornamental water features shall be supplied either by *alternate on-site sources of water* or by municipally *reclaimed water* delivered by the local water utility. Fountains and other features equipped with automatic water refilling valves shall be equipped with (1) makeup water meters, (2) leak detection devices that shut off water

flow if a leak of more than 1.0 gal/h (3.8 L/h) is detected, and (3) equipment to recirculate, filter, and treat all water for reuse within the system.

Exception: Where *alternate on-site sources of water* or municipally *reclaimed water* are not available within 500 ft (150 m) of the *building project* site, *potable water* is allowed to be used for water features with less than 10,000 gal (38,000 L) capacity.

- b. Pools and spas:
 - 1. Recover filter backwash water for reuse on landscaping or other applications or treat and reuse backwash water within the system.
 - 2. For filters with removable cartridges, only reusable cartridges and systems shall be used. For filters with backwash capability, use only pool filter equipment that includes a pressure drop gage to determine when the filter needs to be backwashed and a sight glass enabling the operator to determine when to stop the backwash cycle.
 - 3. Pool splash troughs, if provided, shall drain back into the pool system.

402.4 (IgCC 601.3.5) (6.3.5) Water consumption measurement.

402.4.1 (IgCC 601.3.5.1) (6.3.5.1) Consumption management. Measurement devices with remote communication capability shall be provided to collect water consumption data for the domestic water supply to the *building*. Both *potable* and *reclaimed water* entering the *building project* shall be monitored or submetered. In addition, for individual leased, rented, or other tenant or subtenant *space* within any *building* totaling in excess of 50,000 ft² (5000 m²), separate submeters shall be provided. For subsystems with multiple similar units, such as multicell cooling towers, only one measurement device is required for the subsystem. Any project or *building*, or tenant or subtenant *space* within a project or *building*, such as a commercial car wash or aquarium, shall be submetered where consumption is projected to exceed 1000 gal/day (3800 L/day).

Measurement devices with remote capability shall be provided to collect water use data for each water supply source (**Informative Note:** e.g., *potable water*, *reclaimed water*, rainwater) to the *building project* that exceeds the thresholds listed in Table 402.4.1A (IgCC Table 601.3.5.1A) (Table 6.3.5.1A). Utility company service entrance/interval meters are allowed to be used.

Provide submetering with remote communication measurement to collect water use data for each of the building subsystems if such subsystems are sized above the threshold levels listed in Table 402.4.1B (IgCC Table 601.3.5.1B) (Table 6.3.5.1B).

WATER USE EFFICIENCY

**TABLE 402.4.1A (IgCC TABLE 601.3.5.1A) (TABLE 6.3.5.1A)
WATER SUPPLY SOURCE MEASUREMENT THRESHOLDS**

WATER SOURCE	MAIN MEASUREMENT THRESHOLD
Potable water	1000 gal/day (3800 L/day)
Municipally reclaimed water	1000 gal/day (3800 L/day)
Alternate sources of water	500 gal/day (1900 L/day)

**TABLE 402.4.1B (IgCC TABLE 601.3.5.1B) (TABLE 6.3.5.1B)
SUBSYSTEM WATER MEASUREMENT THRESHOLDS**

SUBSYSTEM	SUBMETERING THRESHOLD
Cooling towers (meter on makeup water and blowdown)	Cooling tower flow through tower > 500 gpm (30 L/s)
Evaporative coolers	Makeup water > 0.6 gpm (0.04 L/s)
Steam and hot-water boilers	> 500,000 Btu/h (150 kW) input
Total irrigated landscape area with controllers	> 25,000 ft ² (2500 m ²)
Separate campus or project buildings	Consumption > 1000 gal/day (3800 L/day)
Separately leased or rental space	Consumption > 1000 gal/day (3800 L/day)
Any large water-using process	Consumption > 1000 gal/day (3800 L/day)

402.4.2 [JO] (IgCC 601.3.5.2) (6.3.5.2) Consumption data collection. All building measurement devices, monitoring systems, and submeters installed to comply with the threshold limits in Section 402.4.1 (IgCC 601.3.5.1) (6.3.5.1) shall be configured to communicate water consumption data to a *meter* data management system. At a minimum, *meters* shall provide daily data and shall record hourly consumption of water.

402.4.3 [JO] (IgCC 601.3.5.3) (6.3.5.3) Data storage and retrieval. The meter data management system shall be capable of electronically storing water meter, monitoring systems, and submeter data and creating user reports showing calculated hourly, daily, monthly, and annual water consumption for each measurement device and submeter and provide alarm notification capabilities as needed to support the requirements of the water user efficiency plan for operation in Section 801.4.1 (IgCC 1001.9.2) (10.9.2).

402.5 (IgCC 601.3.6) (6.3.6) Water softeners. Water softeners shall comply with Sections 402.5.1 (IgCC 601.3.6.1) (6.3.6.1) through 402.5.4 (IgCC 601.3.6.4) (6.3.6.4).

402.5.1 (IgCC 601.3.6.1) (6.3.6.1) Demand-initiated regeneration. Water softeners shall be equipped with demand-initiated regeneration control systems. Timer-based control systems shall be prohibited.

402.5.2 (IgCC 601.3.6.2) (6.3.6.2) Water consumption. During regeneration, water softeners shall have a maximum water consumption of 4 gal (15.1 L) per 1000 gr (17.1 g/L) of hardness removed, as measured in accordance with NSF 44.

402.5.3 (IgCC 601.3.6.3) (6.3.6.3) Waste connections. Wastewater from water softener regeneration shall not discharge to *reclaimed water* collection systems and shall discharge in accordance with the *International Plumbing Code*.

402.5.4 (IgCC 601.3.6.4) (6.3.6.4) Efficiency and listing. Water softeners that regenerate in place, that are connected to the water system they serve by piping not exceeding 1¹/₄ in. (31.8 mm) in diameter, or that have a volume of 3 ft³ (0.085 m³) or more of cation exchange media shall have a rated salt efficiency of not less than 4000 gr of total hardness exchange per pound of salt (571 g of total hardness exchange per kilogram of salt), based on sodium chloride equivalency, and shall be listed and labeled in accordance with NSF 44. All other water softeners shall have a rated salt efficiency of not less than 3500 gr of total hardness exchange per pound of salt (500 g of total hardness exchange per kilogram of salt), based on sodium chloride equivalency.

402.6 (IgCC 601.3.7) (6.3.7) Reverse osmosis water treatment systems. Reverse osmosis systems shall be equipped with an automatic shutoff valve that prevents the production of reject water when there is no demand for treated water. Point-of-use reverse osmosis treatment systems for drinking water shall be *listed and labeled* in accordance with NSF 58.

402.7 [JO] (IgCC 601.3.9) (6.3.9) Dual water supply plumbing. Where sufficient supply of *reclaimed water* or *alternate on-site sources of water* is available, or planned to be available, within five years of completed *building* construction, the water supply system within the *building* shall be installed to allow the supply of reclaimed or alternative water to all urinals and water closets.

Exceptions:

1. *Existing buildings* under renovation, where the water supply to the urinals and water closets within the *building* is to remain intact, shall not be required to supply *nonpotable water* to urinals and water closets.
2. Urinals and water closets designed to operate without the use of water shall not be required to have alternate or reclaimed water supply to the fixture.

CHAPTER 5

HOT WATER SYSTEMS—COMMERCIAL

SECTION CW501 GENERAL REGULATIONS

CW501.1 (IECC C404.1) General. This chapter covers the minimum efficiency of, and controls for, *service water-heating* equipment and insulation of service hot water piping.

CW501.2 (IECC C404.2) Service water-heating equipment performance efficiency. Water-heating equipment and hot water storage tanks shall meet the requirements of Table CW501.2 (IECC Table C404.2). The efficiency shall be verified through data furnished by the manufacturer of the equipment or through certification under an *approved* certification program. Water-heating equipment intended to be used to provide space heating shall meet the applicable provisions of Table CW501.2 (IECC Table C404.2).

CW501.2.1 (IECC C404.2.1) High input service water-heating systems. Gas-fired water-heating equipment installed in new *buildings* shall be in compliance with this section. Where a singular piece of water-heating equipment serves the entire *building* and the input rating of the equipment is 1,000,000 Btu/h (293 kW) or greater, such equipment shall have a thermal efficiency, E_p , of not less than 92 percent. Where multiple pieces of water-heating equipment serve the *building* and the combined input rating of the water-heating equipment is 1,000,000 Btu/h (293 kW) or greater, the combined input-capacity-weighted-average thermal efficiency, E_p , shall be not less than 90 percent.

Exceptions:

1. Where not less than 25 percent of the annual *service water-heating* requirement is provided by *on-site renewable energy* or site-recovered energy, the minimum thermal efficiency requirements of this section shall not apply.
2. The input rating of *water heaters* installed in individual *dwelling units* shall not be required to be included in the total input rating of *service water-heating* equipment for a building.
3. The input rating of *water heaters* with an input rating of not greater than 100,000 Btu/h (29.3 kW) shall not be required to be included in the total input rating of *service water-heating* equipment for a *building*.

CW501.2.2 (IPC 612.1) Solar systems. The construction, installation, alterations and *repair* of systems, equipment and *appliances* intended to utilize solar energy for space heating or cooling, domestic hot water heating, swimming pool heating or process heating shall be in accordance with the *International Mechanical Code*.

CW501.3 (IECC C404.3) Heat traps for hot water storage tanks. Storage tank-type *water heaters* and hot water storage tanks that have vertical water pipes connecting to the inlet and outlet of the tank shall be provided with integral heat

traps at those inlets and outlets or shall have pipe-configured heat traps in the piping connected to those inlets and outlets. Tank inlets and outlets associated with solar water heating system circulation loops shall not be required to have heat traps.

CW501.4 (IECC C404.4) Insulation of piping. Piping from a *water heater* to the termination of the heated water fixture supply pipe shall be insulated in accordance with Table C403.12.3 of the *International Energy Conservation Code*. On both the inlet and outlet piping of a storage *water heater* or heated water storage tank, the piping to a heat trap or the first 8 feet (2438 mm) of piping, whichever is less, shall be insulated. Piping that is heat traced shall be insulated in accordance with Table C403.12.3 of the *International Energy Conservation Code* or the heat trace manufacturer's instructions. Tubular pipe insulation shall be installed in accordance with the insulation manufacturer's instructions. Pipe insulation shall be continuous except where the piping passes through a framing member. The minimum insulation thickness requirements of this section shall not supersede any greater insulation thickness requirements necessary for the protection of piping from freezing temperatures or the protection of personnel against external surface temperatures on the insulation.

Exception: Tubular pipe insulation shall not be required on the following:

1. The tubing from the connection at the termination of the fixture supply piping to a *plumbing fixture* or *plumbing appliance*.
2. Valves, pumps, strainers and threaded unions in piping that is 1 inch (25 mm) or less in nominal diameter.
3. Piping from user-controlled shower and bath mixing valves to the water outlets.
4. Cold-water piping of a demand recirculation water system.
5. Tubing from a hot drinking-water heating unit to the water outlet.
6. Piping at locations where a vertical support of the piping is installed.
7. Piping surrounded by building insulation with a thermal resistance (R -value) of not less than R-3.

CW501.5 (IECC C404.5) Heated water supply piping. Heated water supply piping shall be in accordance with Section CW501.5.1 (IECC 404.5.1) or CW501.5.2 (IECC 404.5.2). The flow rate through $\frac{1}{4}$ -inch (6.4 mm) piping shall be not greater than 0.5 gpm (1.9 L/m). The flow rate through $\frac{5}{16}$ -inch (7.9 mm) piping shall be not greater than 1 gpm (3.8 L/m). The flow rate through $\frac{3}{8}$ -inch (9.5 mm) piping shall be not greater than 1.5 gpm (5.7 L/m).

HOT WATER SYSTEMS—COMMERCIAL

**TABLE CW501.2 (IECC TABLE C404.2)
MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT**

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED ^{a, b}	TEST PROCEDURE
Water heaters, electric	≤ 12 kW ^d	Tabletop ^e , ≥ 20 gallons and ≤ 120 gallons	0.93 – 0.00132V, EF	DOE 10 CFR Part 430
		Resistance ≥ 20 gallons and ≤ 55 gallons	0.960 – 0.0003V, EF	
		Grid-enabled ^f > 75 gallons and ≤ 120 gallons	1.061 – 0.00168V, EF	
	> 12 kW	Resistance	(0.3 + 27/V _m), %/h	ANSI Z21.10.3
	≤ 24 amps and ≤ 250 volts	Heat pump > 55 gallons and ≤ 120 gallons	2.057 – 0.00113V, EF	DOE 10 CFR Part 430
Storage water heaters, gas	≤ 75,000 Btu/h	≥ 20 gallons and > 55 gallons	0.675 – 0.0015V, EF	DOE 10 CFR Part 430
		> 55 gallons and ≤ 100 gallons	0.8012 – 0.00078V, EF	
	> 75,000 Btu/h and ≤ 155,000 Btu/h	< 4,000 Btu/h/gal	80% E _t (Q/800 + 110√V)SL, Btu/h	ANSI Z21.10.3
	> 155,000 Btu/h	< 4,000 Btu/h/gal	80% E _t (Q/800 + 110√V)SL, Btu/h	
Instantaneous water heaters, gas	> 50,000 Btu/h and < 200,000 Btu/h ^e	≥ 4,000 Btu/h/gal and < 2 gal	0.82 – 0.00 19V, EF	DOE 10 CFR Part 430
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and < 10 gal	80% E _t	ANSI Z21.10.3
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal	80% E _t (Q/800 + 110√V)SL, Btu/h	
Storage water heaters, oil	≤ 105,000 Btu/h	≥ 20 gal and ≤ 50 gallons	0.68 – 0.0019V, EF	DOE 10 CFR Part 430
	≥ 105,000 Btu/h	< 4,000 Btu/h/gal	80% E _t (Q/800 + 110√V)SL, Btu/h	ANSI Z21.10.3
Instantaneous water heaters, oil	≤ 210,000 Btu/h	≥ 4,000 Btu/h/gal and < 2 gal	0.59 – 0.0019V, EF	DOE 10 CFR Part 430
	> 210,000 Btu/h	≥ 4,000 Btu/h/gal and < 10 gal	80% E _t	ANSI Z21.10.3
	> 210,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal	78% E _t (Q/800 + 110√V)SL, Btu/h	
Hot water supply boilers, gas and oil	≥ 300,000 Btu/h and < 12,500,000 Btu/h	≥ 4,000 Btu/h/gal and < 10 gal	80% E _t	ANSI Z21.10.3
Hot water supply boilers, gas	≥ 300,000 Btu/h and < 12,500,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal	80% E _t (Q/800 + 110√V)SL, Btu/h	
Hot water supply boilers, oil	> 300,000 Btu/h and < 12,500,000 Btu/h	> 4,000 Btu/h/gal and > 10 gal	78% E _t (Q/800 + 110√V)SL, Btu/h	
Pool heaters, gas and oil	All	—	82% E _t	ASHRAE 146
Heat pump pool heaters	All	—	4.0 COP	AHRI 1160
Unfired storage tanks	All	—	Minimum insulation requirement R-12.5 (h × ft ² × °F)/Btu	(none)

(continued)