



Homes | v4 draft

# Efficient hot water distribution system

EAc2 | Possible 5 points

## Intent

To reduce energy consumption and the burden on water supply and wastewater systems by increasing the efficiency of hot water distribution.

## Requirements

### Option 1. Efficient hot water distribution (2 points)

Design and install an energy-efficient hot water distribution system, based on either maximum pipe length requirements (Path 1) or maximum pipe volume limits (Path 2). The source of hot water is assumed to be a water heater, boiler, circulation loop piping, or electric heat-traced piping. Multiple water heaters and multiple distribution systems may be used to comply with this credit.

Systems that use heat traces that serve a single unit or house are awarded only half credit. All heat traced piping must be insulated.

### Path 1. Maximum Allowable Pipe Length

Do not exceed the maximum allowable pipe length from the source of hot water to the termination of the fixture supply pipe, as listed in Table 1. If a branch consists of more than one size of pipe, use the largest size when determining the maximum allowable length. Branch length requirements do not apply to cold water demand loads (e.g., toilets), tubs without showerheads, or stovetop pot-fillers.

Table 1. Maximum length of pipe

Nominal pipe size (inch)	Maximum pipe or tube length	
	Hot water source is a water heater or boiler with no circulation loop or heat traced pipe or in multifamily buildings a central circulation loop or heat traced pipe (feet)	Hot water source is a circulation loop or heat traced pipe serving a single unit or house (feet)
1/4	50	16
5/16	50	16
3/8	50	16
1/2	43	16
5/8	32	12
3/4	21	8
7/8	16	6
1	13	5
1 1/4	8	3
1 1/2	6	2
2 or larger	4	1

OR

### Path 2. Maximum allowable pipe volume

Do not exceed a maximum volume of hot or tempered water of 64 ounces (1.89 L) for hot water from a **water heater or boiler with no circulation loop or heat traced pipe; or in multifamily buildings a central circulation loop or heat traced pipe or in multifamily buildings a central circulation loop or heat traced pipe** to the fixture; or 24 ounces (0.71 L)

for hot water from a **circulation loop pipe or an electric heat-traced pipe serving a single unit or house** to the fixture.

Pipe volume is the sum of the internal volumes of pipe, fittings, valves, meters, and manifolds between the source of hot water and the termination of the fixture supply pipe. To determine the volume, refer to Table 2, which lists the volumes for specific types of tubing.

Branch volume requirements do not apply to cold water demand loads (e.g., toilets), tubs without showerheads, or stovetop pot-fillers.

**Table 2. Volume of water distribution pipes, by tubing type**

Ounces of water per foot length of hot water tubing								
Normal size (inches)	Copper M	Copper L	Copper K	CPVC CTS SDR 11	CPVC SCH 40	PEX-Al-PEX ASTM F 1281	PE-AL-PE	PEX CTS SDR 9
0.375	1.06	0.97	0.84	N/A	1.17	0.63	0.63	0.64
0.500	1.69	1.55	1.45	1.25	1.89	1.31	1.21	1.18
0.750	3.43	3.22	2.9	2.67	3.38	3.39	3.39	2.35
1.000	5.81	5.49	5.17	4.43	5.53	5.56	5.56	3.91
1.250	8.7	8.36	8.09	6.61	9.66	8.49	8.49	5.81
1.500	12.18	11.83	11.45	9.22	13.2	13.88	13.88	8.09
2.000	21.08	20.58	20.04	15.79	21.88	21.48	21.48	13.86

Source: Modified from 2009 International Plumbing Code Table E202.1 International Code Council.

Conversions:

1 gallon (3.8 liters) = 128 ounces

1 ounce = 0.00781 gallons (0.0296 liters)

0.5 gallons (1.9 liters) = 64 ounces

0.6 gallons (2.3 liters) = 76.8 ounces

### Paths 1 and 2, Pumps and Controls for Hot Water Circulation Loops

Circulating systems must meet the following requirements.

1. Circulating pump may not operate continuously, on a timer control, or on a water temperature (aquastat) sensors. *Gravity and thermo-syphon circulation systems are prohibited.*
2. Circulating pump must be demand activated by a momentary contact switch, motion sensor, flow switch, door switch or voice command.
3. *After the pump starts, the controls shall allow the pump to operate until the water temperature in the return pipe rises not more than 10°F (5.6 °C) above the initial temperature of the water in the pipe. Controls shall further limit the water temperature to a maximum of 105°F (40 °C). Controls shall limit pump operation to not more than 5 minutes per activation in the event that both means of shutting off the pump have failed.*
4. Circulating hot water systems must be provided with an automatic or readily accessible manual switch to turn off the hot water circulating pump when not in use.

**OR**

#### Option 2. Performance test (3 points)

**Case 1. Hot water source is a water heater or boiler with no circulation loop or heat traced pipe: or in multifamily buildings a central circulation loop or heat traced pipe.**

To minimize wasted water before hot water is delivered, using EPA WaterSense testing procedures, verify that no more than 0.5 gallon of water is stored in any piping between the hot water source and any fixture, and that no more than 0.6 gallons of water is collected from the hot water fixture before hot water is delivered.

Projects that meet WaterSense Labeled New Homes requirements automatically achieve this credit.

**Case 2. Hot water source is a circulation loop or heat traced pipe serving a single unit or house**

To minimize wasted water before hot water is delivered, using EPA WaterSense testing procedures, verify that no more than 0.25 gallons of water can be collected from the hot water fixture furthest from the recirculation loop.

Systems that use heat traces that serve a single unit or house are awarded only half credit. All heat traced piping must be insulated.

**AND/OR**

**Option 3. Pipe insulation (2 points)**

Install at least R-4 insulation on all domestic hot water piping, including subslab pipes. Insulation on all piping elbows and tees must adequately insulate changes in direction.

Run buried piping in a slab or below grade through a protective, waterproof raceway, channel, sleeve, or path whose internal dimensions and changes of direction are large enough that the piping and insulation can be removed and replaced without damaging the piping's dimensional integrity.

The waterproof sleeve is not required for below-grade piping if the insulation manufacturer stipulates that the pipe insulation will maintain its insulating value in underground applications in damp soil when installed according to the manufacturer's instructions. This exception does not apply to piping that runs through or under building slabs.