

b. A control valve shall be installed in the supply piping to each water heater and water treatment device and in the fixture supply to each water closet, exterior hose bibb, plumbing appliance and piece of equipment.

c. If a hot water circulation system is provided, a control valve shall be installed on both the inlet and outlet piping to the circulation pump. If a hot water circulation system has 2 or more return pipe lines, a balancing control valve shall be installed in each return piping line.

(5) **HOT WATER SUPPLY SYSTEMS.** (a) *General.* Water heating systems shall be sized to provide sufficient hot water to supply both the daily requirements and hourly peak loads of the building.

Note: See Appendix for further explanatory materials regarding insulation requirements for storage tanks and recirculation piping.

(b) *Temperature maintenance.* If the developed length of hot water distribution piping from the source of the hot water supply to a plumbing fixture or appliance exceeds 100 feet, a circulation system or self-regulating electric heating cable shall be provided to maintain the temperature of the hot water within the distribution piping.

1. If a circulation system is used to maintain the temperature, no uncirculated hot water distribution piping may exceed 25 feet in developed length.

2. If a self-regulating electric heating cable is used to maintain the temperature, the cable shall extend to within 25 feet of each fixture or the appliance.

3. Water distribution piping served by self-regulating electric heating cable shall be identified as being electrically traced in accordance with ch. ILHR 16.

4. The installation of self-regulating electric heating cable may be subcontracted by a plumber to another trade.

Note: See s. ILHR 63.29 for pipe insulation requirements.

(c) *Water heaters.* All water heaters and safety devices shall be designed and constructed in accordance with s. ILHR 84.20 (5) (n).

Note: Water heaters are to be installed in accordance with the requirements specified in chs. ILHR 50 to 64 and ILHR 20 to 26 with respect to enclosures and venting.

(d) *Safety devices.* Water heaters shall be equipped with safety devices as specified in this paragraph.

1. All pressurized storage-type water heaters and unfired hot water storage tanks shall be equipped with one or more combination temperature and pressure relief valves. The temperature steam rating of a combination temperature and pressure relief valve or valves shall equal or exceed the energy input rating in BTU per hour of the water heater. No shut off valve or other restricting device may be installed between the water heater or storage tank and the combination temperature and pressure relief valve.

Note: The temperature steam rating of a combination temperature and pressure relief valve is commonly referred to as the AGA temperature steam rating.

2. All pressurized non-storage type water heaters shall be provided with a pressure relief valve installed at the hot water outlet with no shut off valve between the heater and the relief valve.

3. Temperature and pressure relief valves shall be installed so that the sensing element of the valve extends into the heater or tank and monitors the temperature in the top 6 inches of the heater or tank.

4. A vacuum relief valve shall be installed in each water heater and hot water storage tank which, when measured from the bottom of the heater or tank, is located more than 20 feet above any faucet or outlet served by the heater or tank.

5. Every relief valve which is designed to discharge water or steam shall be connected to a discharge pipe.

a. The discharge pipe and fittings shall be made of a material acceptable for water distribution piping in accordance with s. ILHR 84.30 (4) (e) 1.

b. The discharge pipe and fittings shall have a diameter not less than the diameter of the relief valve outlet.

c. The discharge pipe may not be trapped.

d. No valve may be installed in the discharge pipe.

e. The discharge pipe shall be installed to drain by gravity flow to a floor served by a floor drain or to a receptor in accordance with s. ILHR 82.33 (8). The outlet of the discharge pipe shall terminate within 6 inches over the floor or receptor, but not less than a distance equal to twice the diameter of the outlet pipe. The outlet of the discharge pipe may not be threaded.

f. The discharge pipe for a water heater shall terminate within the same room or enclosure within which the water heater or hot water storage tank is located.

(e) *Controls.* 1. All hot water supply systems shall be equipped with automatic temperature controls capable of adjustments from the lowest to the highest acceptable temperature settings for the intended use.

2. A separate means shall be provided to terminate the energy supplied to each water heater and each hot water circulation system.

(6) **LOAD FACTORS FOR WATER SUPPLY SYSTEMS.** (a) *Intermittent flow fixtures.* The load factor for intermittent flow fixtures on water supply piping shall be computed in terms of water supply fixture units as specified in Tables 82.40-1 and 82.40-2 for the corresponding fixture and use. Water supply fixture units may be converted to gallons per minute in accordance with Table 82.40-3.

(b) *Continuous flow devices.* The load factor for equipment which demands a continuous flow of water shall be computed on the basis of anticipated flow rate in terms of gallons per minute.

ILHR 82.40

**Table 82.40-1**  
**WATER SUPPLY FIXTURES UNITS FOR NONPUBLIC USE FIXTURES**

TYPE OF FIXTURE <sup>a</sup>	WATER SUPPLY FIXTURE UNITS (WSFU)		
	Hot	Cold	Total
Automatic Clothes Washer	1.0	1.0	1.5
Bar Sink	0.5	0.5	1.0
Bathtub, with or without Shower Head	1.5	1.5	2.0
Bidet	1.0	1.0	1.5
Dishwashing Machine	1.0		1.0
Glass Filler		0.5	0.5
Hose Bibb:			
1/2" diameter		3.0	3.0
3/4" diameter		4.0	4.0
Kitchen Sink	1.0	1.0	1.5
Laundry Tray, 1 or 2 Compartment	1.0	1.0	1.5
Lavatory	0.5	0.5	1.0
Shower, Per Head	1.0	1.0	1.5
Water Closet, Flushometer Type		6.0	6.0
Water Closet, Gravity Type Flush Tank		2.0	2.0
Bathroom Groups:			
Bathtub, Lavatory and Water Closet-FM <sup>b</sup>	2.0	7.5	8.0
Bathtub, Lavatory and Water Closet-FT <sup>c</sup>	2.0	3.5	4.0
Shower Stall, Lavatory and Water Closet-FM	1.5	7.0	7.5
Shower Stall, Lavatory and Water Closet-FT	1.5	3.0	3.5

Note a: For fixtures not listed, factors may be assumed by comparing the fixture to a listed fixture which uses water in similar quantities and at similar rates.

Note b: FM means flushometer type.

Note c: FT means flush tank type.

Table 82.40-8

MAXIMUM ALLOWABLE LOAD FOR POLYBUTYLENE TUBING - ASIM D3309 AND  
CHLORINATED POLYVINYL CHLORIDE TUBING - ASIM D2846

Pressure Loss Due to Friction (in lbs. per 100 ft. of length)	Pipe Diameter (in Inches)																	
	1/2"			3/4"			1"			1 1/4"			1 1/2"			2"		
	WSFU			WSFU			WSFU			WSFU			WSFU			WSFU		
	GPM	FM	FT	GPM	FM	FT	GPM	FM	FT	GPM	FM	FT	GPM	FM	FT	GPM	FM	FT
0.5	-	-	-	0.5	-	0.5	2.5	-	2.5	4.0	-	4.0	6.5	-	8.0	13.0	4.5	18.0
1	-	-	-	1.5	-	1.5	3.5	-	3.5	6.0	-	7.0	9.5	-	12.5	19.0	6.0	28.5
2	-	-	-	2.5	-	2.5	5.5	-	6.5	9.0	-	12.0	14.0	4.5	20.0	28.0	11.0	50.0
3	0.5	-	0.5	3.5	-	3.5	6.5	-	8.0	11.5	4.0	15.0	17.0	5.5	25.0	35.0	20.0	70.0
4	1.0	-	1.0	4.0	-	4.0	7.5	-	9.5	13.0	4.5	18.0	20.0	6.5	30.0	42.0	30.0	100
5	1.5	-	1.5	4.5	-	5.0	8.5	-	11.0	15.0	5.0	22.0	23.0	7.5	37.0	47.0	42.0	117
6	2.0	-	2.0	5.0	-	6.0	9.5	-	12.5	16.5	5.5	24.0	25.0	8.5	43.0	52.0	53.0	136
7	2.0	-	2.0	5.5	-	6.5	10.5	-	14.0	18.0	6.0	27.0	27.0	10.0	48.0	58.0	70.0	165
8	2.0	-	2.0	6.0	-	7.0	11.5	4.0	16.0	19.0	6.0	28.5	30.0	14.0	55.0	NP		
9	2.5	-	2.5	6.0	-	7.0	12.0	4.0	17.0	20.5	6.5	31.0	32.0	16.0	60.0	NP		
10	2.5	-	2.5	6.5	-	8.0	12.5	4.5	17.5	22.0	5.0	35.0	34.0	19.0	67.0	NP		
11	2.5	-	2.5	7.0	-	9.0	13.5	4.5	19.0	23.0	6.0	38.0	NP			NP		
12	3.0	-	3.0	7.0	-	9.0	14.0	4.5	20.0	24.0	7.0	40.0	NP			NP		
13	3.0	-	3.0	7.5	-	9.5	14.5	4.5	21.0	NP			NP					
14	3.0	-	3.0	8.0	-	10.0	15.5	5.0	22.0	NP								
15	3.0	-	3.0	8.0	-	10.0	16.0	5.0	23.0	NP								
16	3.5	-	3.5	8.5	-	11.0	16.5	5.5	24.0	NP								
17	3.5	-	3.5	8.5	-	11.0	NP											
18	3.5	-	3.5	9.0	-	12.0	NP											
19	3.5	-	3.5	9.0	-	12.0	NP											
20	4.0	-	4.0	9.5	-	12.5	NP											
21	4.0	-	4.0	10.0	4.0	13.0	NP											
22	4.0	-	4.0	NP														
23	4.0	-	4.0	NP														
24	4.0	-	4.0	NP														
25	4.0	-	4.0	NP														
26	4.0	-	4.0	NP														
27	4.5	-	5.0	NP														
28	4.5	-	5.0	NP														
29	4.5	-	5.0	NP														
30	5.0	-	6.0	NP														
31	5.0	-	6.0	NP														

Note: WSFU means water supply fixture units.  
GPM means gallons per minute.  
FM means predominately flushometer type water closets or syphon jet urinals.  
FT means predominately flush tank type water closets or washdown urinals.  
NP means - not permitted, velocities exceed 8 feet per second

For using this table, round the calculated pressure loss due to friction to the next higher number shown

ILHR 82.40 (7) (f) and (g) specifies minimum sizes for water distribution piping.

ILHR 82.40

Table 82.40-9

**MAXIMUM ALLOWABLE LOAD FOR CROSSLINKED POLYETHYLENE (PEX) TUBING  
ASTM F876 AND F877**

Pressure Loss Due to Friction (in lbs per 100 ft. of length)	Pipe Diameter (in inches)					
	1/2"		5/8"		3/4"	
	GPM	WSFU FT	GPM	WSFU FT	GPM	WSFU FT
0.5	0.5	0.5	1.0	1.0	1.5	1.5
1.0	0.5	0.5	1.5	1.5	2.0	2.0
2.0	1.0	1.0	2.0	2.0	3.0	3.0
3.0	1.5	1.5	2.5	2.5	3.5	3.5
4.0	1.5	1.5	2.5	2.5	4.0	4.0
5.0	2.0	2.0	3.0	3.0	4.5	5.0
6.0	2.0	2.0	3.5	3.5	5.0	6.0
7.0	2.0	2.0	4.0	4.0	5.5	6.0
8.0	2.5	2.5	4.0	4.0	6.0	7.0
9.0	2.5	2.5	4.5	5.0	6.5	8.0
10.0	2.5	2.5	4.5	5.0	7.0	9.0
11.0	3.0	3.0	5.0	6.0	7.5	9.5
12.0	3.0	3.0	5.0	6.0	7.5	9.5
13.0	3.0	3.0	5.5	6.5	8.0	10.0
14.0	3.0	3.0	5.5	6.5	8.5	11.0
15.0	3.5	3.5	5.5	6.5	8.5	11.0
16.0	3.5	3.5	6.0	7.0	9.0	12.0
17.0	3.5	3.5	6.0	7.0		NP
18.0	3.5	3.5	6.5	8.0		
19.0	4.0	4.0	6.5	8.0		
20.0	4.0	4.0		NP		
21.0	4.0	4.0				
22.0	4.0	4.0				
23.0	4.0	4.0				
24.0	4.5	5.0				
25.0	4.5	5.0				
26.0		NP				

Note: WSFU means - water supply fixture units.

GPM means - gallons per minute.

FT means - predominately flush tank type water closets or washdown urinals.

NP means - not permitted, velocities exceed eight feet per second.

For using this table, round the calculated pressure loss due to friction to the next higher number shown.

ILHR 82.40 (7) (f) and (g) specifies minimum sizes for water distribution piping.

**History:** 1-2-56; r. and recr. Register, November, 1972, No. 203, eff. 12-1-72; r. and recr. Register, February, 1979, No. 278, eff. 3-1-79; renum. from H 62.13, Register, July, 1983, No. 331, eff. 8-1-83; renum. from ILHR 82.13 and r. and recr. (2) (b) and (4) (d) 1., am. (4) (c) 3. and (6) (a) (intro.), cr. (6) (b), Register, February, 1985, No. 350, eff. 3-1-85; r. and recr. Register, May, 1988, No. 389, eff. 6-1-88; am. (5) (d) 5 a., r. and recr. (7) (h) 1. and (8) (c), renum. (8) (c) 2. to 6. to be (8) (b) 4. to 8. and am. (8) (b) 4. c., Register, August, 1991, No. 428, eff. 9-1-91; am. (8) (b) 1. and 2., Register, April, 1992, No. 436, eff. 5-1-92; renum. (3) (c) and (8) (a) to be (3) (c) 2. and (8) (a) 1. and am. (8) (a) 1., cr. (3) (c) 1., (e), (8) (a) 2. and Table 82.40-9, am. (7) (c), r. (3)

(b) 1. b. and c., Register, February, 1994, No. 458, eff. 3-1-94; r. (5) (b) 3., renum. (5) (b) 4. and 5. to be (5) (b) 3. and 4., Register, December, 1995, No. 480, eff. 4-1-96.

**ILHR 82.41 Cross connection control. (1) SCOPE.** The provisions of this section set forth the requirements for the protection of potable water within water supply systems when and where there is the possibility of contamination due to cross connections or backflow conditions.