Concise User Guide

Several examples illustrating the use of the Water Demand Calculator with the Uniform Plumbing Code *Appendix A Recommended Rules for Sizing the Water Supply System*.

Example 1: Indoor Water Use Only - Use the information given below to find the pipe size for the building supply to a single-family dwelling with six indoor fixtures as shown in Figure 1 [Pipe Section 4].

Given Information:

Type of construction:	Single-family, one-bathroom	Friction loss per 100 ft:	15 psi
Type of pipe material:	L-copper	Maximum velocity:	10 ft/sec
Fixture number/type:	1 combination bath/shower	1 kitchen faucet	
	1 lavatory faucet	1 dishwasher	
	1 WC	1 clothes washer	

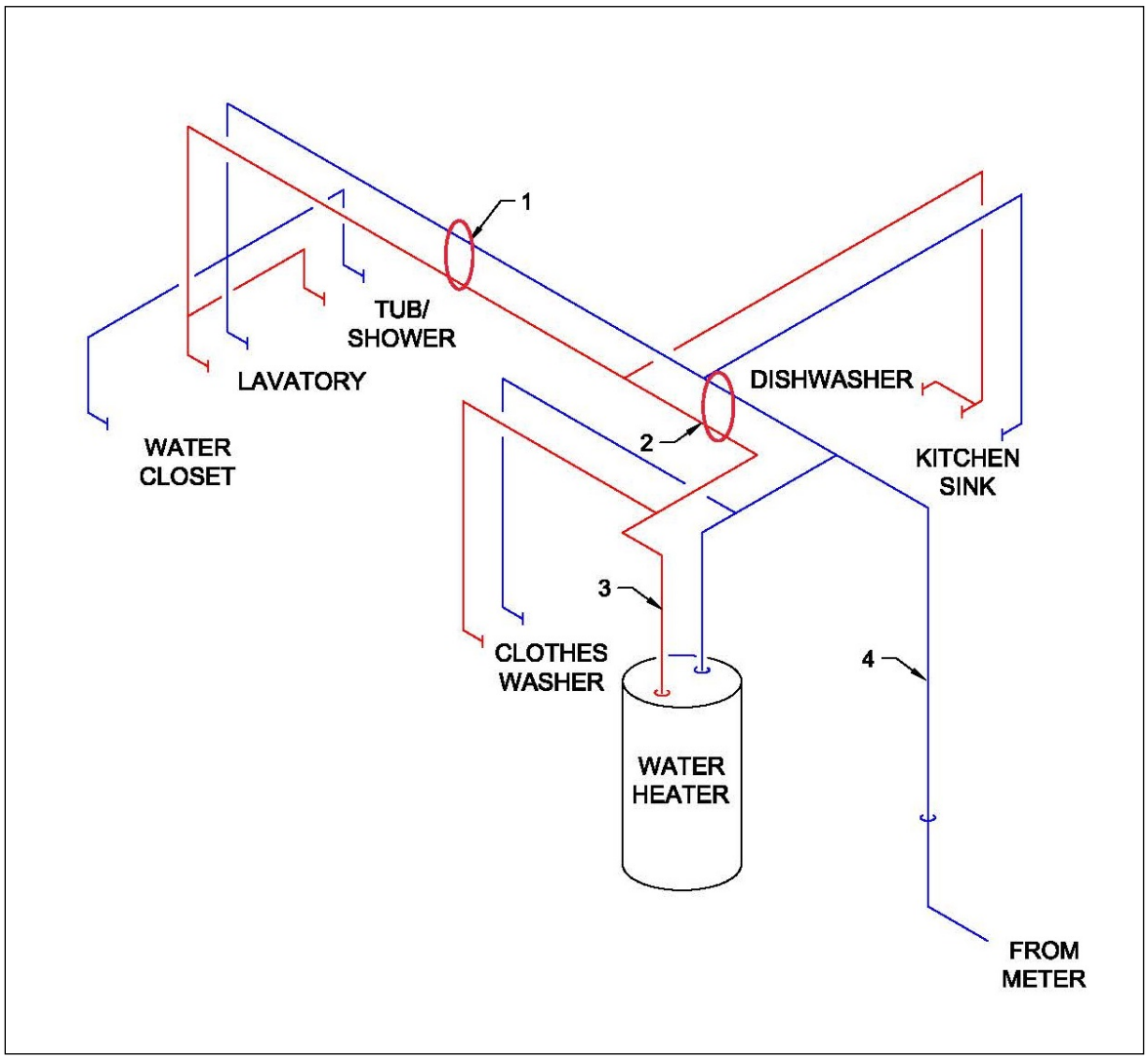

Figure 1. Residential building with six indoor fixtures

Solution: Step 1 of 2 – Find Demand Load for the Building Supply

The Water Demand Calculator [WDC] in Figure 2 is used to determine the demand load expected from indoor water use. The WDC has white-shaded cells and blue-shaded cells. The values in the blue cells are derived from a national survey[1] of indoor water use at homes with efficient fixtures and cannot be changed.

The white-shaded cells accept input from the designer. For instance, fixture counts from the given information are entered in Column [B]; the corresponding recommended fixture flow rates are already provided in Column [D]. The flow rates in Column [D] may be reduced only if the manufacturer specifies a lower flow rate for the fixture. Column [E] establishes the upper limits for the flow rates entered into Column [D]. Clicking the ***Run Water Demand Calculator*** button gives 9.0 gpm as the estimated indoor water demand for the whole building. This result appears in the green box of the WDC in Figure 2.

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↓ Select Units ↓

Monday, June 03, 2019 9:39 AM

PROJECT NAME : XXX-XXX

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FIXTURE GROUPS		[A] FIXTURE	[B] ENTER NUMBER OF FIXTURES	[C] PROBABILITY OF USE (%)	[D] ENTER FIXTURE FLOW RATE (GPM)	[E] MAXIMUM RECOMMENDED FIXTURE FLOW RATE (GPM)
Bathroom Fixtures	1	Bathtub (no Shower)	0	1.0	5.5	5.5
	2	Bidet	0	1.0	2.0	2.0
	3	Combination Bath/Shower	1	5.5	5.5	5.5
	4	Faucet, Lavatory	1	2.0	1.5	1.5
	5	Shower, per head (no Bathtub)	0	4.5	2.0	2.0
	6	Water Closet, 1.28 GPF Gravity Tank	1	1.0	3.0	3.0
Kitchen Fixtures	7	Dishwasher	1	0.5	1.3	1.3
	8	Faucet, Kitchen Sink	1	2.0	2.2	2.2
Laundry Room Fixtures	9	Clothes Washer	1	5.5	3.5	3.5
	10	Faucet, Laundry	0	2.0	2.0	2.0
Bar/Prep Fixtures	11	Faucet, Bar Sink	0	2.0	1.5	1.5
Other Fixtures	12	Fixture 1	0	0.0	0.0	6.0
	13	Fixture 2	0	0.0	0.0	6.0
	14	Fixture 3	0	0.0	0.0	6.0

Total Number of Fixtures 6

99th PERCENTILE DEMAND FLOW = 9.0 GPM

RESET

RUN WATER DEMAND CALCULATOR

Figure 2. Water demand calculator for indoor use at home with six efficient fixtures (Example 1).

Solution: Step 2 of 2 – Determine the Pipe Size of the Building Supply

Chart A 105.1(1) for copper piping systems (from Appendix A of the UPC, shown in Figure 3) is used to determine the pipe size, based on given friction loss, given maximum allowable pipe velocity, given pipe material and the demand load computed in Step 1. In Figure 3, the intersection of the given friction loss (15 psi) and the maximum allowable pipe velocity (10 f/s) is labeled point **A.** The vertical line that descends from point **A** to the base of the chart, intersects four nominal sizes for L-copper pipe. These intersection points are labeled **B, C, D, E** and correspond to pipe sizes of 1 inch, ¾ inch, ½ inch and 3/8 inch, respectively. A horizontal line from points **B, C, D, E** to the right-hand side of the chart gives maximum flow rates of 24 gpm, 12 gpm, 4.5 gpm, and 2.3 gpm, respectively. These results are summarized in Table 1 which shows that a ¾-inch L-copper line is the minimum size that can convey the peak water demand of 9.0 gpm.

[1] Buchberger, S., Omaghomi, T., Wolfe, T., Hewitt, J., and Cole, D., Peak Water Demand Study. 2016.

Table 1
Pipe size options for building supply

Point in Figure 3	Pipe Diameter (inch)	Maximum Flow (gpm)	OK for Building Supply?[1]
E	3/8	2.3	No
D	1/2	4.5	No
C	3/4	12	Yes
B	1	24	Yes

[1.] For Building in Example 1

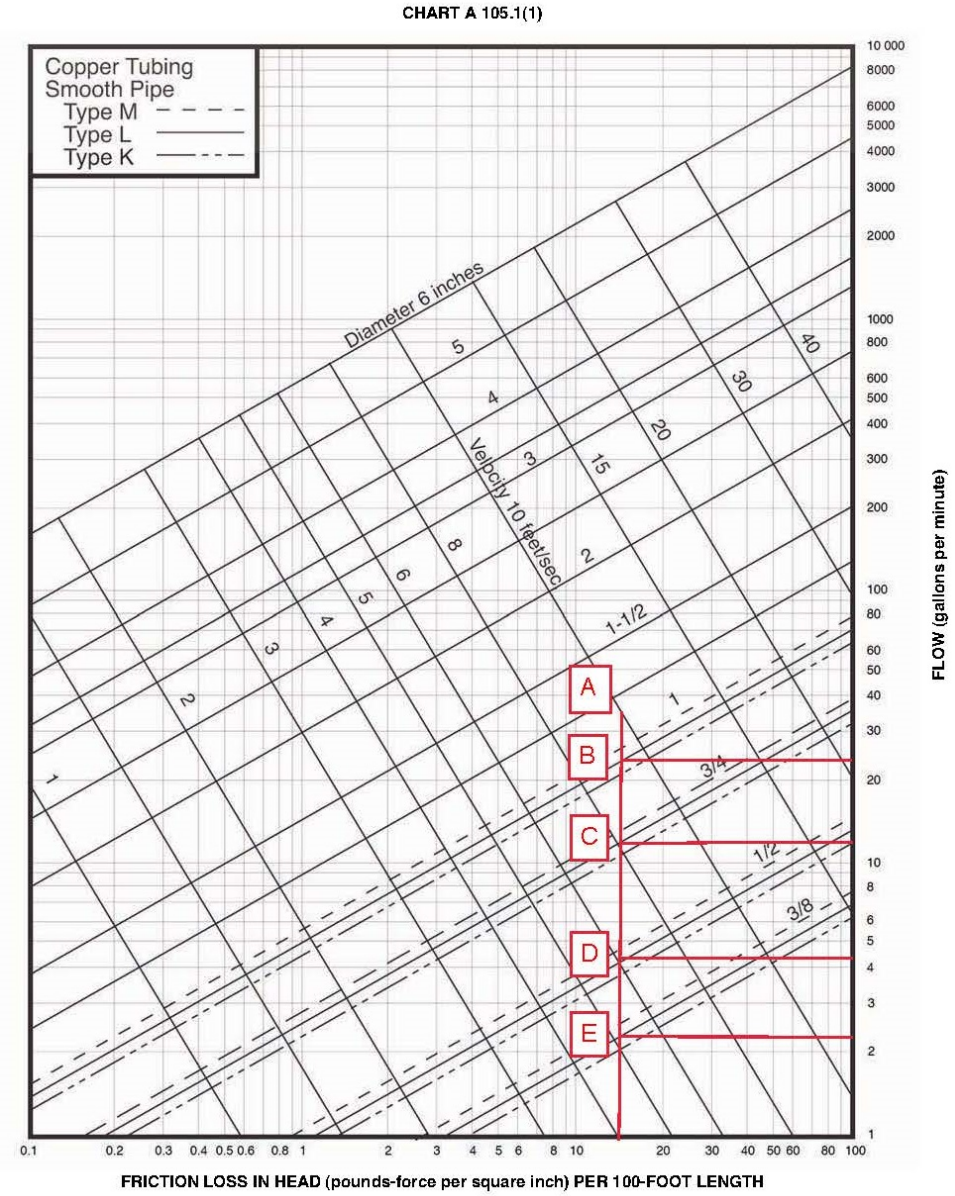

Figure 3. Chart A 105.1(1) for finding pipe size.

Example 2: Indoor and Outdoor Water Use – Find the pipe size for the building supply [Figure 1, Pipe Section 4] if the building in Example 1 adds two outdoor fixtures (hose bibb, each with a fixture flow of 2.0 gpm).

Solution: Step 1 of 2 – Find Demand Load for the Building Supply
The WDC has been developed exclusively for peak indoor water use which can be viewed as a high frequency short duration process. Because fixtures for outdoor water use may operate continuously for very long periods, they are not included in the WDC. To account for water use from one or more outdoor fixtures, add the demand of the single outdoor fixture with the highest flowrate to the calculated demand for indoor water use. With two hose bibbs, the demand of only one hose bibb is included. Hence, in this example, the total demand for the whole house is 9.0 gpm + 2.0 gpm = 11.0 gpm.

Solution: Step 2 of 2 – Determine the Pipe Size of the Building Supply

Table 1 shows that at 11.0 gpm the building supply shall be ¾-inch in diameter.

Example 3: Indoor, Outdoor and Other Fixture Water Use – Find the pipe size for the water supply [Figure 1, Pipe Section 4] if the building in Example 2 adds a kitchen pot filler and a dog bath each with a faucet flow rate of 5.5 gpm.

Solution: Step 1 of 2 – Find Demand Load for the Building Supply
The kitchen pot filler and dog bath are not listed in Column [A] of the WDC. To accommodate cases such as this, the WDC provides up to three additional rows for "Other Fixtures". Enter the kitchen pot filler and dog bath in Column [A] of the WDC and enter the fixture count for each in Column [B]. Find an indoor fixture that has a similar probability of use in Column [C] and add that to the column. Finally enter the flow rate of the kitchen pot filler and dog bath in Column [D]. The estimated indoor water demand for the whole building is 11 gpm, as shown in the WDC in Figure 4. As illustrated in Example 2, the hose bibb will increase the total demand for the whole house to 13 gpm.

Note that a reset button is provided to clear any numbers in Column [B] from a previous calculation.

Solution: Step 2 of 2 – Determine the Pipe Size of the Building Supply

Table 1 shows that at 13 gpm the building supply shall be 1-inch in diameter.

Example 4: Sizing Branches and Risers

For individual hot and cold branches, repeat Steps 1 and 2. For example, for the hot water branch at the water heater [Figure 1, Pipe Section 3], enter all the fixtures and appliances that use hot water into the Water Demand Calculator (toilets will be excluded) as seen in Figure 5. Use the calculated demand load to find the pipe size in Step 2. Table 1 shows that at 9.0 gpm, the hot water branch shall be ¾-inch in diameter.

For each additional hot and cold branch [Figure 1, Pipe Sections 1 and 2], enter the number of fixtures and appliances served by that branch into the WDC and use that demand in Step 2 to determine the branch size. If the branch serves a hose bibb, add the demand of the hose bibb to the calculated demand flow for the branch. As discussed in Example 2, the hose bibb is not to be entered into the WDC, since the Calculator is for indoor uses only.

When there is only one fixture or appliance served by a fixture branch, the demand flow shall not exceed the fixture flow rate in Column [E] of the Water Demand Calculator. The fixture flow rate would be used in Step 2 to determine the size of the fixture branch and supply.

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PROJECT NAME : XXX-XXX

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FIXTURE GROUPS		[A] FIXTURE	[B] ENTER NUMBER OF FIXTURES	[C] PROBABILITY OF USE (%)	[D] ENTER FIXTURE FLOW RATE (GPM)	[E] MAXIMUM RECOMMENDED FIXTURE FLOW RATE (GPM)
Bathroom Fixtures	1	Bathtub (no Shower)	0	1.0	5.5	5.5
	2	Bidet	0	1.0	2.0	2.0
	3	Combination Bath/Shower	1	5.5	5.5	5.5
	4	Faucet, Lavatory	1	2.0	1.5	1.5
	5	Shower, per head (no Bathtub)	0	4.5	2.0	2.0
	6	Water Closet, 1.28 GPF Gravity Tank	1	1.0	3.0	3.0
Kitchen Fixtures	7	Dishwasher	1	0.5	1.3	1.3
	8	Faucet, Kitchen Sink	1	2.0	2.2	2.2
Laundry Room Fixtures	9	Clothes Washer	1	5.5	3.5	3.5
	10	Faucet, Laundry	0	2.0	2.0	2.0
Bar/Prep Fixtures	11	Faucet, Bar Sink	0	2.0	1.5	1.5
Other Fixtures	12	Pot Filler	1	2.0	5.5	6.0
	13	Dog Bath	1	1.0	5.5	6.0
	14	Fixture 3	0	0.0	0.0	6.0

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Total Number of Fixtures 8

99th PERCENTILE DEMAND FLOW = 11.0 GPM

RESET

RUN WATER DEMAND CALCULATOR

Figure 4. Water demand calculator to accommodate Other Fixtures (Example 3).

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↓ Select Units ↓

Monday, June 03, 2019 10:13 AM

PROJECT NAME : XXX-XXX

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FIXTURE GROUPS		[A] FIXTURE	[B] ENTER NUMBER OF FIXTURES	[C] PROBABILITY OF USE (%)	[D] ENTER FIXTURE FLOW RATE (GPM)	[E] MAXIMUM RECOMMENDED FIXTURE FLOW RATE (GPM)
Bathroom Fixtures	1	Bathtub (no Shower)	0	1.0	5.5	5.5
	2	Bidet	0	1.0	2.0	2.0
	3	Combination Bath/Shower	1	5.5	5.5	5.5
	4	Faucet, Lavatory	1	2.0	1.5	1.5
	5	Shower, per head (no Bathtub)	0	4.5	2.0	2.0
	6	Water Closet, 1.28 GPF Gravity Tank	0	1.0	3.0	3.0
Kitchen Fixtures	7	Dishwasher	1	0.5	1.3	1.3
	8	Faucet, Kitchen Sink	1	2.0	2.2	2.2
Laundry Room Fixtures	9	Clothes Washer	1	5.5	3.5	3.5
	10	Faucet, Laundry	0	2.0	2.0	2.0
Bar/Prep Fixtures	11	Faucet, Bar Sink	0	2.0	1.5	1.5
Other Fixtures	12	Fixture 1	0	0.0	0.0	6.0
	13	Fixture 2	0	0.0	0.0	6.0
	14	Fixture 3	0	0.0	0.0	6.0

Total Number of Fixtures 5

99th PERCENTILE DEMAND FLOW = 9.0 GPM

RESET

RUN WATER DEMAND CALCULATOR

Figure 5. Water demand calculator for the hot water branch (Example 4).