COMMERCIAL

Sizing Guide

For the Estimating of
Flow Rates and Water Usage

BIBLIOGRAPHY

The majority of the contents within this publication have been extracted from the American Water Works Association (AWWA) Manual M-22. In determining demands of commercial applications, professional engineering information and on site experience are essential in final analysis of determining probable flows. The AWWA manual lends this design experience to efficiently calculate flow demands in commercial applications.

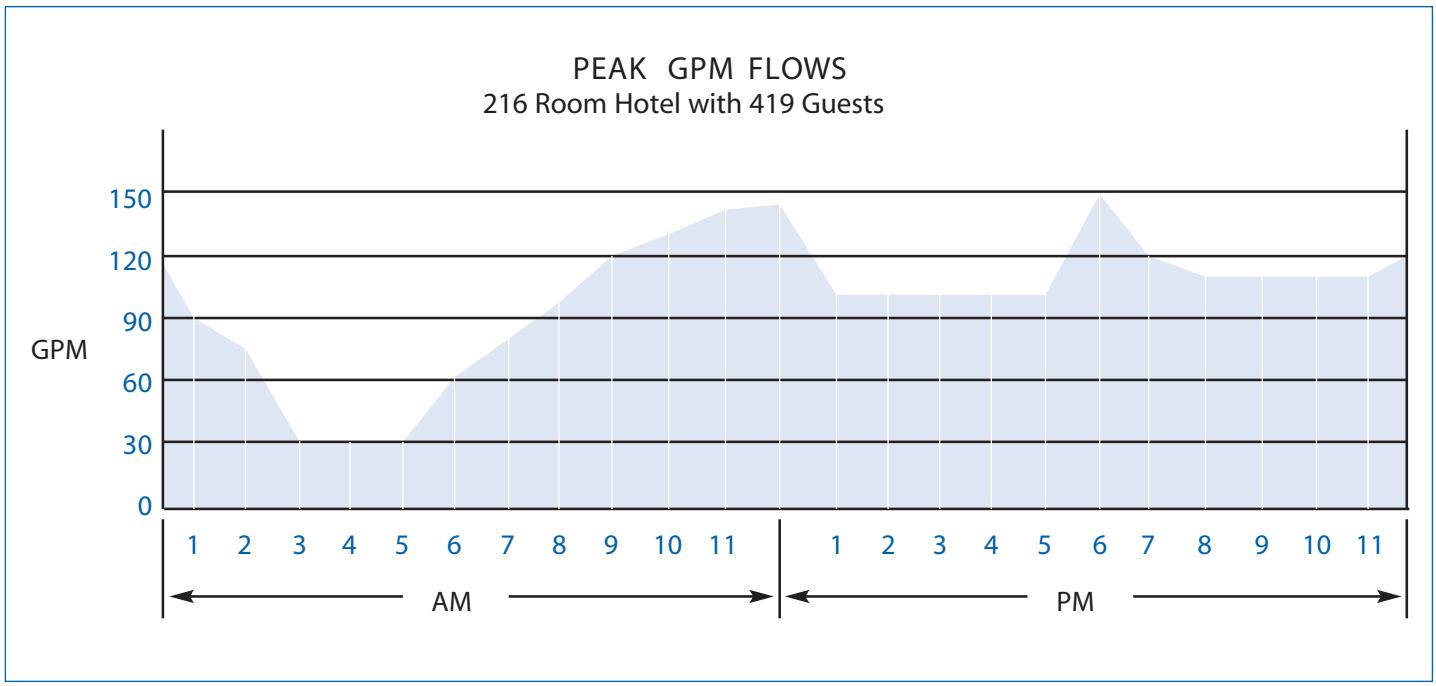
ENGINEERING REFERENCE OF FLOW

Utility engineers have used a wide variety of methods to estimate a customers peak water demand, which range from a rule of thumb procedure to detailed criteria. The information within this publication has been taken from field experiments, utility surveys, technical publications, and hydraulic design methods, all of which are assembled into a condensed explanation of customer demand and how to determine the maximum flows that can be expected.

This publication contains a listing of various water using fixtures and how to estimate the probable demand in residential properties, office buildings, schools, motels and hotels, shopping centers, and many other customers. In order to properly select water conditioning equipment, it is essential to determine flow demands. The recording of actual installations by the use of special meters and recording charts enables us to use the information as an excellent reference tool. The following graphs and data are the result of such research conducted by the AWWA.

HOTELS AND MOTELS

Hotels and motels are subject to wide fluctuations in water use, with peak periods of short duration. The example of a 216 room hotel had a maximum demand of 150 GPM, or 0.7 GPM/unit, which occurred at one time during the 24 hour period. The graph below represents the result of a recorded survey on a Texas hotel.



SCHOOLS

Flush valves with high flow requirements are normally used for sanitary purposes, and schools usually operate with uniform recess periods, both of which produce extreme water-flow-rate demands.

Test results from a South Texas modern high school with 1390 students demonstrated the need to properly size equipment for these types of applications. In this particular application flows of 150 GPM were common, with peak demands reaching 210 GPM on many occasions.

APARTMENTS

Apartments, like hotels have wide variations in flow rates as shown below. The survey conducted illustrates the flows throughout a one week period.

ESTIMATING GPM FLOW

Most types of fixtures and uses are listed in this publication to permit the estimating of the probable gallon per minute demand in residential, public buildings, motels and hotels, office, schools, shopping centers, and other customers.

The following information which the AWWA assembled in the estimating of flows, is also in part, data that has been published from the National Bureau of Standards, using plumbing manual report BMS-66. This method includes a list of fixtures and a table of values for each fixture, as well as a value for the fixture if it is in public use.

GPM PEAK RECORDINGS

	S	M	T	W	T	F	S
Midnight	10	10	10	10	10	10	10
6:00 AM	25	50	30	30	45	35	30
Noon	35	90	45	80	90	85	35
6:00 PM	30	40	45	30	30	30	30

99 Unit Apartment Complex
140 Baths, 99 Dishwashers, 8 Washing Machines

PLUMBING FIXTURE VALUES

The following represents each individual fixture value as if each fixture was operated independently at 35 PSI inlet pressure. A bathtub for example flows at a rate of 8 GPM without any interference from other fixtures. As more fixtures are present, the probability of flow decreases. When encountering devices or fixtures not listed, the demand in gallons per minute should be determined and added to the total fixture count.

Fixture Type		Fixture Value Based on 35 PSI Inlet Pressure
Bathtub Arrangement		8
Bedpan Washers		10
Combination Sink and Tray		3
Dental Unit		1
Dental Lavatory		2
Drinking Fountain (cooler)		1
Drinking Fountain (public)		2
Kitchen Sink:	1/2 in. connection	3
	3/4 in. connection	7
Lavatory:	3/8 in. connection	2
	1/2 in. connection	4
Lavatory Tray:	1/2 in. connection	3
	3/4 in. connection	7
Shower Head (shower only)		4
Service Sink:	1/2 in. connection	3
	3/4 in. connection	7
Urinal:	Pedestal Flush Valve	35
	Wall or Stall	12
Wash Sink:	(each set of faucets)	4
Water Closet:	Flush Valve	35
	Tank Type	3
Dishwasher:	1/2 in. connection	4
	3/4 in. connection	10
	commercial (nominal)	15
Washing Machine:	1/2 in. connection	5
	3/4 in. connection	12
	1 in. connection	25
	1-1/4 in. connection	35
	1-1/2 in. connection	50
Hose (50 ft. length-wash down):	1/2 in.	6
	5/8 in.	9
	3/4 in.	12
	1 in.	25

PRESSURE

Water pressure available has a significant influence on the gallon per minute flow of the application. To illustrate this all important factor, the chart below provides evidence that the water pressure factor must be included in your sizing.

Variations in Flows with a 50 Foot Garden Hose

Water Pressure PSI	Flow GPM
10	7
20	9
30	11
40	13
50	15
70	18
100	22

Due to the variation illustrated above, compensation must be applied when calculating the flow demand on any application. Multiplication factors must be applied upon completion of converting fixture value to probable GPM flow. The chart in Figure A should be used for this important adjustment.

Example: A probable demand of 50 GPM was determined. The application has an inlet pressure of 60 PSI. Using the chart below, a multiple factor of 1.34 should be used. 50 GPM x 1.34 = 67 GPM compensated flow demand.

Figure A

Pressure PSI	Factor
20	0.74
30	0.92
35	1.00
40	1.07
50	1.22
60	1.34
70	1.46
80	1.57
90	1.68
100	1.78

Figure B

*Fixture Value Conversion Charts

Chart I		Chart II	
Country Clubs, Hospitals, Nursing Homes, Hotels, Office Buildings, Schools, Shopping Centers, Restaurants		Apartments, Condominiums, Dormitories, Trailer Parks, Homes, Motels	
Fixture Value	Probable GPM Flow	Fixture Value	Probable GPM Flow
10	–	10	10
20	–	20	18
25	–	25	20
40	–	40	21
50	35	50	22
75	43	75	23
100	50	100	24
125	55	125	26
150	57	150	28
200	62	200	30
250	67	250	33
300	72	300	37
350	77	350	39
400	82	400	42
450	86	450	44
500	90	500	46
550	94	550	50
600	98	600	52
650	102	650	54
700	106	700	56
750	110	750	58
800	112	800	59
900	117	900	61
1,000	122	1,000	62
1,100	127	1,100	64
1,200	131	1,200	66
1,300	133	1,300	68
1,400	136	1,400	69
1,500	138	1,500	70
2,000	140	2,000	72
3,000	156	3,000	76
4,000	162	4,000	82
5,000	168	5,000	88
6,000	174	6,000	94
7,000	180	7,000	100
8,000	186	8,000	108
9,000	192	9,000	116
10,000	198	10,000	122
11,000	204	11,000	128
12,000	210	12,000	134
13,000	216	13,000	140

The following is an example of estimating the probable GPM demand for an apartment complex.

Customer: 160 unit apartment complex pressure at meter: 50 PSI

Fixture	Fixture Value			Extended Fixture Values
205 tank water closets	x	3	=	615
259 lavatories: 3/8 in.	x	2	=	518
138 dishwashers: 1/2 in.	x	4	=	552
10 washing machines: 1/2 in.	x	5	=	50
165 kitchen sinks: 1/2 in.	x	3	=	495
162 bathtubs	x	8	=	1296
Total Fixture Value				3526

Fixture value: 3526

Conversion from Figure B, Chart II: 80 GPM

Adjustment to 50 PSI inlet water pressure:
80 GPM x 1.22 = 97.6 GPM or 98 GPM.

The probable peak demand therefore, in this example of a 160 unit apartment, would be 98 GPM.

*Charts are based on inlet pressure of 35 PSI. For other pressures, adjust by use of Figure A.

WATER USAGE GUIDE

In determining water consumption of any application, it is more desirable to obtain the actual water meter history. Generally, a six month history will be representative of the applications requirements. This can easily be accomplished by contacting the water service supplying the application. Such requests are considered public information. Many of these services record usage in cubic feet. To convert volume given in cubic feet to gallons, multiple by 7.5. Example: 50 cubic feet x 7.5 = 375 gallons.

Another procedure in determining consumption, and in particular when a meter reading is not available such as on a well system, is the use of a clock recording method. Upon determining the GPM rating of a well pump, connect an inexpensive clock to the pump circuit. Set at 12:00 o'clock and record daily the number of minutes the pump ran. Multiply these minutes recorded by the GPM rate and the average total daily consumption can then be estimated more realistically.

A third method that can lend credability to an estimated daily usage is through comparison. By obtaining an actual meter recording usage of a similar operation, the customer will have more confidence in your projections.

When it is not practical to utilize any of the methods thus far described, the estimating of usage can be achieved by the chart below.

Apartments
Based on 3 persons/apt.
Hot and cold = 150 gal./unit/day
Hot only = 60 gal./unit/day

Barber Shops
55 gal./day/chair

Beauty Salons
270 gal./day/station

Boilers
To determine daily makeup in gallons:
1. Multiply boiler h.p. by 4.25
2. Then multiply by hours per day of operation.
3. Then multiply by the % operating rating.
4. Then subtract the % condensate returns.

Note: When ratings are given in pounds of steam per hour, divide by 500 to obtain GPM requirement. When ratings are given in BTU's, divide by 12,000. For every 12,000 BTU's, there is an equivalent of 1 h.p.

Camps
Day (no meals) = 15 gal./day/person
Resorts = 50 gal./day/person
Tourist = 35 gal./day/person

Cooling Tower
To determine daily makeup in gallons:
1. Multiply the tonnage by four (this includes 2 gal./day/hr./ton bleed off).
2. Then multiply by the number of hours per day of operation.

Dentist
4,000 gal./month/chair

Dormitories
Hot and cold = 40 gal./person/day
Hot only = 20 gal./person/day

Hospitals
Meter reading preferred
Hot and cold = 250 gal./bed/day
Hot only = 170 gal./bed/day

Lawns
25 gal./square ft./season

Laundry
Hot and cold = 2.5 lb. capacity is equivalent to gallons per cycle.

Livestock and Poultry
Cow, beef = 12 gal./animal/day
Cow, dairy = 20 gal./animal/day
Goat = 2 gal./animal/day
Hog = 12 gal./animal/day
Horse = 12 gal./animal/day
Mule = 12 gal./animal/day
Sheep = 2 gal./animal/day
Chickens = 10 gal./each 100/day
Turkeys = 18 gal./each 100/day

Motels
Hot and cold = 130 gal./unit/day
Hot only = 60 gal./unit/day

Nursing Homes
Hot and cold = 100 gal./bed/day
Hot only = 50 gal./bed/day

Office Buildings
Hot and cold = 20 gal./person/day
Hot only = 3 gal./person/day

Restaurants
Hot and cold = 15 gal./meal/day
Hot only = 7 gal./meal/day
Add on for bar or cocktail lounge = 2 gal./patron/day

Schools
Elementary: Hot and cold = 13 gal./stu./day
Hot only = 5 gal./stu./day
Jr. High: Hot and cold = 20 gal./stu./day
Hot only = 10 gal./stu./day
Sr. High: Hot and cold = 35 gal./stu./day
Hot only = 15 gal./stu./day

Shopping Centers
300 gal./day/1000 sq. ft.

Trailer Parks
150 gal./trailer/day

NOTES