Water Flow Rate & Sizing Guide

for Commercial & Industrial Use

MARLO
INCORPORATED ®
2227 South Street
P.O. Box 044170
Racine, WI 53404-7003
Ph. (262) 681-1300
Fax (262) 681-1318
www.Marlo-Inc.com

Quality Products for Quality Water

Table of Contents

Sizing Procedures

1 **Obtain a properly taken water analysis**
   A. Analyze water with portable test kit.
   B. Check with local water utility department for their water analysis records.
   C. Send water sample to Marlo, Inc. for analysis.

2. **Analysis should at least test for the following**
   A. Hardness as $CaCO_3$ in grains per gallon (gpg) or convert parts per million (ppm) to gpg by dividing ppm by 17.1
   B. Total Iron in ppm or mg/l.
   C. Total Dissolved Solids (TDS) in ppm or mg/l.
   D. pH

3. **Determine the daily water usage amount to be softened**
   A. Use consumption figures from water utility billings. (To convert billings in cubic feet to gallons multiply by 7.5)
   B. Take water meter readings.
   C. Use sizing tables when Steps A or B are not available.

4. **Determine continuous and peak flow rates in gpm**
   A. Use the Water Supply fixture Units (WSFU) from your State Plumbing Codes and Flow Rate Tables on pages 6 and 7 to determine required flow rate.
   B. Obtain flow rates for continuous equipment which requires softened water, such as boilers, reverse osmosis units...etc. from equipment specifications or manufacturer. (If flow rate data is given in pounds per hour, divide by 500 to convert to gallons per minute.)
   C. Install a digital readout water meter in gpm and record peak gpms during peak consumption.

5. **Private water supplies**
   A. Find out the pumps capacity in continuous gpm.
   B. Check the pump start and stop settings.
   C. Install a working pressure gauge if needed.

6. **Now determine daily water to be conditioned**
   A. All water conditioned.
   B. Hot water only.

7. **Determine capacity required per day**
   A. Capacity = (Gallons Per Day x Grains Per Gallon) Add 3 grains per gallon for each ppm of ferrous clear water iron present. If ferrous iron content is above 2 ppm, consult factory for pretreatment that may be needed. If ferric iron is present, an iron filter is required.

8. **Selecting the proper unit for capacity per day**
   A. To properly select the correct unit, go to the capacity specifications chart and find the unit which will handle the peak daily capacity (grains per day) when regenerated on low or medium salt dosages.
   B. Select a unit that will not regenerate any more often than every 2 - 3 days on low or medium salting.

C. Sizing systems on low or medium salting levels save up to 40% on annual salt costs plus additional water usage savings. Avoid sizing equipment which will require regeneration with the high salt dosage.

9. Analysis should at least test for the following

A. When sizing for continuous flow rate, subtract the pressure drop at the operating gpm flow across the softener from line pressure. At least a 30 psi should be left for working pressure.

B. When sizing for peak flow rate, subtract the pressure drop across the softener from line pressure. At least a 20 psi should be left for working pressure.
NOTE: Some automatic fixtures (such as Flushometer type toilets) have specific pressure requirements by the manufacturer which may be greater than 20 psi.

C. If either (A) or (B) above is lower than the minimum allowable working pressure for the unit selected in Step # 8, select a larger softener which has a lower pressure drop at the gpm demand and capacity needed.

D. Always conform to all local and state plumbing codes.

Other Important Checks

1. **Available Space** - Compare dimensions of unit(s) selected with the installation space provided.
2. **Doorways** - Make sure all equipment will fit through all doorways, hallways and elevators leading from the delivery area to installation site.
3. **Backwash Rates** - If unit is operated on a private water supply, make sure the pump will be able to maintain the backwash rate required. Drains on all installations must be able to handle the backwash flow rates of the unit(s) selected.
4. **Special Applications** - While most commercial equipment will produce satisfactory softened water at 1 to 2 grains hardness leakage for apartment buildings, hotels, laundries, and similar applications, some applications such as boiler, reverse osmosis etc. may require higher quality water of less than 3 - 5 ppm of hardness leakage. Consult the factory on these applications.

Maximum Allowable Flow Rate for Copper Tube Type M-ASTM B88*

1” ....21.0 gpm
1.25” ....32.0 gpm
1.5” ....46.0 gpm
2” ....80.0 gpm
2.5” ....120.0 gpm
3” ....175.0 gpm
4” ....280.0 gpm

*Velocities not to exceed 8 feet per second.

Water Consumption Estimating Guide

This guide is provided for estimations only when actual meter readings are unavailable. Estimate peak gpm using “Supply Fixture Units” on page 6.

Apartments
One Bedroom Units - 1.75 people/apt.
Two Bedroom Units - 3 people/apt.
Three Bedroom Units - 5 people/apt.
Full Line - 60 G.P.D./person
Hot Only - 25 G.P.D./person

Barber Shops
75 G.P.D./chair full line

Beauty Shops
300 G.P.D./station full line

Boilers
Steam boilerts require 4.25 gallons of water per hour for each horsepower rating of the boiler. Many boilers have a condensate return and this percentage should be subtracted from the full demand to determine actual requirement.

Boilers (Cont'd)

The amount remaining is your "**makeup**" per hour. The makeup water requires further softening.

Multiply the % of operation rating to determine actual makeup per hour. Multiply this number times hours of operation per day.

Example:

50 H.P. Boiler
60% Condensate Return
75% Operation Rating
24 Hours/Day
50 H.P. x 4.25 Gallons/Hour = 212.5 Gallons/Hour
212.5 Gallons x 60% Condensate - 127.5 Gallons/Hour
212.5 Gallons - 127.5 Condensate Return = 85 GallonS Makeup
85 Gallons Makeup x 75%
Operating Rating = 65.25 Gallons Of Actual Makeup
65.25 Gallons x 24 Hours/Day = 1,566 Gallons/Day

If a boiler is rated in lbs/hour figure as follows:
10,000 lbs/500 = 20 G.P.M. less % return.
To Convert BTUs to HP multiply BTUs x .0003931

Boiler Feedwater (Makeup Requirements)

4.25 gallons/hour per Horsepower = Gallons of water evaporated/hour

Lbs. evaporation/hour x .12 = Gallons of water evaporated/hour

Feedwater makeup requirements:

1. Rated in horsepower - 4.25 gallons of water evaporated per hour. This is then multiplied by the percentage rating at which the boiler is operated. *Example*: A 300 HP boiler operated at 75% of rating = 300 x 4.25 x 75% / 100% = 956.25 gallons of water evaporated/hour. Gallons per hour x hours/day = gallons/day of makeup.
2. Lbs. of evaporation/hour x 0.12 = Gallons of water evaporated per hour. *Example*: 25,000 lbs. x 0.12 = 3000 gallons of water evaporated/hour Gallons/hour x hours/day = gallons per day of makeup.

Adjustment for Percentage of Condensate Returns:

If the boiler system doesn't use condensate return, then the feedwater makeup requirements above are used to determine sizing. When condensate returns are used, the feedwater makeup is the difference between the number of gallons of water evaporated per hour and the number of gallons of condensate return.

Example: 3600 gallons of water evaporated per hour and condensate return of 50%; the amount of boiler feedwater makeup required is: 3600 - (50% of 3600) = 1800 gallons per hour of boiler operation for feedwater makeup. Gallons per hour x hours per day = gallons per day of makeup.

Bowling Alleys

75 G.P.D/Lane

Carwash

With the variety of number of different types of carwash systems available in today's market, we advise you to consult the specific manufacturer for your application.

G.P.M. Estimate:

1. Multiply the number of Self Serve Bays by 4.
2. Multiply the number of Automatic Bays by 38.
3. Add together the answers from step 1 and 2.
4. Add the Spot Free Rinse demand (from the manufacturer) to the total in step 3 to calculate the total G.P.M.

Consumption Guideline:
Average Gallons Per Day Automatic Bay - 6,840
Average Gallons Per Day Self Serve Bay - 600

Cooling Towers

To determine daily makeup in gallons:

1. Multiply the tonnage by 4. (This includes 2 gallons/hour/ton evaporation and 2 gallons/hour/ton/bleed off.)
2. Next multiply the answer in step 1 by the hours per day of operation.

Dormitories

40 G.P.D./Person Full Line
16 G.P.D./Person Hot Only

Factories

35 G.P.D./Person/Shift w/Showers Full Line
25 G.P.D./Person/Shift w/o Showers Full Line
NOTE: Estimate any process water separately.

Farm Animals

Dairy Cow - 35 G.P.D.
Beef Cow - 12 G.P.D.
Goat - 2 G.P.D.
Hog - 4 G.P.D.
Horse - 12 G.P.D.
Sheep - 2 G.P.D.
Chickens - 10 G.P.D./100 Birds
Turkeys - 18 G.P.D./100 Birds

Hospitals

250 G.P.D./Bed Full Line 170 G.P.D./Bed Hot Only
NOTE: Estimate air conditioning and laundry separately.

Laundry

1. Obtain capacity (Lbs) from customer or capacity table on next page.
2. Calculate usage and flow from formulas A & B.

Formula A = Capacity (Lbs) x 2.5 = Gallons/Cycle
Formula B = Capacity (Lbs) x 10% = Flow Rate (gpm)

Commercial Laundry Capacity Table

Tumbler Size (inches)	Clothes Capacity (lbs)	Tumbler Size (inches)	Clothes Capacity (lbs)	Tumbler Size (inches)	Clothes Capacity (lbs)	Tumbler Size (inches)	Clothes Capacity (lbs)
30 x 16	25	36 x 42	125	42 x 96	400	44 x 126	575
24 x 36	48	36 x 54	165	42 x 108	450	48 x 84	460
30 x 30	60	42 x 42	175	42 x 126	510	48 x 96	535
30 x 36	70	42 x 48	200	44 x 54	245	48 x 120	680
30 x 42	80	42 x 54	225	44 x 64	300	48 x 126	715
30 x 48	95	42 x 64	265	44 x 72	330	54 x 84	600
36 x 30	90	42 x 72	300	44 x 84	385	54 x 96	680
36 x 36	110	42 x 84	350	44 x 96	440	60 x 96	900

MOTEL
100 G.P.D./Room Full Line
40 G.P.D./Room Hot Only
NOTE: Estimate the restaurant, bar, air conditioning, swimming pool, and laundry facilities separately and add to room total.

MOBILE HOME COURT
Estimate 3.75 People/Home
60 G.P.D./Person
NOTE: Estimate outside water for sprinkling, washing cars, etc. separately.

NURSING HOMES
75 G.P.D./Bed Full Line
50G.P.D./Bed Hot Only
NOTE: Estimate laundry separately

OFFICE BUILDING
15 G.P.D./Person Full Line
2 G.P.D./Person Hot Only

RESTAURANTS
10 G.P.D./Person Full Line
4 G.P.D./Person Hot Only
2 G.P.D./Person Cocktail Bar Facilities

REST HOMES
175 G.P.D./Bed Full LIne
100 G.P.D./Bed Hot Only
NOTE: Estimate laundry separately

SCHOOLS
20 G.P.D./Student Full Line w/Showers
10 G.P.D./Student Full Line w/o Showers
10 G.P.D./Student Hot Only w/Showers
4 G.P.D./Student Hot Only w/o Showers

TRAILER PARKS
100 G.P.D./Space

FLOW RATE ESTIMATING CHART IN U.S. GALLONS

Instructions For Use:

1. Count and total the number of each type of fixture to be serviced by water conditioning equipment.
2. Multiply the number of each type of fixture by the unit count given for the appropriate water supply fixture table.
   Private - Apartment Buildings, Trailer Parks, Group Homes, Houses, etc.
   Public - Office Buildings, Hospitals, Motels, Clubs, Schools, etc.
   NOTE: Make sure you use the correct values for hot, cold or hot & cold.
3. Find the total fixture count by adding the values found in Step 2.
4. Using the correct chart on page 6, find your total supply fixture count value in the left hand column and read across to the right to find the gpm demand. Make sure you use the correct gpm column for “**private**” or “**public**”.

Example: 10 Unit Apartment (Hot Only)

10 Kitchen Sinks @ 1	= 10
10 Dishwashers @ 1	= 10
10 Bathroom Groups @ 2	= 10
10 Automatic Clothes Washers @ 1	= 10
Total SFUs	= 50
GPM Demand	= 28

When both private and public fixtures are present, use the “predominately” higher percentage of private or public to obtain your gpm demand.

WATER SUPPLY FIXTURE UNITS FOR *PUBLIC USE FIXTURES*

TYPE OF FIXTURE[a]	WATER SUPPLY FIXTURE UNITS (WSFU)		
	Hot	Cold	Total
Automatic Clothes Washer, Individual	2.0	2.0	3.0
Automatic Clothes Washer, Large Capacity	b	b	b
Bathtub, with or without Shower Head	2.0	2.0	3.0
Coffeemaker		0.5	0.5
Dishwasher, Commercial	b	b	b
Drink Dispenser		0.5	0.5
Drinking Fountain		0.25	0.25
Glass Filler		0.5	0.5
Hose Bibb: 1/2” diameter		3.0	3.0
3/4” diameter		4.0	4.0
Icemaker		0.5	0.5
Lavatory	0.5	0.5	1.0
Shower, per Head	2.0	2.0	3.0
Sinks: Bar and Fountain	1.5	1.5	2.0
Barber and Shampoo	1.5	1.5	2.0
Cup		0.5	0.5
Flushing Rim		7.0	7.0
Kitchen and Food Preparation per faucet	2.0	2.0	3.0
Laboratory	1.0	1.0	1.5
Medical Exam and Treatment	1.0	1.0	1.5
Service	2.0	2.0	3.0
Surgeon Washup	1.5	1.5	2.0
Urinal: Siphon Jet		4.0	4.0
Washdown		2.0	2.0
Wall Hydrant, Hot and Cold Mix: 1/2” diameter	2.0	2.0	3.0
3/4” diameter	3.0	3.0	4.0
Wash Fountain: Semicircular	1.5	1.5	2.0
Circular	2.0	2.0	3.0
Water Closet: Flushometer		7.0	7.0
Gravity Type Flush Tank		3.0	3.0

WATER SUPPLY FIXTURE UNITS FOR *PRIVATE USE FIXTURES*

TYPE OF FIXTURE[a]	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
Dishwasher 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	1.0
Lavatory	0.5	0.5	1.0
Shower, per Head	1.0	1.0	1.5
Water Closet: Flushometer		6.0	6.0
Gravity Type Flush Tank		2.0	2.0
Bathroom Groups:			
Bathtub, Lavatory and Water Closet - Flushometer	2.0	4.5	8.0
Bathtub, Lavatory and Water closet - Flush Tank	2.0	3.5	4.0
Shower Stall, Lavatory and Water Closet - Flushometer	1.5	7.0	7.5
Shower Stall, Lavatory and Water closet - Flush Tank	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: Load factors in gallons per minute, gpm, based on manufacturer’s requirements.
Source: Wisconsin Administrative Code, Register, October, 1991, No. 430, 428

CONVERSION OF WATER SUPPLY FIXTURE UNITS TO GALLONS PER MINUTES

Water Supply Fixture Units	GALLONS PER MINUTE	
	Predominately Flushometer Type Water Closets or Siphon Jet Urinals	Predominately Flush Tank Type Water Closets of Washdown Urinals
1	-	1
2	-	2
3	-	3
4	10	4
5	15	4.5
6	18	5
7	21	6
8	24	6.5
9	26	7
10	27	8
20	35	14
30	40	20
40	46	24
50	51	28
60	54	32
70	58	35
80	62	38
90	65	41
100	68	42
120	73	48
140	78	53
160	83	57
180	87	61
200	92	65
250	101	75
300	110	85
400	126	105
500	142	125
600	157	143
700	170	161
800	183	178
900	197	195
1000	208	208
1250	240	240
1500	267	267
1750	294	294
2000	321	321
2250	348	348
2500	375	375
2750	402	402
3000	432	432
4000	525	525
5000	593	593

NOTE: Values not specified in the table may be calculated by interpolation.
Source: Wisconsin Administrative Code, Register, October, 1991, No. 430

Worksheet
Sizing for Marlo Commercial Units

Prospect Name:____ Date:___________________________

Address:____

Contact Person:____ Telephone:__________________________

Prepared By: ____

A. Water to be Used for

❍School ❍Restaurant ❍Motel ❍Boiler ❍RO
❍Laundry ❍Dishwasher ❍Other ____

B. Hours per day operation____________________ Days per Week____________________

C. Water requirements

(a) Constant flow rate________ gpm Peak flow________ gpm
(b) Daily usage/24 hour_______gal Days per week - 5, 6, 7___________?
(c) Was usage determined by ❍fixture count? ❍flow meter? ❍water bill?

D. Water quality required

Permissible hardness leakage_____________ppm?

E. Water, Influent

(a) Source: ❍Municipal ❍Private Well ❍Both
(b) Composition:

Total Hardness__________ gpg
Ca + Mg_______________
Iron__________________ ppm
pH___________________
H_2S__________________ ppm

Color___________________________
Turbidity________________________
Other___________________________
____
T.D.S.__________________________

F. Facilities

Supply pipe size_______ inches
Pump capacity_________gpm
Drain line sump_____________

Operating pressure__________to_________psi
Pressure at point of installation___________ psi
Minimum pressure allowed after unit_______psi

G. Installation details or limitations

Available floor space__________" length x _________" width x __________" height
What floor____________________ Weight versus floor support ______________

H. Installation details or limitations (Cont'd)

Door openings ____________________ Stairways ______________________________
Remote brine tank location ____
Any other unusual installation requirements ___________________________________
____
____

I. Existing equipment at this prospect?

Tank size_______ " diameter x ____________" height
Valve size __________ Capacity _____________ cu. ft. Resin __________
Make ______________ Model # _____________ Approx. age __________

J. Notes: ____
____
____

2-307-R2 5/02