How to Choose the Right Pump

Making the right choice for your pump is important because you need to have enough pressure and flow to meet the demands of the systems which use the rainwater you've collected. After all – that's what you collected it for, right? So we've compiled and simplified this information so you can make the right pump choices without having to go through pump school.

Determining Pump Requirements:

The first step in choosing a pump is to determine what purposes the water will be used for so we can get an idea on the volume of water (GPM) and the pressure requirements (PSI).

> **GPM** demand is determined by adding all of the possible *simultaneous* requirements from the various demands on the water system. For example, if you have an 8-zone irrigation system, you probably won't have more than 1 zone will be running at any given time, so only the GPM of the most demanding zone should be used. However, if you will also be using your water to flush toilets, then we need to add about 3 GPM to the requirements since the toilet may run at the same time as the irrigation. For typical water demands, see Page-3.

> **PSI** (pressure) requirements are derived by simply finding which of your water devices needs the *most* pressure. Anything else which cannot withstand that pressure will require a pressure regulator. For example, a drip irrigation system usually requires a minimum of 25 PSI and comes with its own regulator whereas most other fixtures like sprinklers, toilets and urinals, washing machines and hose bib attachments require about 40-45 PSI.

The next step is to add the remainder of what the industry calls "Dynamic Head" so we can define the "*Total Dynamic Head*" (TDH) requirements. There are only two *major* components left to identify (there are other factors but are comparatively insignificant):

> **Vertical lift**: The vertical lift component is simply the distance (in feet) between the bottom of the *pump intake* and the highest point of demand in your system. For example; if you are using a submersible pump in an underground tank, and your highest sprinkler head is 20 feet higher than the bottom of the tank, then the vertical lift component is 20 feet. This is added directly to the dynamic head requirements.

> **Friction loss**: Friction loss is generally derived using charts and tables to determine how hard the pump has to work just to push the water through the pipes. There are basically two components: Horizontal distance - and – friction. For example: 100' of 1" Sch 40 PVC pipe at 15 GPM adds 14.63' of TDH to the equation. To determine this precise number, refer to the charts and tables on Page 4. As a general rule in design, larger pipes, shorter distances and limiting the number of 90 degree elbows in the system are best for performance.

Completing the Total Dynamic Head equation:

We now have 4 components: GPM, PSI, Vertical Lift and Friction Loss:

1. Your GPM demand will be matched with a corresponding pump GPM output by cross-referencing your TDH and the GPM on a pump performance curve chart (*example on Page 5*) to finalize your pump choice.
2. PSI is converted into its TDH component by multiplying the maximum PSI requirement by 2.31. For example, if your system requires 40 PSI then you need to add (40 X 2.31) 92.4 feet of TDH to the requirements.
3. Vertical lift is directly added to the TDH requirement. If you have 20 feet of maximum lift, then add 20 feet to the requirements.
4. Friction loss components are added together and the sum is directly added to the TDH requirements.

Sample environment: We have a site where we have 8 irrigation zones and we also want to be use rainwater for two lavatories:

A. **Sprinkler Zones**: The largest sprinkler zone requires 40 PSI, it has 5 sprinkler heads using a total of 12 GPM; the highest elevation requires 18 feet of vertical lift. We have also calculated approximately 20 feet of friction loss in the most demanding zone. Requirement: ((40 psi X 2.31) + 18 + 20), or (92.4 + 18 + 20), or 130.4 feet of TDH. The sprinkler system requires 12 GPM (save for cross-reference).
B. **Lavatories**: We've determined that operation of 2 lavatories requires approximately 7 GPM and will operate using the same pressure as the irrigation system. The toilets are lower in elevation than the highest sprinkler zone so there is *no additional vertical lift*. We have calculated 5 feet of friction loss so we add 5 feet of TDH at 7 GPM for the lavatories.

Total requirements: (130.4 + 5) = 135.4' of TDH at 19 GPM. (In this example, both lavatories can be flushed simultaneously with no performance impact on the most demanding sprinkler zone. Only you can decide if this is truly necessary).

We cross reference this to the pump performance curve on Page 5 and determine that the 1 HP 1SC51E1HA submersible pumps will meet those demands.

If a modest impact on irrigation performance is allowable while flushing lavatories, or if there are no lavatories in the equation, then a ¾ HP 1SC51D1GA submersible pump will deliver satisfactory performance.

Typical Water Demands

PRIVATE RESIDENCES

Outlets	Flow Rate GPM	Total Usage Gallons	Bathrooms in Home			
			1	1½	2-2½	3-4
Shower or Bathtub	5	35	35	35	53	70
Lavatory	4	2	2	4	6	8
Toilet	4	5	5	10	15	20
Kitchen Sink	5	3	3	3	3	3
Automatic Washer	5	35	–	18	18	18
Dishwasher	2	14	–	–	3	3
Normal seven minute* peak demand (gallons)			45	70	98	122
Minimum sized pump required to meet peak demand without supplemental supply		7 GPM (420 GPH)	10 GPM (600 GPH)	14 GPM (840 GPH)	17 GPM (1020 GPH)	

Notes:
Values given are average and do not include higher or lower extremes.
* Peak demand can occur several times during morning and evening hours.
** Count the number of fixtures in a home including outside hose bibs. Supply one gallon per minute each.

YARD FIXTURES

Garden Hose – ½"	3 GPM
Garden Hose – ¾"	6 GPM
Sprinkler– Lawn	3-7 GPM

FARM USE

Horse, Steer	12 Gallons per day
Dry Cow	15 Gallons per day
Milking Cow	35 Gallons per day
Hog	4 Gallons per day
Sheep	2 Gallons per day
Chickens/100	6 Gallons per day
Turkeys/100	20 Gallons per day
Fire	20-60 GPM

PUBLIC BUILDINGS

Pump Capacity Required in U.S. Gallons per Minute per fixture for Public Buildings							
Type of Building	Total Number of Fixtures						
	25 or Less	26-50	51-100	101-200	201-400	401-600	Over 600
Hospitals	1.00	1.00	.80	.60	.50	.45	.40
Mercantile Buildings	1.30	1.00	.80	.71	.60	.54	.48
Office Buildings	1.20	.90	.72	.65	.50	.40	.35
Schools	1.20	.85	.65	.60	.55	.45	
Hotels, Motels	.80	.60	.55	.45	.40	.35	.33
Apartment Buildings	.60	.50	.37	.30	.28	.25	.24

1. For less than 25 fixtures, pump capacity should not be less than 75% of capacity required for 25 fixtures.
2. Where additional water is required for some special process, this should be added to pump capacity.
3. Where laundries or swimming pools are to be supplied, add approximately 10% to pump capacity for either.
4. Where the majority of occupants are women, add approximately 20% to pump capacity.

Friction Loss

SCH 40 – PLASTIC PIPE: FRICTION LOSS (IN FEET OF HEAD) PER 100 FT.

GPM	GPH	⅜"	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"	10"
		ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
1	60	4.25	1.38	.356	.11									
2	120	15.13	4.83	1.21	.38	.10								
3	180	31.97	9.96	2.51	.77	.21	.10							
4	240	54.97	17.07	4.21	1.30	.35	.16							
5	300	84.41	25.76	6.33	1.92	.51	.24							
6	360		36.34	8.83	2.69	.71	.33	.10						
8	480		63.71	15.18	4.58	1.19	.55	.17						
10	600		97.52	25.98	6.88	1.78	.83	.25	.11					
15	900			49.68	14.63	3.75	1.74	.52	.22					
20	1,200			86.94	25.07	6.39	2.94	.86	.36	.13				
25	1,500				38.41	9.71	4.44	1.29	.54	.19				
30	1,800					13.62	6.26	1.81	.75	.26				
35	2,100					18.17	8.37	2.42	1.00	.35	.09			
40	2,400					23.55	10.70	3.11	1.28	.44	.12			
45	2,700					29.44	13.46	3.84	1.54	.55	.15			
50	3,000						16.45	4.67	1.93	.66	.17			
60	3,600						23.48	6.60	2.71	.93	.25			
70	4,200							8.83	3.66	1.24	.33			
80	4,800							11.43	4.67	1.58	.41			
90	5,400							14.26	5.82	1.98	.52			
100	6,000								7.11	2.42	.63	.08		
125	7,500								10.83	3.80	.95	.13		
150	9,000									5.15	1.33	.18		
175	10,500									6.90	1.78	.23		
200	12,000									8.90	2.27	.30		
250	15,000										3.36	.45	.12	
300	18,000										4.85	.63	.17	
350	21,000										6.53	.84	.22	
400	24,000											1.08	.28	

Friction Loss

EQUIVALENT NUMBER OF FEET STRAIGHT PIPE FOR DIFFERENT FITTINGS

Size of fittings, Inches	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"
90° Ell	1.5	2.0	2.7	3.5	4.3	5.5	6.5	8.0	10.0	14.0	15	20	25
45° Ell	0.8	1.0	1.3	1.7	2.0	2.5	3.0	3.8	5.0	6.3	7.1	9.4	12
Long Sweep Ell	1.0	1.4	1.7	2.3	2.7	3.5	4.2	5.2	7.0	9.0	11.0	14.0	
Close Return Bend	3.6	5.0	6.0	8.3	10.0	13.0	15.0	18.0	24.0	31.0	37.0	39.0	
Tee-Straight Run	1	2	2	3	3	4	5						
Tee-Side Inlet or Outlet or Pitless Adapter	3.3	4.5	5.7	7.6	9.0	12.0	14.0	17.0	22.0	27.0	31.0	40.0	
① Ball or Globe Valve Open	17.0	22.0	27.0	36.0	43.0	55.0	67.0	82.0	110.0	140.0	160.0	220.0	
① Angle Valve Open	8.4	12.0	15.0	18.0	22.0	28.0	33.0	42.0	58.0	70.0	83.0	110.0	
Gate Valve-Fully Open	0.4	0.5	0.6	0.8	1.0	1.2	1.4	1.7	2.3	2.9	3.5	4.5	
Check Valve (Swing)	4	5	7	9	11	13	16	20	26	33	39	52	65
In Line Check Valve (Spring) or Foot Valve	4	6	8	12	14	19	23	32	43	58			

ITT

GOULDS PUMPS
Residential Water Systems

APPLICATIONS

Submersible water pumps designed for pumping out of reservoirs and storage tanks:

- Homes and farms
- Mobile home parks and motels
- Schools and hospitals
- Municipal applications
- Industrial applications
- Commercial applications

SPECIFICATIONS

Pump:

- 1¼" NPT discharge and open suction.
- Maximum suspended solids ⅛".
- Capacities: to 35 U.S. GPM (7.9 m³/h).
- Total heads: to 240 feet TDH (70 m).
- Temperature:
  104ºF (40ºC) continuous
  140ºF (60ºC) intermittent.
- Maximum submergence: to 65 feet (20 m).
- Continuous duty rated, non-overloading motor.

Motor:

- Single phase: 3450 RPM, 115 and 230 V, 60 Hz.
- Three phase: 3450 RPM, 230 V, 60 Hz.
- Non-overloading.
- Class F insulation.
- Thermal overload protection: built-in with automatic reset on single phase.
- Three phase models require external overloads in panel.
- Power cord: All 30' long.
  Single phase – 16/3, with 115 V or 230 V plug
  Three phase – 16/4 STO, bare leads

  NOTE: See accessory section for separate control panels.