PACIFIC LIQUID & AIR SYSTEMS
PUMPS • MOTORS • CONTROLS

SIZING WATER SYSTEMS
PUMPS AND TANKS

Proper sizing of residential water pumps and tanks is important for two reasons: 1) The system will run more efficiently and therefore use less electricity. 2) The system will last longer. Put simply, a properly sized domestic water system costs less over the long haul.

PRESSURE VS FLOW

As a homeowner, there are two rules about pressure and flow that are worth remembering: 1) For a given pipe size the greater the flow in GPM (gallons per minute), the greater the pressure required. 2) As the output of a pump in GPM increases, the pressure it generates decreases.

In most cases a small, single story residence with adequate plumbing will require a pump that can deliver water at a pressure of 35 - 40 PSI (pounds per square inch). Some homeowners will want a higher pressure, but 35 - 40 PSI is adequate for most fixtures. If the plumbing is substandard (ie long runs of 1/2" or 3/4" pipe or lots of 90 degree bends) a pressure of 40 - 50 PSI may be required to produce an adequate flow. As a residence increases in size it is likely that the demand for water will increase proportionally. Based on rule number one, a higher pressure will be required to effect the increase in volume or flow.

Fortunately, most pump manufacturers have designed their pumps to provide plenty of pressure at a given flow. Therefore if we size the pump correctly for flow, the pressure will usually be more than adequate. As a rule of thumb always select a pump that will produce at least 40 PSI at the desired flow rate.

DETERMINING THE FLOW REQUIRED

There are several methods used to compute the flow rate required to meet the water demand of a given residence. One of the simplest and most accurate measures the amount of water used during a seven minute peak demand period. These peak demand periods can occur several times during the morning and evening hours. Any residential water system should be sized to meet or slightly exceed the demand of the seven minute peak period.

The table on page two allows us to determine the average seven minute peak demand for residences of various sizes. As you can see the table takes into account the number of bathrooms, bathroom fixtures, the kitchen, and the laundry. For example, a typical one bath residence requires 45 gallons during the seven minute peak period. In this case the pump must be able to provide a minimum of 7 GPM at the desired pressure. A home with three to four baths will require 122 gallons or a pump that will supply at least 17 GPM. If you are

planning an addition to your residence, be sure to include the additional requirements in your calculations.

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)

Note: Values given are average and do not include higher or lower extremes.
*Peak demand can occur several times during morning and evening hours.

SIZING THE HYDROPNEUMATIC TANK

Now that flow and pressure have been determined, the tank can be sized. Minimally, the tank drawdown, at the desired operating pressure, must be equal to the design flow rate of the pump. This will allow the pump to run for at least one full minute. Short run cycles reduce pump life and use more electricity. A drawdown table for various tank sizes is available from your pump dealer. For example the 7 GPM pump used in the one bath house will require a 20 gallon tank when operating at an average pressure of 30 PSI. At 40 PSI a 36 gallon tank is required. In the case of the 17 GPM pump a 52 gallon tank is needed for 30 PSI operation. An 86 gallon tank is required at 40 PSI.

You have probably noticed from the examples above that drawdown capacity diminishes with increased pressure. Therefore, selecting the lowest operating pressure that meets your requirements will increase the efficiency of the tank. If you would like to learn more about hydropneumatic tanks and how they operate, ask for the HLS publication: SET UP AND TUNING OF PRESSURE SWITCHES AND DIAPHRAGM TANKS.

Ideally, you should select the largest tank you can afford. More drawdown means longer pump life and lower electrical costs. In cases where space is at a premium, several smaller tanks can be installed in place of a single larger one. Finally, always have a pump professional review your selection before you purchase.

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