

House of Resistance



TRAINING MODULE



**PUMP SIZING
MADE SIMPLE**

F&W®
FLINT & WALLING
Trust runs deep.

The Problem – Traditional Pump Sizing

Pump sizing has long been a confusing venture for irrigation distributors and contractors. Traditional terminology and teaching practices used by pump companies to educate irrigation contractors on pump sizing have not been well-received or well-retained. This has created a lack of confidence when it comes to sizing pumps.

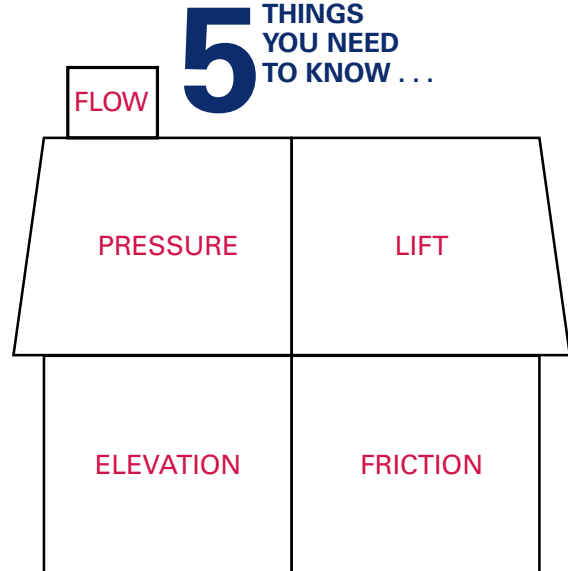


The Solution – The House of Resistance

The House of Resistance was created to combat this lack of confidence. It's easy to use, easy to understand, and easy to retain.

There are only five things you need to know to size a pump for irrigation applications.

1. Flow (in GPM)
2. Pressure (in PSI)
3. Lift (in feet)
4. Elevation (in feet)
5. Friction (in feet)



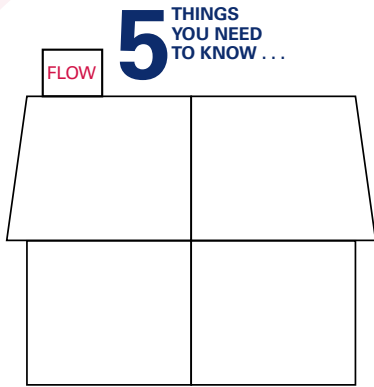
5 Things You Need to Know

1. FLOW:

A typical irrigation system will consist of multiple zones. Certain zones within the system may require more flow than others. When sizing a pump, you only need to consider the zone that requires the most flow (this is called 'peak flow rate').

Refer to rotor manufacturer's published flow requirements for your application's peak flow rate.

This illustration shows a system with three zones, each with a varying number of rotors and flow rates. In this example, Zone 2 has the highest flow requirement. Peak flow rate for this system is 15 GPM (gallons per minute).



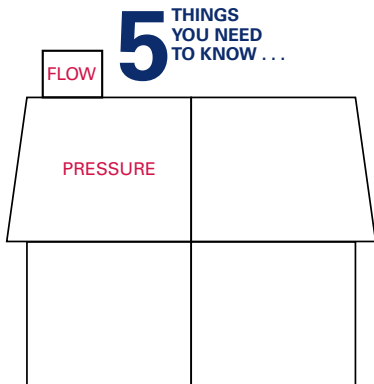
2. PRESSURE:

Most irrigation contractors are looking for pressure of at least 50 PSI. You can choose more or less than that, but this number needs to be determined before a pump can be correctly sized.

Refer to rotor manufacturer's published pressure requirements for your application's required pressure.

This illustration shows a pressure requirement of 50 PSI.

This value will be converted from PSI to feet (this will be covered in a later section)



5 Things You Need to Know

3. LIFT

Lift is the vertical distance (in feet) from the surface of the water source to the inlet (suction) of the pump.

Please note that the measurement is from the surface of the water source and not from the bottom of the submerged suction pipe.

To better understand why – refer to the illustration at the right.

Picture a glass nearly full of water – this represents the water source.

Now add a straw – this represents the suction pipe.

Note that the water level inside the straw is the same as the water level inside the glass – this works the same with the water source and suction pipe.

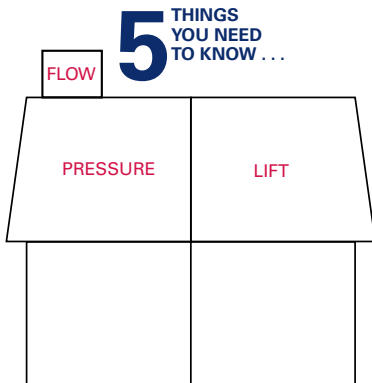
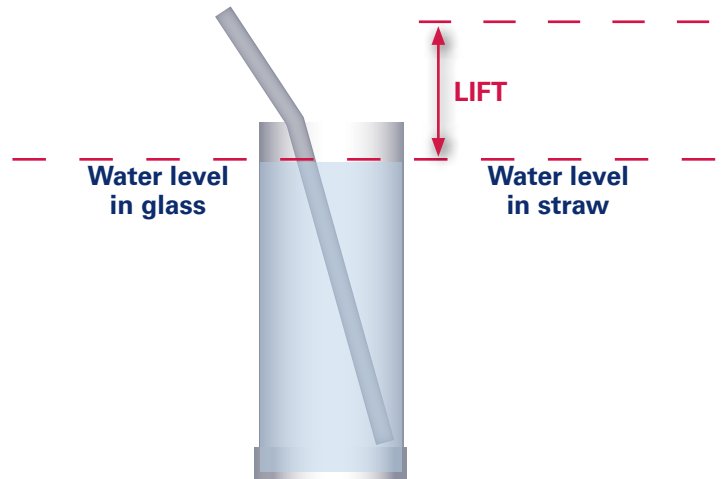
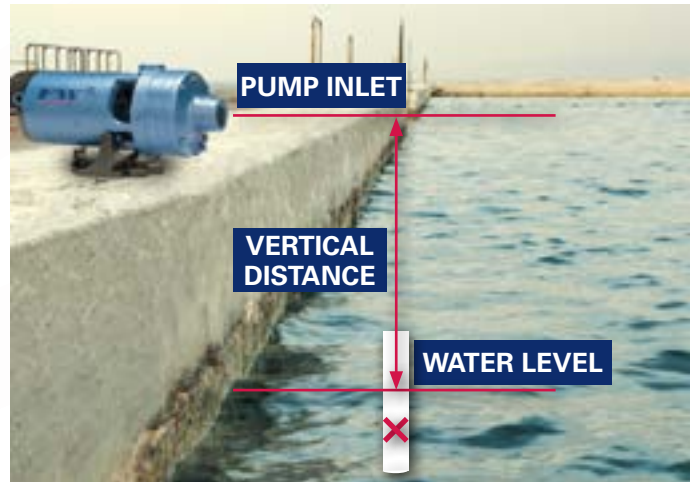
There are many water sources where lift will need to be factored in. For example:

- Drilled Wells
- Underground cisterns and storage tanks
- Lakes and Ponds

There are also applications where no lift is factored in. For example:

- City (municipal) water supplies
- Above ground storage tanks

These applications are referred to as 'flooded suction'. The value for lift in these applications is 0 (zero).

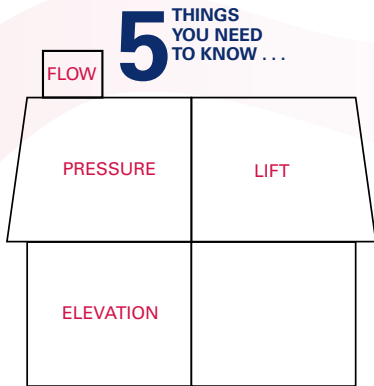


5 Things You Need to Know

4. ELEVATION:

Elevation is the vertical distance (in feet) from the outlet (discharge) of the pump to the highest point in the irrigation system. If your system is level with, or downhill from your pump the elevation value is 0 (zero).

There are apps available that can help you quickly determine this distance.



5. FRICTION:

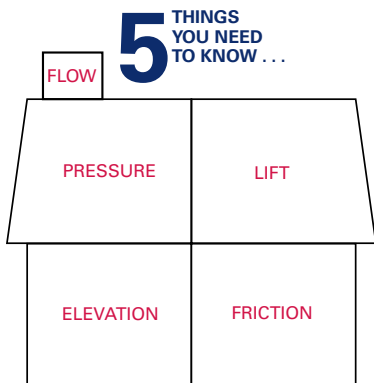
Friction (sometimes referred to as 'friction loss') occurs in every pump application. There are three factors that affect the amount of friction:

- Flow rate (higher flow rate = more friction)
- Pipe length (longer pipe = more friction)
- Pipe diameter (smaller diameter = more friction)

Friction loss charts are readily available from most pump, pipe, and irrigation control manufacturers.

SCHEDULE 40 PVC PIPE				
FLOW RATE (GPM)	FRICTION LOSS CHART (FEET) PIPE SIZE			
	1.00"	1.25"	1.50"	2.00"
5	1.7	0.4	0.2	0.7
7	3.2	0.8	0.4	0.1
10	6.0	1.6	0.7	0.2
15	12.8	3.3	1.5	0.5
20	21.8	5.6	2.6	0.8
25	32.9	8.5	4.0	1.2
30	46.1	11.9	5.5	1.6
35		15.8	7.4	2.2
40		20.2	9.4	2.8
45		25.1	11.7	3.4
50		30.5	14.3	4.2

NOTE: PER 100 FT. OF PIPE



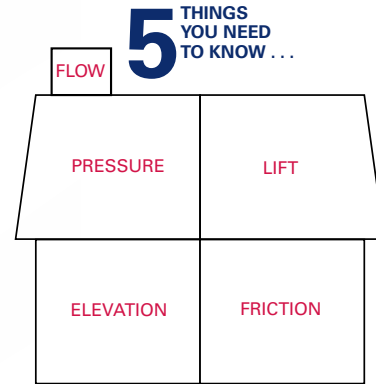
Build A House/Size A Pump

APPLYING WHAT YOU HAVE LEARNED

Now that you understand what each room in the house represents, let's apply what you have learned.

In this example, we need 15GPM (peak flow rate as determined on page 3 section 1) at 50PSI delivered to our system.

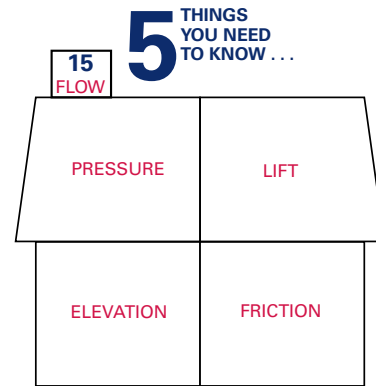
All the factors defined previously (Flow, Pressure, Lift, Elevation, and Friction) provide resistance to meeting this requirement. This is the reason for the name 'House of Resistance'. We will build this house to determine which pump will overcome the resistance to deliver the performance required.



Build a House / Size a Pump

FLOW

We determined that the peak flow rate of the system is 15 GPM. Place 15 in the FLOW section of the house.

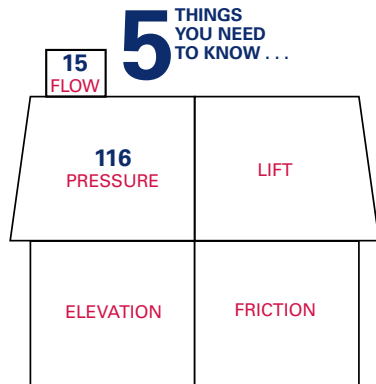


PRESSURE

We also determined that 50PSI is the desired pressure to operate this system.

Note that three of the four rooms in the house are measured in feet. We need all four to be measured in feet to properly determine resistance. To do this, we will need to convert pressure (PSI) to feet. To do this, simply take the pressure and multiply by 2.31.

For this example, we will take 50×2.31 and arrive at 115.5. We will round this up to 116. Place 116 in the PRESSURE section of the house.



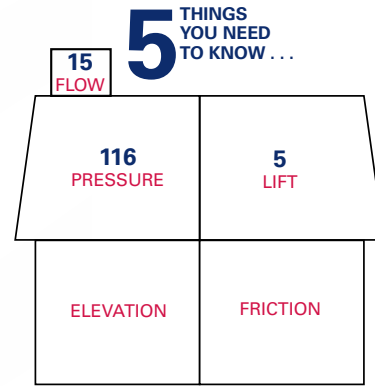
Trust runs deep.

Build A House/Size A Pump

LIFT

Measure the vertical distance (in feet) from the surface of the water source to the inlet (suction) of the pump. Round up to the nearest foot. If you have a flooded suction application, this value will be 0 (zero).

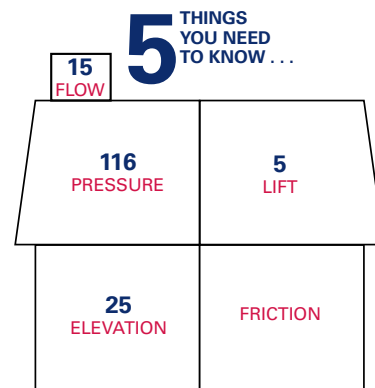
For this example, we will use 5 feet. Place 5 in the LIFT section of the house.



ELEVATION

Determine the highest point in the system. Measure the vertical distance (in feet) from the outlet (discharge) of the pump to the highest point in the system. Round up to the nearest foot. If the system is flat or runs downhill from the pump, the value will be 0 (zero).

For this example, we will use 25 feet. Place 25 in the ELEVATION section of the house.



FRICTION

Three factors determine friction (or friction loss):

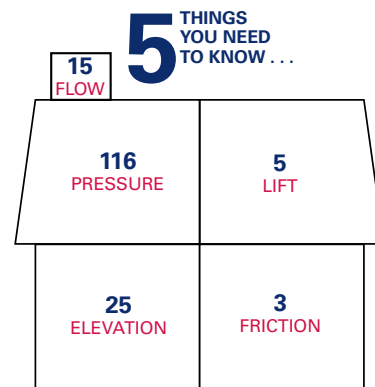
Flow rate (in GPM)

Pipe length (in feet)

Pipe diameter (in inches)

We have already determined flow rate (15GPM). For this example, we will use 200' of 1-1/2" pipe. Refer to the friction loss chart on page 8. Come down from 1-1/2" and right from 15GPM and you find a value of 1.5 feet of friction loss. NOTE: This value is for every 100' of pipe.

Since we have 200' of pipe in this example we will take 1.5' x 2 (or 3 feet of friction loss). Place 3 in the FRICTION section of the house.



Build A House/Size A Pump

Now that the house is built, let's size a pump.

Most published pump curves list GPM and Feet (or Feet of Head) to determine the correct pump.

We have already determined GPM (15).

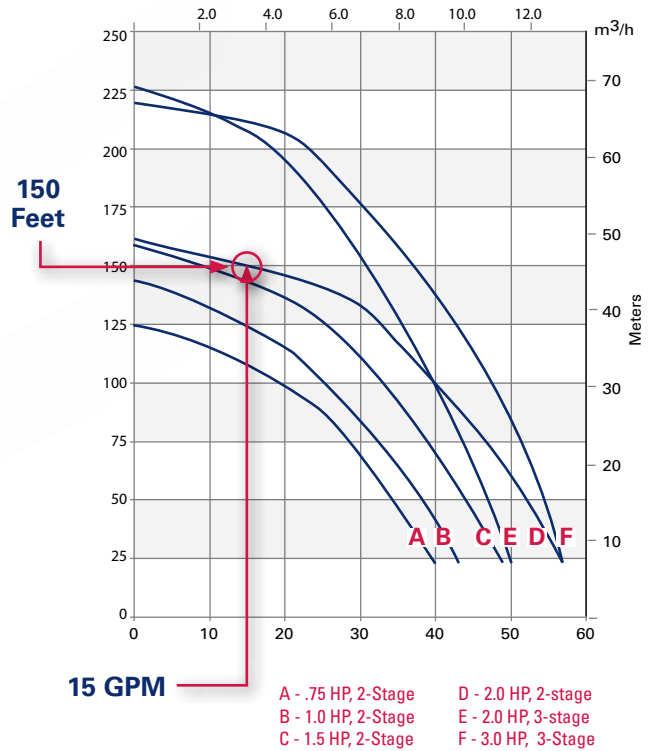
To arrive at Feet (or Feet of Head), simply add the numbers together in the four rooms:

$116 + 5 + 25 + 3 = 149'$. For ease, we can round this up to 150'.

From here, simply find where the values for GPM and Feet intersect.*

If this value lands directly on a curve, select that pump. If this value lands between two curves, select the pump whose curve falls to the right of the intersection point.

***In this example, we would select pump 'D'; 2 HP, 2-Stage.**



REFERENCE CHARTS

PRESSURE CONVERSION CHART

PSI	FEET
30	69
35	81
40	92
45	104
50	116
55	127
60	139
65	150
70	162
75	173
80	185

PSI X 2.31 = FEET

FRICITION CHART

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	PIPE SIZE			
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NOTE: PER 100 FT. OF PIPE