

# Sizing a Pump for Hydroponics or Aquaponics

## Sizing a pump? First, decide what type of pump you need.

So you're building a system. You're ordering materials, and all that's left for you to do is to order a pump.

You open the web browser, search for hydroponic pumps, and there are:

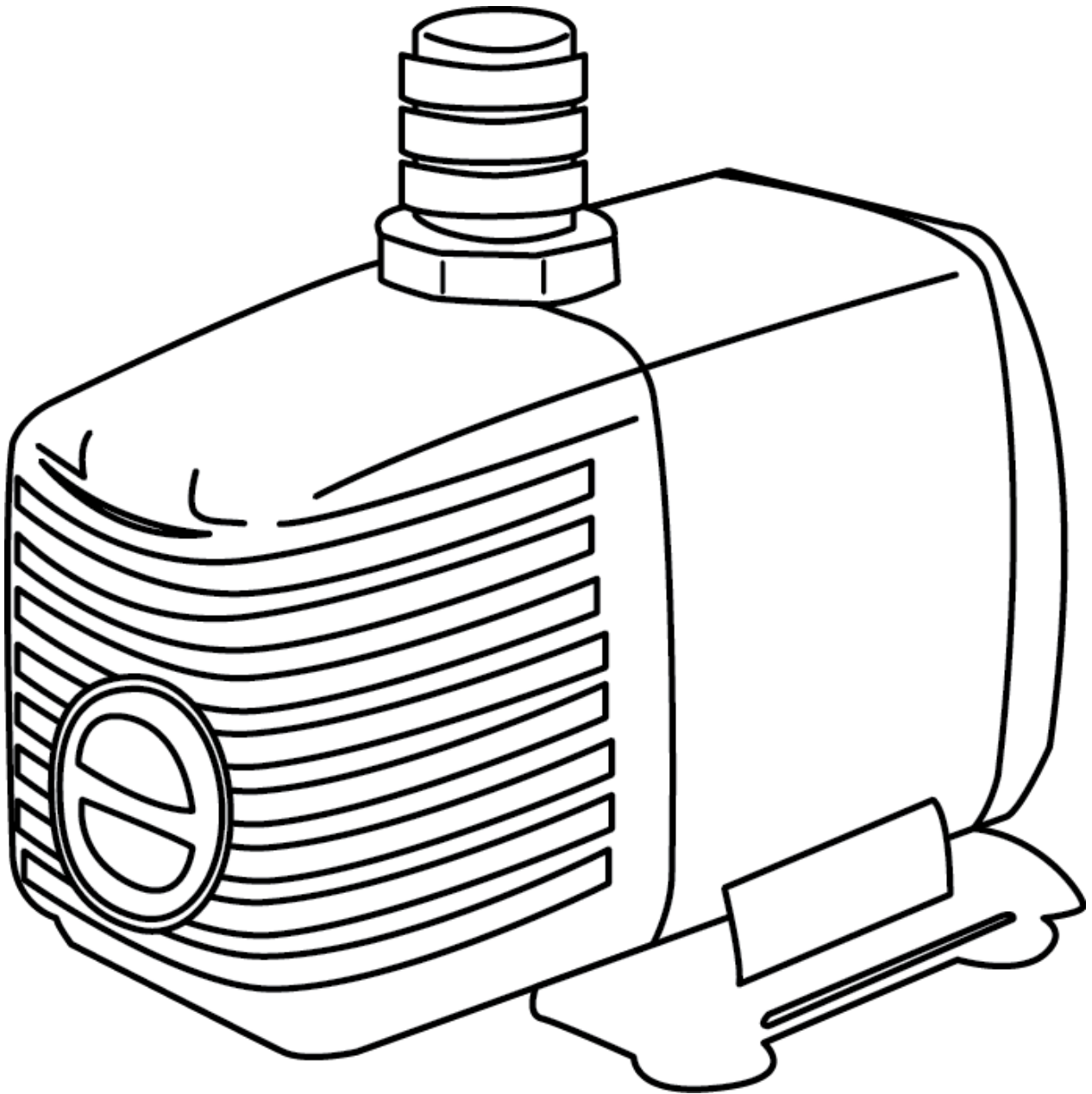
- sump pumps
- air pumps
- submersible pumps
- inline pumps
- peristaltic pumps

Which kind and which size should you get?

Pump sizing varies based on whether you're using hydroponics or aquaponics, your overall system size, and the type of hydroponic or aquaponic system you're running (the types covered in this post are DWC, NFT, media bed, Bato bucket, and ZipGrow Towers).

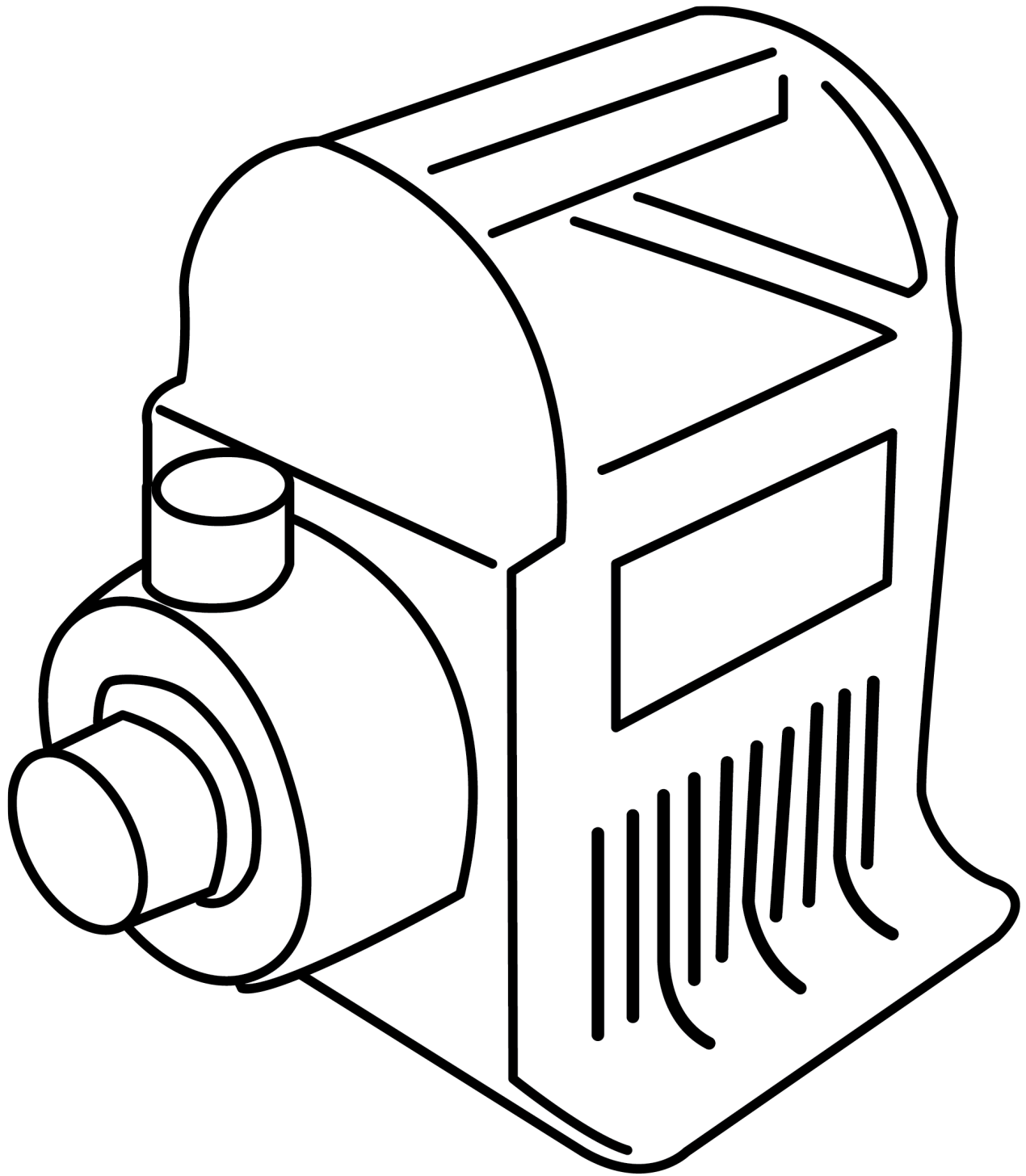
Read on to learn about different types of pumps.

## Inline vs submersible pumps



The two main categories of pumps that you will be choosing from are inline and submersible pumps.

**Submersible pumps** are cooled by the water and sized in GPH. These sit directly in the water of a tank or gutter and pump water through a fitting (and hose that you attach) from the top of the pump. Submersible pumps are limited in power and are only suitable for systems with a total GPH need of 1200 or less. This fits most hobby systems, display systems, and very small commercial systems.



**Inline pumps** are air-cooled, sit outside of your tank, and are typically suited best for larger (50 or 100+ tower) operations. Inline pumps typically have more power, which is measured not in the volume of water that they can move like submersible pumps, but in horsepower, HP.

The term “**sump pump**” refers to a pump that moves water from one sump tank to another or is used for turbulence and mixing nutrients inside one sump tank. These help with consistency and can help with oxygenation. We use [submersible pumps](#) for this.

An **air pump** may be used to pump low volumes of air at a high pressure, usually for aerating the water. Aeration is important to supplying oxygen to root zones and avoiding anaerobic decomposition. Seedling carts with fertilizer solutions may benefit from an air pump, for example.

**Peristaltic pumps** are small pumps that are most often used in auto-dosing. Most auto-dosing systems come with the pumps.

### 3 steps to sizing a pump

Finding the right size of pump isn't half as complicated as it might seem! We've put together easy formulas to use—one for hydroponic growers, and one for aquaponic growers. In order to determine the best pump for your system, you'll need to do three things:

- Calculate the GPH (gallons-per-hour) that your pump will be moving
- Measure the head height of your system
- Combine these two value using the chart that comes with the pump

*If you start feeling overwhelmed at any point during this post, just ask a question in the chat box on the right side of the screen!*

We've put together two tables for both hydroponics and aquaponics to help anyone sizing a pump for your system:

HYDROPONICS		
	Flow rate GPH	Total GPH
<b>ZipGrow Towers</b>	2 GPH per Tower	=(# of towers)(Flow rate GPH)
<b>DWC</b>	Tank volume in gallons/hr	=(total volume)(Flow rate GPH)
<b>Media Beds</b>	Bed volume in gallons 1-3 times/hr	=(# of beds)(Flow rate GPH)
<b>NFT</b>	4-6 GPH per trough	=(# of troughs)(Flow rate GPH)
<b>Bato Buckets</b>	2 GPH per bucket	=(# of buckets)(Flow rate GPH)

AQUAPONICS		
	GPH	Total GPH
<b>ZipGrow Towers</b>	7 GPH per Tower = Flow rate GPH	=[(# towers)(Flow rate GPH)] + (Turnover GPH)
	(Fish tank volume in gal)(2)/hr = Turnover GPH	
<b>DWC</b>	Tank volume in gal/hr = Flow rate GPH	=[(# DWC tanks)(Flow rate GPH)] + (Turnover GPH)
	(Fish tank volume in gal)(1 or 2)/hr = Turnover GPH	
<b>Media Beds</b>	Bed volume in gal 1-3 times/hr = Flow rate GPH	=[(# beds)(Flow rate GPH)] + (Turnover GPH)
	(Fish tank volume in gal)(2)/hr = Turnover GPH	
<b>NFT</b>	Hydroponics only	n/a
<b>Bato Buckets</b>	Hydroponics only	n/a

Let's go through the 3 steps to sizing a pump; we'll use a ZipGrow Tower system as an example.

## Step 1: Calculate the required GPH

Pumps will almost always have a gallons-per-hour (GPH) rating that tells you how many gallons of water that pump will move every single hour. Obviously, places that favor the metric system will use liters per hour. (You can use the same equations, just remember that if you change one unit you have to change all of them.)

## Calculating GPH for hydroponics

Your total GPH is the flow rate times the units with that flow rate.

In hydroponics with ZipGrow Towers, you want to run two gallons of water through each tower every hour. This means that the number of gallons per hour is essentially the number of towers, times 2. So you end up with a gallons-per-hour (GPH) for hydroponics equation like this: (where t=towers)

$$(t \times 2) = \text{GPH}$$

This is the equation for a ZipGrow system. If you had a DWC system, on the other hand, the equation would be (total volume)(flow rate GPH)=total GPH

\*Tip: You'll also have a bit of extra water in your sump—a good rule is to add fifty gallons for the sump.

**Example (DWC):** DWC hydroponic system with two 500 gallon tanks.

**Example (Media bed):** 400-gallon media bed system with a 2/hr turnover and a 60-gallon fish tank.

## Calculating GPH for aquaponics

Now imagine that our example is ZipGrow Towers in aquaponics. In aquaponics, you'll want to run between seven and ten gallons of water through each tower every hour. Since you've got the fish tanks as well, you also need to factor in the fish tank gallons. You'll also be turning over the fish water twice every hour, so the gallons per hour for aquaponics equation looks like this: (where t=towers)

$$\left( t \times 7 \frac{\text{gal}}{\text{hour}} \right) + (\text{fish tank vol.} \times 2) = \text{GPH}$$

This is the equation for a ZipGrow system. If you were running a media bed system, the equation would be [(number of beds)(Flow rate GPH)] + (Turn over GPH) = Total GPH

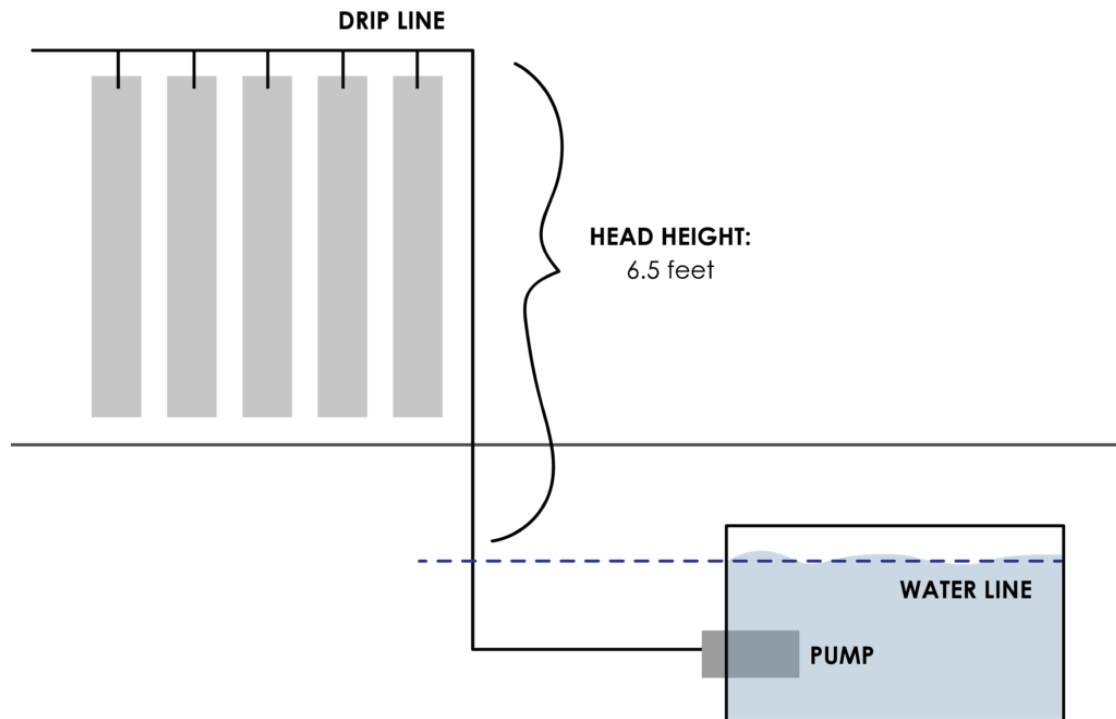
Run your system type and size through the appropriate calculation using the tables above. Keep your GPH number on hand; next, we're talking about head height.

## Step 2: Measure system head height

Because almost all aquaponic or hydroponic growers need to move water upwards, you'll need to also understand how efficient your pump is at

bed model or NFT or [ZipGrow](#) Towers, you'll still need to move water vertically from your fish tank to your beds, troughs, or Towers. To compensate for the height, we use a measurement called **head height**.

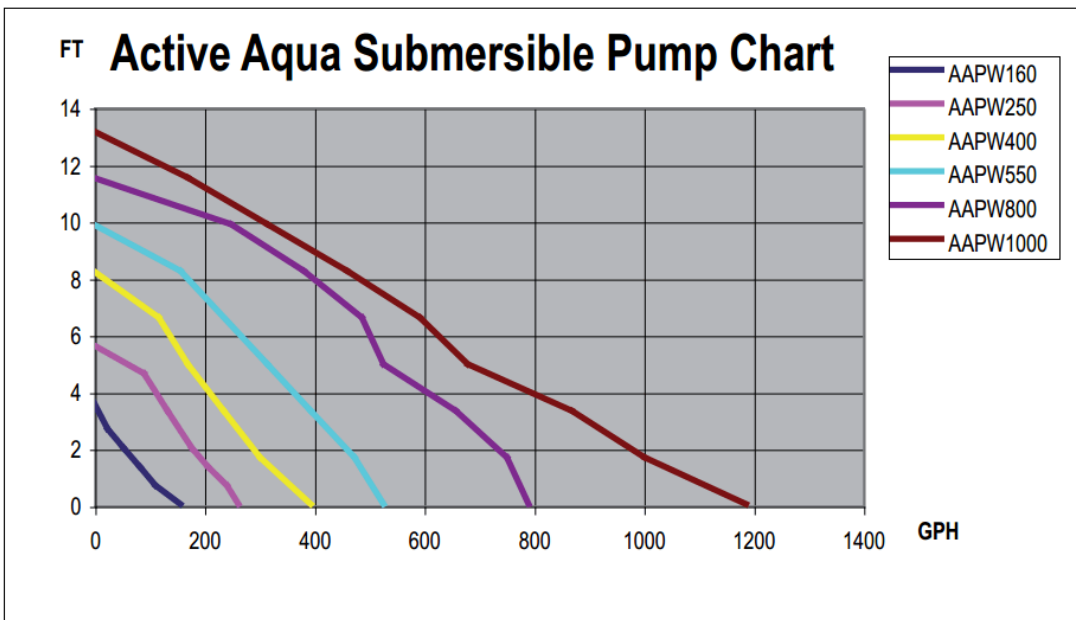
Head height is the distance between the top of your grow bed (or ZipGrow Tower) and the top of the water in your tank. You won't need a calculation for this. Just measure the length between the water line in your sump and the exit point of your irrigation (in a ZipGrow system, the exit point is the drip lines above your Towers).



**For example:** If you have an in-ground sump and the water line is one foot below ground level, and you're irrigating your Towers 5.5 feet above ground, your head height is 6.5 feet.

### **Step 3: Combine GPH and head height**

All pumps will come with a chart similar to this one:



This chart is going to be your cheat sheet for pumps. This one specifically matches the strength of Active Aqua pumps, and other pump brands will come with their own chart. **(Make sure you're using the right chart for your type of pump! Inline pumps and submersible pumps function differently.)**

Using the GPH you calculated and your head height, find the pump that matches your needs. Pump efficiency at different head heights is almost never a linear relationship.

## Sizing an inline pump: use the same 3 steps

Inline pumps will also have GPH or GPM listed and come with a curve that shows the GPH and head height intersections. This means that the sizing an inline pump requires the same steps as sizing a submersible pump.

One note is that if you're running a large operation, then you'll probably want to order a pump with extra power so that you don't have to buy a new one when you scale up.

## Remember: Systems vary!

When choosing a pump, remember that our recommendation of turning over your entire system volume at least twice per hour is a *recommendation*. If you shoot a little long or fall a little short of this



that every aquaponics or hydroponics system out there varies considerably. Whether it's the plumbing, system design, grow media, etc., every system is different and required GPH can vary because of it.

If you are growing aquaponically, you must be exchanging your water fast enough to maintain a good level of [dissolved oxygen](#) in your system. This is crucial to healthy fish!

## **Plan on 15-30% loss in efficiency**

When researching GPH and various head heights for your own application, remember that you'll be moving water through what could be quite a long length of hose. That said, the further your system volume travels, the lower your pump's efficiency will be, and that could mean a decreased GPH or overall system performance.

While it's possible to do the efficiency calculations here, it's much more simple just to eyeball it and calculate anywhere from a 15% to 30% loss of efficiency (this, of course, depends on your plumbing and system design).

**See how Dr. Nate sizes pumps for ZipGrow systems:**

## Related posts:

[How to Maintain a Y-Filter in a ZipFarm](#)

[Plumbing in Hydroponics: How to Join Pipes](#)

[How to be Successful at Plumbing Bulkheads](#)

[Hydroponic Drip Emitters: What You Need to Know](#)

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