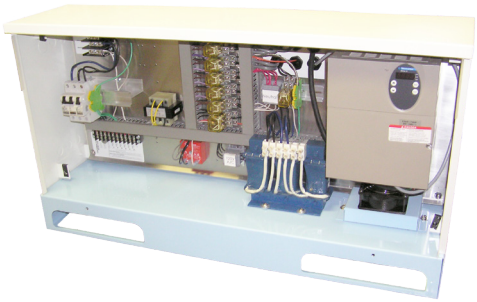
ZONE Genie
HIGH PRESSURE PUMPS



What is VFD Technology?

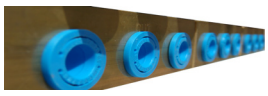
A VFD or Variable Frequency Drive is a piece of electronics that varies the frequency of electricity delivered to a motor. In short, it changes the speed of motors, variably.

What does this have to do with misting technology? It's all about the pump. Water does not compress like air, so water-in must equal water-out. Every stroke of the three pistons (called plungers) in a triplex high pressure pump moves a set amount of water. This means the pump delivers the rated flow (GPM) all the time when mounted to a single speed motor. This creates a problem of what to do with extra water that is not needed in the system. For example, a mist system may need 1.7 GPM of flow but the pump is a 2.2 GPM pump, leaving 0.5 GPM of water with no where to go.

Where does the water go? Through a valve called an 'unloader' or 'bypass valve', the unused water is redirected back to the inlet of the pump. Some bypass can be good for the pump (1% to 5%) but too much is bad for the pump. The absolute bare minimum that **good** pumps can be operated at is 50% bypass, BUT operating at this level shortens the pump's life. Basically, the less bypass used, the longer the life of the pump. This is illustrated in the chart below in the "Single Speed" column where red is the no-go flow rate. You can see how multi-zoning a system can quickly run into problems with small flow zones.

How does the VFD solve this issue? The VFD changes the speed of the motor, which changes the speed of the pump, there by changing the amount of water the pump moves. Now you can slow the pump down so that there is no excess water to bypass. By using a pressure sensor, the VFD can read the pressure and it adjusts the speed of the motor to keep a set pressure and flow. This ability is perfect for multi-zone systems because as the demand on the pump changes by the opening and closing of zones, the VFD adjusts the pump speed to compensate. Slowing down the pump means that only the required amount of water is pumped, therefore, no work performed by the pump is wasted resulting in the most energy efficient high pressure pump possible.

What are the limitations of a VFD system? VFDs can only slow down a motor so far before running into motor overheating problems. This is why, unique to Zone Genie VFD pumps, we use active thermal protection directly integrated into the motor windings to protect our motors from the dangers of overheating. If the motor (and pump) are slowed to their minimum speed (and flow) the bypass takes over for further flow reduction. The performance of a VFD pump set is illustrated in the chart below in the "Variable Speed" row. As the chart below shows, you cannot operate a VFD system below 7% of the pump's rated flow (GPM).



What if lower flows are required? Beyond single VFD systems are Master Pumps. A Master Pump is several VFD pump sets in one. Multiple consecutively sized VFD pumps work together to create the ultimate variable high pressure pump system. For commercial, industrial, and super high end residential applications where flow rate demands fall below the 7% minimum of a single VFD system.

What should I look for in a VFD system? Two very important features that all VFD systems must have are external motor cooling and external VFD cooling. Heat is enemy #1 of all electronic systems. Motors are cooled by fans attached to the back of the motor, but when the motor is slowed down by the VFD, so is the fan. It is critical that all VFD systems incorporate external motor cooling like all variable speed Zone Genie pumps. Because of the sophistication of the VFDs themselves, heat can be a real problem. They have their own cooling fan built in but if locked in a sealed cabinet, that fan does no good without fresh air. All VFD systems should have a power ventilated electrical compartment like all variable speed Zone Genie pumps.

Usage Chart - Percentage of Pump Capacity Used in System