WATER INJECTION KIT

The **JETWORKS Water Injection Kits** are designed to increase bottom end response and mid-range pull by altering the effective tuned length of the exhaust system. This is done by injecting water inside the exhaust chamber. This cools the exhaust charge and slows down the exhaust pulse wave. This slower exhaust pulse has the same effect of lengthening the exhaust chamber similar to a low RPM torque producing chamber. The water is controlled electronically based on RPM. This allows you to optimize your exhaust systems bottom end without sacrificing any of your top end speed. It further allows you to tune your exhaust system by altering the amount of water through its fixed or manually adjusted orifice.

Our kits are designed to hit hard right off the start line with no hesitations or flat spots. Be quicker to the first buoy as well as from buoy to buoy.

What makes our kits different from the rest is that we set up the injection start points to where the watercraft performs better at bottom end instead of improving primarily the mid-range power band only, like most others. Currently most water injection systems come on from 2,850 or 3,000 RPM. Most have adjustability as to where you can turn the water off. Some with a choice of RPM points where the amount of water is gradually turned off within certain RPM parameters. This is usually at too high of an RPM.

We feel the RPM points where the water is turned on and off differs based on the type of vehicles and exhaust systems being used. The primary difference being the distance from the exhaust port to the water injecting point.

- The shorter the distance, the higher the RPM ON point must be.
- The longer the distance, the lower the RPM ON point must be.

Otherwise you risk picking up water moisture when the sonic wave returns back from the reflector cone. These small amounts of water can cause intermittent misfire under acceleration from low RPM's. This is caused by the water momentarily shorting out the spark plug gap due to its conductivity. If on the other hand the RPM ON point is set too high, 3,000 RPM for example, and you have a moderately long distance from the water spray point to the exhaust port, you are giving up needed low RPM response that could be easily obtained.

Our kits are not designed specifically, or strictly, for the aftermarket exhaust systems. Most OEM exhaust systems benefit greatly from a properly selected water injection kit. If you are hesitating buying an aftermarket exhaust system due to price and/or reliability, and bottom end and mid-range is primarily what you are after, then the **JETWORKS Water Injection Kit** might be all you will ever need.

Let's take a look at two examples of how the same engine responds and runs differently based on different water injection mapping curves.

EXAMPLE 1:

Engine idles at 1,500 RPM. The solenoid to the sprayer is turned off. Suddenly an quickly you open the throttle. The engine must rev to 3,000 RPM before the solenoid can be electronically actuated. How long after this takes place it is until you actually get water spray into the head pipe depends on a few factors.

1. Water pressure
2. Hose diameter

3. Distance from solenoid to sprayer
4. Orifice diameter in solenoid
5. Whether or not a restrictor is used and where the restrictor is placed

All these are factors in determining how long it's going to take to fill the hose and actually begin to spray into the head pipe. Now let's ask ourselves, at what point do we really begin to get the performance gains??? It might be later than we think. this setup will have a definite weak spot at low RPM's similar to a bog or a lag. There will be other factors that contribute to this lag, they are:

1. Low compression
2. Too tall or overly aggressive impeller/pump combination (too small of a nozzle)
3. Too short of an exhaust chamber (tuned length)
4. Excessive exhaust and/or transfer port duration
5. Improper or incorrectly set ignition timing

Let's say, for example, that the exhaust system for example #1 starts to develop horsepower rapidly around 5,700 RPM but the injector remains on until 6,200 or 6,600 RPM. As this watercraft is quickly accelerating, it lingers on or stays near these RPM's longer than it should because the water is trying to tune the exhaust system for torque not higher RPM's. This happens because, after the solenoid is turned off, it takes time to heat up the exhaust chamber gases to the point where it tunes itself for high RPM. This will depend on the on the amount of water being injected and the RPM point when it is turned off. Remember, the typical time to reach the first buoy in a closed course race is approximately 5 seconds. You can't afford to give up any time when it really counts. If you shut the water off at say 5,500 or 5,600 RPM, you can accomplish a much quicker elapsed time to the first buoy and a much shorter time period to achieve full top end speed. Turning the water off earlier also allows you to inject larger amounts of water into the head pipe for increased bottom end and mid-range. This is accomplished by not having to utilize a jet, or a restrictor, in the system in order to get the RPM's high enough to actually turn the solenoid off. (A jet is usually used to lessen this upper mid-range lingering effect.)

Some tuners and racers say that they leave the starting line above 3,000 RPM, so they believe a lower ON point would be of no significant importance to them. We say it's definitely possible to leave the starting line at these RPM's if you are on a runabout or sport class watercraft. But not on a stand up. We have seen better acceleration times on some watercraft by actually leaving the starting line at much lower RPM point. What happens under higher RPM is that you are flowing larger amounts of water around the water intake grate (usually a top loader) since the craft doesn't have any forward movement to make the grate work, and the engine is at a point where the power band is a quick stab of the throttle away. It is very possible to have slight cavitations without even knowing it.

One thing for sure is that the RPM of these watercraft frequently drop below 3,000 RPM under hard deceleration and tight hairpin types of turns. When they do the solenoid turns off. If the solenoid was held ON at these lower RPM's, or even under deceleration (using Pascal's Law), when you quickly reapply the throttle, the water pressure at the sprayer quickly rises at the same time as it does at the pump... ***instantly***. If you are running the **JETWORKS Flow Control Valve** to the stinger, the instant you back off the throttle, even slightly, it checks or stops the flow of water to the water box. Upon re-acceleration the response is further improved by not having to blow out residual water locked in the water box and exit hoses. This much improved bottom end throttle response performance is very noticeable around turns and when the craft is at a real idle speed and you suddenly and quickly go to wide open throttle.

EXAMPLE 2:

Using the same engine as in example 1, the dyno shows the pipe coming on strongly at 5,700 RPM. Let's say it's a stand up vehicle. On the line you are only allowed one holder, so you have to leave the line around 2,000 RPM.

SO, how would we set this up? Obviously we have to have the solenoid on at this RPM. *We don't have to fill the hose and wait for the sprayer to work.* The next question is what is the pressure inside the chamber at this RPM? We all know the pressure is not constant and varies depending on many variables (typically -3 to +3 PSI). If we check the water pressure at this RPM, we will discover 1.5 to 2 PSI. This is because the water has exits that it can go through and the pump has not yet built up pressure. How do we build up pressure in the cooling system to overcome exhaust chamber pressure at this RPM point? By installing a **JETWORKS Flow Control Valve** to the cooling hose going to the stinger and possibly installing a restrictor or a second flow valve on any of the extra bypasses. Better yet, you could run a separate dedicated cooling line to the exhaust only. This way you can raise the water pressure much higher by adjusting the **JETWORKS Flow Control Valve** without affecting the cooling of the engine. A secondary benefit of installing the **JETWORKS Flow Control Valve** is that it eliminates all water going into the water box at this RPM so you don't have to blow out all of this residual water upon sudden acceleration. This alone is worth the installation of the valve itself.

Let's see what happens now when we suddenly stab the throttle wide open. The solenoid is already on and injecting water under higher pressure than the pressure inside the exhaust chamber. The water box and exit hoses are completely dry at this time so the watercraft quickly responds and gets on plane faster. This is aided by the fact that the exhaust is already tuned for torque right from the start. Since we are accelerating quickly, and at wide open throttle, we can start to shut down the water sooner, like 5,400 RPM, for example, and start to heat up and speed up the sonic wave speed in the chamber which will bring on the top end pull much earlier. What you end up with is a craft that pulls much stronger right from the start, with much improved mid-range pull and reaches top end speed quicker.

This type of performance is really useful is closed course racing. If you can pull on the competition by one boat length right from the start, or better yet let's say it's only a half boat length or approximately four feet. One MPH is equivalent to 1.47 feet per second. It would take your competition over two full seconds at full speed to catch up to that 1/2 boat length assuming he had a gain over your top speed of one MPH. How long are we at full speed before reaching the first buoy? One full second? That's 4 seconds if you get him by one full boat length at the start. He will have to be 4MPH faster than your boat for one full second to cover 5.866 feet. That's still less than one boat length. That is why it is so important to leave the line hard and with no hesitations or flat spots. Even around the turns, if you can out accelerate the guy behind you by only half a boat length at every buoy, and assuming you can both keep up the pace and are of equal riding ability, that's four feet on each buoy on each lap (4 feet x 'number of buoys' x number of laps). That adds up to a BIG lead at the end of the race.

Jet Kit
Catalytic Converter Plate