Common misconceptions about pumps and hydraulics

By A. Butsch *(Used with permission)*
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As an officer who works a fair amount of OT [overtime] and CSBs [trades], I get the opportunity to travel around the county and work with a wide variety of people. The following concepts are ones that I have often heard people express confusion about. I offer the following thoughts in the spirit of education and not criticism.

#1: Pressure vs. Volume.

Most people have heard the maxim, "Big Fire, Big Throttle" and some therefore think that increasing engine discharge pressure will automatically increase the volume of water discharged. In fact, when dealing with a centrifugal pump, discharge pressure and volume are inversely related; that is as the discharge pressure rises, the maximum possible discharge volume falls. You can vividly see this relationship by looking at the pump capacity plate located on the discharge panel. At 150 psi, most of our pumpers are rated at 1250 gpm. At 250 psi, most of our pumpers are rated for 625 gpm. This is a decrease in maximum available GPM of 50%.

This relationship doesn't matter a whole lot if you are just flowing a couple of handlines because the GPM you are flowing doesn't approach the pump's limitations. It does matter a lot in big water situations if you are the supply engine. This is one reason that we advocate heavy water hookups, and the use of four inch hose, and the stationing of engines no more than 1000' apart in a relay operation. All of these things minimize friction loss in supply lines and therefore don't require engines to develop discharge pressures in excess of 150 psi.

#2: Heavy water hookups #1:

There are some that believe that the heavy water hookup increases the incoming pressure. In fact, the heavy water hookup simply increases the *volume* of water available.

A hydrant with a static pressure of 100 psi, will always have a static pressure of 100 psi, whether you are using just your soft sleeve, or two four inch lines to the butts, or some combination of the above. Because you are increasing your available volume, and therefore decreasing your incoming friction loss, what you gain is an increase in the residual intake pressure.

If you utilize only a soft sleeve for your supply, you may see a residual pressure of 80 psi while flowing 500 gpm. If you utilize a soft sleeve and a four inch line from the butt, you may see a residual pressure of 85 psi while flowing 500 gpm. Again, this simply means that you have more volume available to you to flow.

A real heavy water hookup – and the hydrant was still not maxed out!

#3: Maximum Volumes.

There are some that believe that an engine is not able to flow any more volume (GPM) than what the pump is rated for. You should understand that this number is developed by testing the pump at a *draft* of 10' using a single six inch hose to the steamer connection. You also need to understand that by its design, a centrifugal pump is able to take advantage of incoming pressure.

If you are tied into a good hydrant system, it is fairly easy to develop big flows. By sitting on a hydrant and using the heavy water hookup, I have seen a 1250 gpm pumper flow over 2000 gpm. This is because the hydrant was sited on a fairly large main (so lots of volume) with good pressure (about 100 psi). So if the intake pressure is about 100, and the master stream devices we are flowing require about the same (or even less) discharge pressure, you can readily see that our pumper has to do little work to flow this amount of water.

Increasing your intake opportunities may also improve your flows even at draft. I recently saw an article by B/C Davis that illustrated how *at draft* a 1500 gpm pumper was able to achieve flows of over 2300 gpm. They did this by using multiple hard sleeves attached to multiple intakes. Having a shallow draft didn't hurt either.

#4: Humat use vs. non Humat use:

I am a big proponent of the KISS principle because I have seen people mess up the simplest tasks when placed under the pressure of "the big one". Therefore my thought has always been that the Humat should not be used when the supply engine is arriving very soon after the attack engine. It just seems to me that the Humat is unnecessarily complicated, that it would be far simpler to attach the supply line to your discharge, and sleeve the hydrant. However, it has been pointed out to me that if the supply pumper has an issue with hooking up to the hydrant (soft sleeve is too short, bursts, got stolen by aliens, etc.) then if the Humat had been used initially there would still be water going to the attack pumper (even if only at hydrant pressure) and this would buy the supply pumper driver more time to fix his/her issue. This argument does make a lot of sense to me but does conflict with my belief in the KISS principle.

I think ultimately the answer is that engine drivers should be trained to expect the unexpected and should practice multiple ways to accomplish their tasks. You can hookup to a hydrant and achieve big flows without utilizing your soft sleeve and your front intake and you should know at least five different ways to do it. You can open hydrants when the bonnet is missing. You can use the hydrant if a butt or steamer cap is missing or inoperable. All it takes is knowledge, the right tools and appliances, flexibility, and practice!

Plan B – Soft sleeve blew apart – what would you do if you did not have a 4.5" NST to 4" Storz adapter available?

#5: Heavy water hookups #2: There are some that believe that heavy water hookups should only be utilized for "big fires". My answer to that is that you cannot always tell what will turn into the big fire. I also believe that if you do something as a matter of routine, you will be able to do it correctly and quickly when the big one comes.

I welcome comments via e-mail and again only offer the above for educational purposes.