Fire Apparatus & Emergency Equipment

TurboDraft Operations: A Solution to Your Rural Water Access Problems, Part 2

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Accessing water in the rural environment is one of the biggest challenges a pump operator may be faced with. Part 1 introduced the TurboDraft Fire Eductor and explained how its conventional configuration can allow operators access to water sources up to 100 feet away. Using a Venturi effect, this device can yield a return flow rate of between 550 and 700 gallons per minute (gpm) back at the supply pumper through 5-inch supply line.

1 Employing a tandem TurboDraft operation allowed this Scottsville (VA) Fire Department engine to flow 1,000 gpm from a source 75 feet away. (Photos by author.)

In its conventional configuration, the TurboDraft has a 2½- or 3-inch line connected from a discharge of the supply pumper to the inlet of the device. A 5-inch supply line is then run from the discharge of the TurboDraft (the volute) back to an intake on the supply pumper. Using the TurboDraft in this conventional configuration allows a single operator to rapidly deploy the device and establish water. Although this arrangement allows for the establishment of a fast water supply, it does come with some operational limitations.

One of the biggest limiting factors to conventional TurboDraft operations is the flow rate that can be achieved. If used as a means to access water at a fill site, a conventional TurboDraft operation will fall short of the desired 1,000-gpm fill rate for National Fire Protection Association 1901, Standard for Automotive Fire Apparatus, compliant water shuttle apparatus. In addition, because the 5-inch supply is directly connected to the supply pumper's intake, there is a risk that the supply line could collapse if discharge valves are opened too quickly. These two variables can contribute to a less effective fill site operation. Part 2 highlights alternative TurboDraft operational configurations that will yield higher flow rates while simultaneously allowing access to even the most stubborn sources. These alternative configurations include larger supply line operations, tandem TurboDraft operations, TurboDrafts feeding a dump tank, and shallow water operations. It will become evident that the TurboDraft Fire Eductor is the key to unlocking water sources never thought achievable in the rural setting *(photo 1)*.

Larger Supply Lines

As previously stated, the minimum supply line diameter that should be used with a TurboDraft is 5-inch hose. Anything smaller will result in lower return flow ratios that render the device useless. One option for increasing the efficiency of a TurboDraft operation is to simply use a bigger supply line from the device back to the pumper—usually 6-inch soft hose. This concept works because there is less friction loss in the larger-diameter hose, which will result in more water being available at the intake of the supply pumper. Tests compared the use of 5-inch hose with 6-inch hose for TurboDraft operations. When 50 feet of 5-inch hose was used, a usable return flow rate of 700 gpm was achieved. By simply switching out the 5-inch hose for 50 feet of 6-inch soft sleeve, the usable return flow rate increased to 950 gpm *(photo 2)*.

The use of larger supply hose allowed the operation to get closer to the desired water shuttle fill rate of 1,000 gpm over 50 feet using only one TurboDraft. It is important to remember that this configuration was using 50 feet of 6-inch soft hose — not hard sleeve. Another major advantage of operating in this configuration is that the process for placing the TurboDraft in service is exactly the same whether using 5-inch or 6-inch soft sleeve.

When strictly using 5-inch hose, the maximum practical distance that the device and pumper can be from each other is 100 feet. This means that the distance between the rig and the device could be increased when 6-inch hose is used without significantly sacrificing the return flow rate. If the water source is beyond 100 feet from where the pumper can access, sections of 6-inch hose can be used to “bridge the gap.” This can be accomplished by simply running 100 feet of 5-inch hose from the device back toward the supply pumper and finishing the layout with the necessary lengths of 6-inch soft sleeve *(photo 3)*. Remember, the amount of 6-inch soft sleeve may be limited, so the operational distance will be dictated by the 6-inch available.

Your department may not be carrying any lengths of 6-inch soft sleeve; however, that doesn’t necessarily mean that you are limited to 100 feet when using TurboDraft conventionally. An option for overcoming more distance is to use 6-inch hard sleeve to bridge the gap between the pumper’s intake and where the 5-inch ends. Depending on the rig and the equipment carried, this may allow the operator to overcome an additional 20 feet of horizontal distance during the operation.

Often, people will ask, “Does the hard sleeve have to be rated for pressure to be used?” The answer is no, because during TurboDraft operations, the supply line is never truly pressurized. We know this because the TurboDraft is open at the top of the basket strainer. This means that even if “drafting only” hard sleeve is used, there is never a risk of the hard sleeve being pressurized to the point where it will be damaged. Another advantage of using hard sleeve between the end of the 5-inch and the pump intake is that it will usually prevent kinks from occurring from the weight of the hose hanging off the intake valve *(photo 4)*.

2 By switching out the 50-foot 5-inch return line with 50 feet of 6-inch soft sleeve, the flow rate from this single TurboDraft increased from 700 gpm to 950 gpm.

3 Fifty feet of 6-inch hose is being used by this Shepherdstown (WV) Fire Department engine to finish the layout from the TurboDraft that already has 100 feet of 5-inch attached.

4 Hard sleeve being used by a Hanover County (VA) Fire Department engine to prevent a kink from forming at the intake from the weight of the supply line.

Tandem TurboDraft Operations

Arguably the easiest and most efficient way to increase the flow capability of a TurboDraft operation is to perform a tandem TurboDraft operation. In this configuration, the operator simply puts two TurboDrafts into service off the same supply engine. This essentially doubles the return flow rate delivered back to the supply engine *(photo 5)*.

Practically speaking, these operations typically begin with the supply engine placing its TurboDraft in service in the conventional fashion. Once this first TurboDraft is placed in service and the supply of water is established, the operator can begin gathering the necessary equipment for a tandem TurboDraft operation. The equipment needs will mirror those of a traditional single TurboDraft operation. This is one of the many reasons it is recommended that water shuttle apparatus also carry this device and associated equipment; when a tankerarrives at the fill site to be filled, the operator can steal the TurboDraft and associated equipment to expand the fill operation.

5 A tandem TurboDraft operation being employed to increase the operational flow capabilities over challenging terrain with significant distance and lift.

The major advantage of this tactic is that the process of placing the second TurboDraft in service will be identical to placing the first one in service. Once the second device is operating, the pump operator will notice that he will be able to increase the flow rate without collapsing the supply hoses. As stated earlier, the realistic maximum distance between the rig and the device when using 5-inch hose is 100 feet, and it will yield a usable return flow rate of about 550 gpm. By performing a tandem TurboDraft operation, the operator can effectively increase the usable return flow rate to 1,000 gpm over the same 100-foot setback when minimal lift is present *(photo 6)*.

The operator must remember to maintain at least 200 pounds per square inch (psi) on the discharges supplying both TurboDraft devices. Failure to do so will cause the supply lines to collapse when the flow rate is increased. It is also critically important to remember that this operation is established in segments. The first TurboDraft should be placed in service normally before any efforts to establish a tandem TurboDraft operation begin. Only after the first device is in operation can efforts be made to place the second TurboDraft in service. Always remember: “If you can put one TurboDraft in service, you can put two in service.”

6 By employing a tandem TurboDraft operation, the flow capability of this pumper was increased to 1,000 gpm.

TurboDraft to a Dump Tank

The previous two examples are essentially variations of a conventional TurboDraft operation. There are two major disadvantages of the conventional TurboDraft configuration:

1. There is a risk of collapsing the supply line if the flow rate is increased too much or too abruptly.

2. The discharge lines feeding the devices must be pumped between 175 and 225 psi to create a sufficient Venturi to draw water back to the pumper. This means that on the back side of

every other discharge valve on the pumper, there is between 175 and 225 psi. This can make these valves very difficult to open and, in some cases, the valves may be opened too abruptly and cause the collapse of the supply lines.

One option for overcoming these disadvantages while simultaneously increasing the available flow rate from a TurboDraft is to run the return line from the device directly into a nearby dump tank. This essentially creates system. When the supply pumper discharges a portion of its tank water to initiate the process, the water that returns from the device fills the dump tank instead of going directly to the pumper's intake. Using hard sleeve connected to an intake, the supply pumper will then draft from the dump tank *(photo 7)*.

7 The engine on the right is supplying two TurboDrafts that are filling a dump tank that is 150 feet from the water source and 25 feet above the source. The engine on the left is drafting from this dump tank and flowing 1,000 gpm without outpacing the supply from the TurboDrafts. The engine on the right is able to maintain the flow to both TurboDrafts and keeps the tank full because it too is drafting from the dump tank to maintain the process.

When placing this operation in service, it should only take a couple hundred gallons of tank water to raise the water level in the dump tank to sufficiently submerge the low-level strainer. Once the strainer is submerged, the operator should establish the prime. After the prime is established and the apparatus booster tank is refilled, the process will use a portion of the water being drafted out of the tank to continue feeding the TurboDraft, which continues to fill the dump tank. While continuing to supply water to the TurboDraft and maintain water in the dump tank, the operator can now discharge water to whichever discharges that require it. The major advantage of this operation is that it allows higher flow rates to be achieved compared to traditional TurboDraftoperations. As long as the dump tank is full of water, the supply engine is capable of drafting the rated pump capacity. This configuration also enables some flexibility with regards to pump pressures during the operation. While the operator should still maintain 200 psi on the discharges to the devices filling the dump tank, this configuration allows the operator the flexibility to idle down when opening other discharges if needed. This makes opening additional discharges easier, but it won't cause the supply lines to collapse. Note that once the additional discharges are opened, the discharges feeding the TurboDrafts should be brought back up to 200 psi.

8 Tucking the hard sleeve from the TurboDraft return line between the last two rungs of a ground ladder allows the hard sleeve to act as a spout that directs water right into the tank.

One critical point to remember when employing this water supply tactic is to secure the 5-inch return line to the dump tank in some fashion. The easiest and most effective way to achieve this is to connect the 5-inch return line to a section of hard sleeve and then place a ground ladder on the edge of the dump tank with the butt of the ladder resting on the ground. The hard sleeve can now rest on the ladder with the open end tucked between the rungs at the tip. The hard sleeve essentially acts as a faucet that directs water into the dump tank during the filling operation *(photo 8)*.

This tactic is particularly advantageous when attempting to access water that is beyond 100 feet from the pumper. In these circumstances, connecting the 5-inch return line directly to the pumper's intake would result in a lower return flow rate as the operator attempted to prevent the line from collapsing. When the open butt of the return line is placed inside a dump tank, the operator doesn't have to maintain a specific amount of pressure to prevent the supply line from collapsing in on itself. Friction will still affect how quickly the dump tank fills; however, the TurboDraft will always supply water out the open end as long as it is being pumped to.

By employing this tactic, we essentially move a water source from a great distance to a point where we can access it. In one training scenario, we tasked students with accessing water from a stream 350 feet from the roadway using this TurboDraft tactic. Once the operation was in service, the pumper supplying the TurboDraft was capable of filling water shuttle apparatus at a rate of 1,000 gpm while filling the dump tank from a source 350 feet away *(photo 9)*.

For peak efficiency during this type of supply operation, it is advisable to use two TurboDrafts to supply the dump tank for every 1,000 gpm that will be discharged from it. Depending on the distance from the source, a single TurboDraft may be able to keep up with the discharge rate; however, by using two devices to fill the tank, the operator ensures that he will not draw the tank level down faster than it is replenished. Configuring a fill site in this manner can easily allow a single engine to maintain a water shuttle fill rate of 1,000 gpm *(photo 10)*.

Organizations that are resource rich can expand this configuration one step further by using two pumpers. One pumper can be used to power the TurboDrafts and fill the dump tank. This supply engine will establish a prime out of the tank and continually maintain the appropriate water level in the dump tank. The second pumper will position so that it can establish a draft out of the same dump tank and focus on filling water shuttle apparatus *(photo 11)*.

The major advantage to this configuration is that it eliminates any issues with regards to pressure surges; the engine supplying the TurboDrafts maintains 200 psi on the discharges while the engine filling the water shuttle apparatus maintains the appropriate pressures for that operation. The major disadvantage here would be that it requires the use of two pumpers.

It may not be practical or feasible to employ this advanced TurboDraft tactic for initial fill site operations. However, this is an ideal option for expanding a fill site from a bountiful source. In these situations, there may only be enough room for the initial pumper to establish a traditional draft near the source. By employing this option, a later arriving pumper can access the water from a

9 This engine is supplying a TurboDraft located in a creek 350 feet away and using the water from the device to fill a dump tank. The engine is then able to draft out of the tank and fill tankers at a rate of 1,000 gpm while also supplying the TurboDraft.

10 La Plata (MD) Fire Department Engine 11 supplies two TurboDrafts that are filling a dump tank from which the engine is drafting. By using two TurboDrafts to fill this tank, Engine 11 was able to fill tankers at 1,000 gpm without the risk of draining the dump tank.

11 When resources allow, it is advantageous to use two pumpers for this TurboDraft tactic; one pumper will draft out of the tank and supply the TurboDrafts to ensure the tank remains full while the other drafts and supplies water where is needed.

distance and increase the capability of the fill site *(photo 12)*.

Shallow Water Operations

Shallow water sources can be particularly difficult to deal with in the rural environment. Traditionally, using these sources requires the operator to create some sort of dam so that the water depth is sufficient to draft from. The TurboDraft can be used in two configurations to overcome this rural water challenge.

If the shallow water source has a rock bottom free of sand and silt, one option is to simply flip the TurboDraft upside down in the source. This will enable the device to be placed in water sources as shallow as 4 to 6 inches. What is critically important to remember when using this tactic is that the source must be a clean, silt free, rock bottom. If the bottom of the source is silty, the Venturi produced by the TurboDraft will cause a significant amount of silt to enter the pump. This option can also be used to transfer water between dump tanks that are spaced out from each other at a dump site *(photos 13, 14)*.

In situations where the source has a “dirty” or silty bottom, the TurboDraft can still be used to establish a reliable water supply. It will require the device to be placed into the water right side up and realistically requires the water to be 10 to 12 inches deep. Performing a conventional TurboDraft operation in shallow water like this runs the risk of drawing air directly into the pump and affecting the operation; however, if the return line is run from the shallow source into a dump tank, water can be drafted out of the dump tank

12 Using this advanced TurboDraft tactic allowed a third arriving fill site pumper to access the water source and increase the fill capability of the fill site without cramping the narrow levy that the other two pumpers were operating on. This configuration allowed the three pumpers to work in conjunction to support a 3,000-gpm fill site.

13 Flipping the TurboDraft upside down is an option for “clean bottom” shallow water sources and dump tank operations.

14 The TurboDraft in the far tank allows water to be easily transferred to the primary dump tank over a distance.

as outlined above *(photo 15)*. Any air that is entrained through the Venturi created by the TurboDraft will be observed as "froth" coming out of the hard sleeve filling the dump tank.

Operations in the rural environment require the pump operator to overcome a myriad of challenges. One of the most common challenges is access to the rural water source. The TurboDraft Fire Eductor can be used to overcome these access issues. These devices can also be operated in conjunction with traditional drafting methods to enhance the overall flow capability of a rural water supply operation.

While the traditional TurboDraft setup may limit the available flow rate of the operation initially, the operation will be established rather quickly. The operator must remember that once the flow of water is established, the option to expand the system always exists. The tactics outlined here can provide rural pump operators with superior fire flows from some of the most difficult water sources they may encounter *(photo 16)*.

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15 For shallow sources with silty bottoms, place the TurboDraft right side up with the return line run into a dump tank. The supply engine can then draft out of the tank.

16 Using the TurboDraft makes access to the most challenging sources easy for the rural pump operator.