Pump it Up

Comprehensive testing reveals that the addition of a hydrant booster valve can increase dramatically water pressure and flow. BY DOUG MILLER

National statistics show a decrease in the number of fires that departments respond to annually. However, there is still a critical need to provide adequate water supply when dispatched to a fire. Many departments are answering the call with fewer personnel for various reasons. The fire does not know this, nor does it care. Moreover, fire attack and water supply training has taken a back seat to the many other hats we are expected to wear proficiently these days.

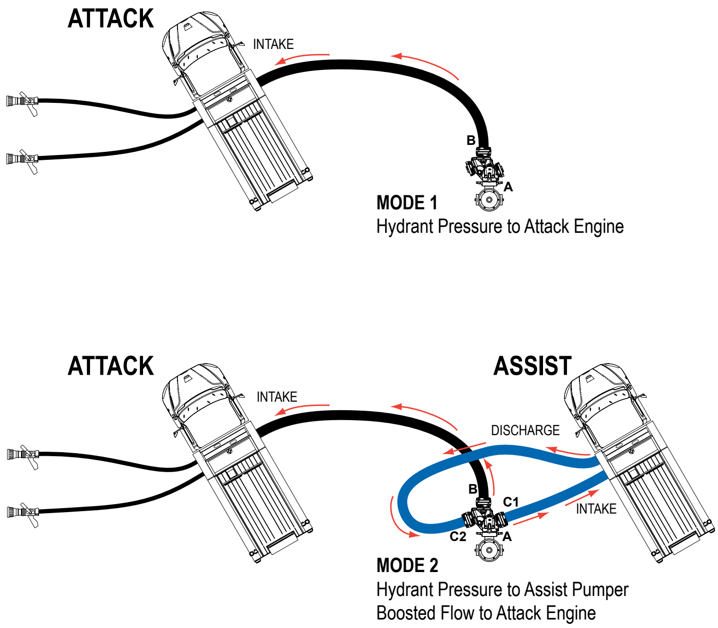
However, by reviewing your standard operating procedures and guidelines, and then training on them with the expected number of response personnel using your existing equipment, you may confirm that an adequate water supply exists. Or you may realize that something needs to change in order to provide the required water flow to extinguish the fire, save lives of firefighters and citizens, and mitigate the scene.

Our fire department did such a review and decided to change some of our tried-and-true water supply evolutions by adding a few pieces of equipment, and by revising how we initiate and supplement our water supply for many of our target hazards.

Hydrant System is a Problem

We operate in a suburban/rural area, but are faced with a growing number of larger homes and motels, as well as industrial and transportation hazards that didn't exist just a few years ago. As do most communities, we have a large high

VALVE ON HYDRANT USED FOR HYDRANT BOOSTING



school with high life-hazard potential. We also find that our fire department neighbors count on our mutual-aid assistance as much as we count on theirs. Most of our water supply is provided by tanker shuttles. During our joint training exercises, our area fire departments continuously train and modify our water-shuttle supply system and do quite well in this area.

The same cannot be said for our hydrant system, which has deficiencies. The first problem is that a very limited number of hydrants exist; a second is that they are connected to a sometimes less-than-adequate system over which we have little control. In addition, in some high-hazard areas — notably the growing industrial area and a multi-story hotel complex — the training exercises revealed limited water pressure, which was compounded by long supply-line hose lays that limited the maximum flow we could achieve.

We set out to determine how we could improve flows, first by contacting the municipal water supply authority to gather a more in-depth understanding of system infrastructure, as well as opportunities to improve it. This also was a great time to get to know the players that may become involved during an incident or when problems arise.

After informing the water authority, we ran tests to see what flows were produced with our current single-engine forward lay arrangement using 5-inch LDH as our supply line from the hydrant to the engine.

Our first test consisted of laying a 950-foot hose bed from the hydrant steamer and using our deck gun with a stacked tip nozzle; flow was measured using a pitot gauge. A pressure gauge was

TEST SERIES 1

	Hydrant Static Pressure (no flow)	Hose Length	Inlet Pressure on Lead Apparatus	Engine Discharge Pressure	Tip Size/Pressure/Flow	2nd Engine Residual Pressure	Hydrant Residual Pressure
1	80 psi	950 feet	35 psi	35 psi	2”/ 24 psi/ 582 gpm	N/A psi	75 psi
2	80 psi	950 feet	0 psi	100 psi	2”/ 57 psi/ 897 gpm	N/A psi	65 psi
3	80 psi	950 feet	psi	125 psi	gpm	psi	psi
4	80 psi	950 feet	psi	150 psi	gpm	psi	psi
5	80 psi	950 feet	psi	175 psi	gpm	psi	psi
6	80 psi	950 feet	psi	200 psi	gpm	psi	psi
7	80 psi	950 feet	psi	225 psi	gpm	psi	psi

Testers were not able to go to higher discharge pressure test points past 100 psi, as the inlet pressure was zero. The current practice is to have no less than 5 psi on the intake gauge in order to avoid damaging pump cavitation, but for the purpose of the short test under close observation, testers took it to the lower limit.

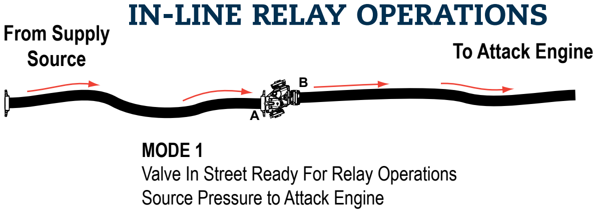
installed on the hydrant's 2½-inch discharge, and pump discharge pressures were increased in 25-psi increments. As directed by the water authority, we waited about three minutes for their pumps to increase the pressure to the system and stabilize before taking each of the readings. A second engine was not used in the first series of tests, so that we could determine the accuracy of the attack engine's on-board flow meter.

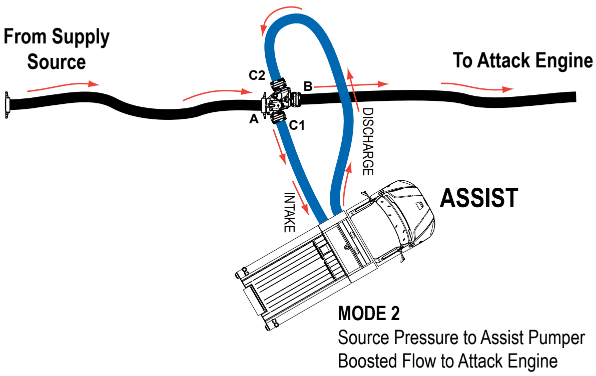
For the second series of tests, we used a hydrant-assist (boost) valve at the hydrant steamer. This was a new product provided by the manufacturer for the purpose of our testing.

We had placed the hydrant-assist valve on the initial supply line to our attack pumper for the first series of tests. Without interrupting flow to our initial engine, the boost supply connection on the assist valve was connected to a second engine's pump intake using 5-inch LDH, and a pump discharge line was connected to the valve's boosted pressure inlet connection. The assist valve had an internal valve that was opened, which directed water to the second engine's intake without disrupting the flow to the attack engine. The boosting pumper's discharge also was opened, which provided water back into the assist valve.

It was noted that the assist valve's clapper valve went to an intermediate position, due to the fact that hydrant pressure and the pressure through the boost pumper were equal when the pump was not engaged. When the boost engine's pump was engaged, the clapper immediately closed to a posi-

VALVE IN STREET USED FOR IN-LINE RELAY OPERATIONS





tion that allowed all incoming hydrant flow to be boosted by the second pumper. The clapper valve automatically will allow hydrant flow and pressure to be maintained to the attack pumper should the boosting pumper have an issue maintaining flow or pressure.

A second series of tests began using 125 psi as the boost pumper's discharge pressure and the same test points on the attack pumper as our first series of tests. Our first test point was at 150 psi due to the added pressure from the boosting pumper. Since our goal was to achieve maximum flow, it made no sense to restrict the incoming pressure to test at the lower discharge pressures. We were not able to achieve any higher pump-discharge pressures on the attack engine while the boosting pumper was flowing at 125 psi.

We then attempted to perform a test at the hose's maximum working pressure rating of 185 psi, but

TEST SERIES 2

	Hydrant Static Pressure (no flow)	Hose Length	Inlet Pressure on Lead Apparatus	Engine Discharge Pressure	Tip Size/Pressure/Flow	2nd Engine Residual Pressure	Hydrant Residual Pressure
1	80 psi	950 feet	psi	psi	gpm	psi	psi
2	80 psi	950 feet	psi	100 psi	gpm	psi	psi
3	80 psi	950 feet	psi	125 psi	gpm	psi	psi
4	80 psi	950 feet	40 psi	150 psi	2"/80 psi/1063 gpm	*10 psi	55 psi
5	80 psi	950 feet	45 psi	175 psi	2"/98 psi/1176 gpm	**0 psi	45 psi
6	80 psi	950 feet	psi	200 psi	gpm	psi	psi
7	80 psi	950 feet	psi	225 psi	gpm	psi	psi

**Boosting pumper discharge pressure 125 psi **Boosting pumper discharge pressure 150 psi*

Using data provided by the manufacturer, testers calculated on a similar scenario with 4-inch LDH. The increase in flow would be between 50% and 60%, but the overall flows would be less, maximizing at around 900 gpm in this layout.

KEY POINTS TO CONSIDER WHEN DOING ANY TESTING OR EVALUATION

- Discuss and plan exactly what criteria are important and how the test will be conducted to capture those criteria.
- Create worksheets to record data easily.
- Consistency will yield the most accurate and usable results.
- •ake pictures or video to clarify later questions or to repeat layouts for further comparative testing.
- Review and discuss the test data.

maxed out the layout and hydrant at 150 psi discharge pressure on the boost engine.

The Results

We learned that adding a hydrant booster valve — which allows either our second engine or a mutual-aid engine to boost the pressure and flow from the hydrant—increased flow significantly, by 31%, without interrupting water flow to the initial attack pumper.

As with many volunteer fire departments, our typical staffing on the lead engine ranges from two to four firefighters, with the same for the second-due engine. A single firefighter can make the hydrant connection with the pre-connected valve on our supply line. With this layout, only one pump operator is needed at the boosting pumper, which allows the remaining crew to be assigned as needed. There are some negatives to committing a second engine to this task. One is that the second engine's crew is split up and equipment such as ladders, tools and lighting would be a distance away at the hydrant. Using any attack lines from the second engine may not be practical.

We have found this set-up to be very useful in our area's many long-lay situations, where the water source is a long distance from the point of attack. The supply line is laid with the hydrant assist/relay valve, while a second-due relay pumper lays in from the supply, such as a portable tank dump site. The relay pumper then boosts the supply line pressure in a similar manner as used on a hydrant. This takes an additional pumper in a portable tank operation, but yields improved results on supply hose lays greater than 1,000 feet.

Our testing resulted in higher water flows, which were achieved by adding just one appliance. We continue to train using the new hydrant-assist valve in various operations and are including our mutual-aid partners several times a year, so that everyone will be exposed to and understand the change in operations. We will be adding an aerial/quint to our operations in the near future, and these changes fit well into our long-range strategic plan to be able to supply adequate water flow. ■

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