Dual Pumping and Tandem Pumping

Dual Pumping and Tandem Pumping are two different water supply procedures used for two different purposes. The terms are commonly misused in the fire service. Even amongst various authors of published articles some will misuse the terms.

Dual pumping is two Engines using the same hydrant to take advantage of available water left in the hydrant after the 1^{st} Engine is flowing its capacity or desired flow.

Tandem Pumping is a two Engine relay used to overcome friction loss in elevation.

Dual Pumping

Purpose: To establish a procedure using two Engines to maximize available water left in a high flow hydrant after the 1^{st} Engine is flowing its capacity or desired flow.

Background: This procedure should be applied cautiously in areas with multiple hydrants in close proximity to each other. Water supply can often be expanded by simply positioning additional engines on other nearby hydrants.

This procedure could be implemented in an area where there are few hydrants or the secondary hydrants are too far from the scene to be used effectively. It may also be useful where railroad tracks or divided highways make laying hoselines impossible or impractical.

For this procedure to be effective there must be sufficient water flow from the hydrant. The first Engine operator needs to estimate the residual capacity available before attempting to set up for dual pumping.

Estimating Residual Hydrant Capacity

$$\frac{\text{Static} - \text{Residual}}{\text{Static}} \times 100 = \%\ \text{drop}$$

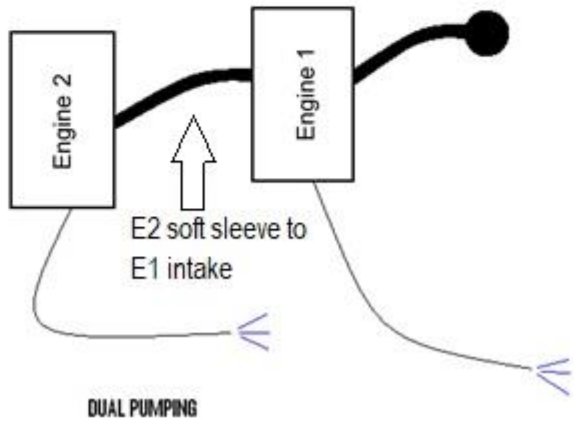
<10% drop: 2x water available
<25% drop: 1x water available
>25% drop: less than 1x water available

Procedures: There are several procedures to accomplish dual pumping. With a variety of manufacturers of pumps and Engine companies, procedures may vary depending on the configuration of the pump and the appliances that Engine has available to them.

<u>Procedure #1 for Engines Using Steamer Intakes – Sharing Water</u>

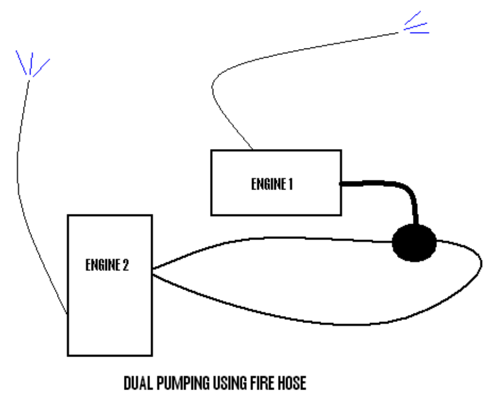
1. Engine 1 established own water supply from hydrant using heavy water hookup.
2. Engine 1 flows rated capacity or desired flow.

3. Engine 1 estimates remaining water left in hydrant. If additional capacity is available Engine 2 positions to align their soft sleeve to connect with Engine 1's unused large diameter intake.
4. Engine 1 must continuously monitor their intake pressure to verify adequate supply remains. Engine 1 opens MIV for the large diameter intake that will supply Engine 2. Engine 2 opens MIV for the soft sleeve. Engine 2 will begin to receive residual water supply through Engine 1's pump.



<u>Procedure # 2 for Engines Using Standard Intakes – Sharing the Hydrant</u>

1. Engine 1 establishes water supply from hydrant via soft sleeve only (no heavy water hookup) and places hydrant gate valves on the two 2½" outlets on the hydrant.
2. Engine 1 flows at or near capacity.
3. Engine 1 estimates remaining water left in hydrant. If additional capacity is available Engine 2 positions to connect to the same hydrant utilize the remaining outlets.
4. Engine 2 establishes a water supply via the two hydrant gate valves. Engine 1 must continuously monitor their intake pressure as Engine 2 slowly opens the hydrant gate valves one at a time to begin water supply.



Key Operational Considerations:

- The intake pressure for both engines is critical and must be monitored closely whenever flow from either pump is increased. The first and second engine operators must coordinate any increased flows to avoid cavitation of either pump.
- Dual pumping may be used in area with few hydrants or where hydrants are too far apart for practical use.
- Dual pumping may be used in areas where it would require Engines using secondary hydrants to cross rail road tracks or divided highways.
- Standard MCFRS hard sleeves are not rated for positive pressures and should not be used to connect to a hydrant under normal circumstances.

Tandem Pumping

Purpose: To provide a procedure to supply water to a standpipe system in upper floors in high rise buildings, when the fire pump is out of service, using a two Engine relay to overcome pressure losses due to elevation.

Background: Standpipe systems are designed to deliver 500gpm at 150psi from the riser outlets with an accepted elevation loss of 5psi per floor above the ground level. Without the assistance of the building fire pump the pressures required on upper floors may be too high for one Engine company to achieve and provide the required flow. The use of two Engines in series allows the 2nd Engine to take advantage of incoming pressures from the 1st Engine to supply the standpipe system.

For example, a fire on the 40th Floor of high rise building with fire pump out of service:

EL = 40 floors x 5psi per floor = 200psi in elevation loss

NP = 150psi at the riser outlet to supply 500gpm

FL = friction loss for supply hoses; assumed to be neglible here

AL = appliance loss = 0psi

PDP = EL + NP + FL + AL

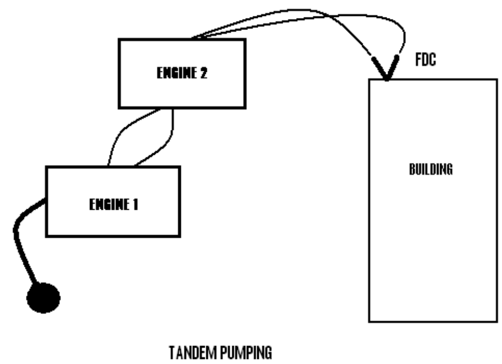
PDP = 200 + 150 + 0 + 0 = 350psi to the FDC

Using a single Engine to supply the FDC creates two problems:

- This pump discharge pressure is reaching dangerous levels for most hose as well as for the apparatus pump.
- The pump rating at this pressure is unknown, however less than 50% and may approach 20%.

Recall that centrifugal pumps are rated as follows:

150psi = 100% capacity of pump
200psi = 70% capacity of pump
250psi = 50% capacity of pump
350psi = ??? considerably less



Given the same scenario, using two engines in series makes adequately supplying the FDC more feasible. If Engine 1 is on a hydrant with 50psi intake pressure they can deliver 200psi to Engine 2 while maintaining a net pump discharge pressure of 150psi and 100% of their rated capacity.

Engine 2 now has 200psi to their intake and may pump 350psi to the FDC while maintaining a net pump discharge pressure of 150psi and 100% of their rated capacity.

To successfully achieve higher pressures and maintain volume, pump operators must understand Net Pump Pressure and how centrifugal pumps take advantage of incoming pressure.

NFPA 20, The Standard for the Installation of Centrifugal Fire Pumps, does not allow fire department connections (FDC) to be on the intake side of the building's fire pump. While there can be rare exceptions due to age or incorrect design, building fire suppression systems are supplemented by FDC connected to the discharge side of the building's fire pump. Plumbing the FDC to the intake side of the building's fire pump would then subject the supplemental water supply to the building's intake relief valve and defeat the additional pressure that fire department Engines could supply to the system. In other words, buildings with the FDC plumbed to the intake side of the fire pump do not allow the fire department to control the pressures in the standpipe system in the building. Further be aware that attempting to circumvent the fire pump or intake relief valve by connecting supply lines to a standpipe discharge may not be successful due to pressure limiting devices built into the standpipe valves. It is important to pre-plan buildings that may be large enough to require the higher pressures of tandem pumping.

Operations:

1. Engine 1 establishes water supply from a hydrant using heavy water hookup.
2. Engine 2 positions within 100 feet of Engine 1 and the FDC.
3. Engine 2 may either blind cap the intake relief valve discharge or adjust the intake relief valve to a higher pressure. The adjustment of the relief valve in the field is inexact and requires access behind the pump panel and a wrench. The intake relief valve is pre-set at 125psi and has a range of 75 to 250psi on most MCFRS pumps. If given a choice, adjusting the relief setting is safer than blind capping the relief valve discharge.
4. Engine 2 closes auxiliary coolers, circulating lines, tank fill lines, tank-to-pump valves, and discharge relief valves so that high pressures do not cause damage.
5. Engine 1 supplies available flow and pressure to Engine 2.
6. Engine 2, leveraging the intake pressure from Engine 1, supplies the FDC utilizing discharges that are remote from the pump panel. All valves must be opened and closed slowly to avoid damage to the pump or rupture of hoselines.

Key Operational Considerations:

- Hose lines at pump panels must be tied off near couplings like in hose testing. Keep people clear of hose and connection. Discharges opposite the pump operator's panel should be used to supply the standpipe connections so the pump operator is not exposed to the hoselines. Pressures are at the highest here in this short relay.
- If using LDH, ensure it is designed as "attack" hose and with service pressure rating of 400psi. Regardless, the pressure of a tandem pumping operation will approach the limits of the design of the hose.
- Shut down at water supply first to prevent water hammer.
- Close auxiliary coolers, circulating lines, tank fill lines, tank-to-pump valves, and discharge relief valves so that high pressures do not cause damage.
- Consider marking hose at couplings with a magic marker that is used to supply standpipe FDC. Check after tandem pumping to see if it moves more than ⅛ inch after exposed to high pressures. If so remove from service.
- One of Montgomery County's tallest buildings is Washingtonian Towers, 26 stories.