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 1st 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 1st 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.

<table>
<thead>
<tr>
<th>Estimating Residual Hydrant Capacity</th>
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<tbody>
<tr>
<td>Static – Residual x 100 = % drop</td>
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<tr>
<td>Static</td>
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<tr>
<td>&lt;10% drop: 2x water available</td>
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<tr>
<td>&lt;25% drop: 1x water available</td>
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<tr>
<td>&gt;25% drop: less than 1x water available</td>
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**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.

**Procedure #1 for Engines Using Steamer Intakes**

1. Engine 1 established own water supply from hydrant via soft/hard sleeve.
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 intake with Engine 1’s unused intake for a supply from the same hydrant.

4. Engine 1 closes hydrant until their intake pressure is at or near 0 psi (< 5psi).

5. Both Engines remove main intake blind caps quickly and join the two Engines at the main intakes via hard sleeve. With intake pressure at or below 0psi, the Engine 1 steamer cap may be hard to remove due to negative pressure. Once the cap is removed it would suck in air affecting hose streams, therefore it is important to maintain an intake pressure above 0 psi. When the cap is removed some water will come out the intake. Note: Intake gauges are not a perfect indicator of residual pressure after the hydrant is gated back.

6. Engine 1 opens hydrant completely and the 2nd Engine will receive the remaining water left in the hydrant or desired flow.

Procedure # 2 for Engines Using Standard Intakes

1. Engine 1 established own water supply from hydrant via soft sleeve and place hydrant gate valves on the two 2½” outlets on the hydrant.

2. Engine 1 pumps 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.

4. Engine 2 establishes a water supply via the two hydrant gate valves. Open hydrant gate valves one at a time while Engine 1 monitors their intake pressure.

5. Engine 2 will flow remaining water left in the hydrant or the required flow. If Engine 1 experiences a significant drop in intake pressure the dual pumping operation may need to be limited or discontinued.

Key Operational Considerations:

- 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.
o Some hard sleeves are not rated for positive pressures.

o Ensure the proper adapters are available to make connections with hard sleeves.

o Consider using two hard sleeves instead of one to allow more flexibility in positioning.

**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 friction losses in 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 a 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 negligible 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 pumps 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. Most buildings are supplied through the discharge side of the building’s fire pump. The reason is that if Engines supply water through the intake side of the building’s centrifugal fire pump, the pumps intake relief valve will open and dump the excessive pressure of water above 125psi, typically. In this instance the fire department cannot control the pressures in the standpipe system in the building. There are a few buildings constructed with FDC supplying the system to the intake side of the building’s fire pump. Consider pumping into the 1st floor globe valve to bypass the building’s fire pump. Know your buildings for tandem pumping.

**Operations:**
1. Engine 1 establishes water supply from a hydrant using heavy water hookup. If Engine 1 has a two-stage pump, then it should be used in “volume” mode.
2. Engine 2 positions within 100 feet of Engine 1 and the FDC. If Engine 2 has a two-stage pump, then it should be used in “pressure” mode.
3. Engine 2 blind caps the intake relief valve, which are usually set at 125 or 150psi. Some Engines have adjustable intake relief valves. If given a choice, adjusting would be safer than blind capping the intake valve.
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 required 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 tested to 400psi.
- 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.
- FYI - One of Montgomery County’s tallest buildings is Washingtonian Towers, 26 stories.