DRILL OF THE MONTH

INSTRUCTOR GUIDE

Title: Static Water Sources and Drafting

Time Required: 2-3 Hours

References:
MFRI Pumping Apparatus Instructors Guide, Lessons6-1 & 11-1.

Teaching/Learning Materials:

- A minimum of one pumpers with drafting equipment (more units as appropriate)
- A static water source with a 5-10 foot lift if possible
  Optional:
  - A deck gun with a smooth bore tip
  - 200 feet of 2½" or 3" hose
  - A pitot gauge

Enabling Objectives (EOs):

EO 1 Explain Lift and Drafting Principles
EO 2 Define Static Water Sources and identify same in the 1st due
EO 3 Identify and explain the function of all pump panel instrumentation including all gauges, valves and accessories.
EO 4 Draft from a static water supply
EO 5 Flow a master stream device from Draft and measure GPM Flow (optional)

Motivation: The Drive Operator of a Fire Department Pumper will occasionally be called on to draft from a static water source. The ability to establish a draft and provide an uninterrupted supply of water to the fire ground will directly impact the outcome of the incident. This evolution is not something we do very often and can be a challenge under ideal conditions. It is important that driver operators remain competent to draft. It is also important to know the equipment is in proper condition to accomplish this task. The location and usability of Static Water sources need to be identified ahead of time.

Student Performance Objective:
Given a suitable training area, an emergency vehicle equipped with a pump and a static water source the student will be able to supply water from draft.

Overview

Principles of Drafting (Lift)
Natural Static Water Sources
Artificial Static Water Sources
Pump Panel Instrumentation
Drafting Operations

I. Principles of Lift

A. Principles of Lift

1. Lift is the difference in elevation between the surface of the static water supply and the center of the pump intake.

2. During process of drafting, priming device exhausts air from the intake hose and fire pump creating a pressure difference between inside of the pump, intake hose, and atmosphere.

a. Pressure in intake hose and pump drops lower than atmospheric pressure.

b. Results in water being forced into hose and pump because of partial vacuum created in the pump. A total vacuum is impossible to create using fire service equipment.

c. Because pressure outside the intake hose is higher than pressure in the hose, water is forced in and continues to rise until pump is full of water or pressure within the pump and intake hose equals atmospheric pressure. If water does not rise to level of the pump intake, drafting will not be possible.

B. Theoretical Lift

1. If a fire department pumper were capable of creating a total vacuum, water could be raised by atmospheric pressure to a height in accordance with that pressure.
   a. Generally speaking this would be 33.9 feet.
   b. Pumpers cannot be expected to draft water that is located 33.9 feet below the level of the pump because a total vacuum is unattainable

C. Maximum Lift

1. Greatest height to which any amount of water may be raised through an intake hose to the pump.
2. Variables affecting maximum lift include
   a. Atmospheric pressure
   b. Condition of fire pump and primer
   c. Intake hose, gaskets, and all valves.
3. Condition and strength of motor driving fire pump may affect ability to achieve maximum lift and delivery of required amount of water. This is normally not a problem with modern fire apparatus.
4. In most circumstances, maximum lift is approximately 25 feet. As point of maximum lift is approached, all available atmospheric pressure is used to overcome gravity pressure affecting the lift. As a result, volume of water available for fire pump may be too low to be of value in fire suppression

D. Dependable lift

1. The height a column of water may be lifted in sufficient quantity to provide a reliable fire flow.
2. Driver/operator should have an understanding of the theoretical and maximum lift but is generally more concerned with the concept of dependable lift.

3. After factoring in surrounding atmospheric pressure and friction loss in intake hose, every fire pump operating properly should have a dependable lift of at least 14.7 feet
4. Fire department pumping apparatus are rated when drafting with a minimum lift of 10 feetfrom the center of a pump intake to the surface of water through 20 feet of hard intake hose.
5. Strainer submerged at least 2 feet in water at least 4 feet deep is ideal.
6. Pump may only deliver about 70 percent of the pump's capacity if lift is increased by 5 feet to a 15-foot lift, and 60 percent at a 20 foot lift.

II. Natural Static Water Sources

SAFETY NOTE: *Firefighters working near water's edge, regardless of the assumed depth, must wear personal flotation devices and use safety lines.*

A. Natural static water supply sources include
    1. Lakes
    2. Ponds
    3. Streams
    4. Rivers
    5. Bays and Oceans
B. Through pre-incident planning, you should become familiar with all potential drafting sources within your jurisdiction and surrounding jurisdictions.
C. Accessibility of Natural Static Water Supply Sources
    a. Driver/operators must evaluate conditions that affect water source accessibility
        i. Inability to position pumper close enough to the water
        ii. Wet/soft ground approaches
        iii. Inadequate depth of water source
            1. 2 feet of water all around a barrel-type strainer is generally considered minimum.
            2. Floating strainers may be used for water as shallow as 1 foot.
            3. A ladder and salvage cover may be used to create a dam to raise the water level in a small stream.

III. Dry Hydrants as Water Sources

A. Although they may restrict the volume of water that can be drafted, dry hydrant allows for more efficient access to a natural supply source through a pre-piped installation.
B. When properly installed and maintained, approaches to the site will be safer and problems with debris minimized

IV. Freezing weather

A. Consider that Natural Water Sources may freeze, slowing and complicating access.
B. Access should be considered and pre-planning done to address it.

V. Swift water

A. Drafting operation using swiftly flowing water can be difficult and dangerous.

B. Strong currents often make it difficult to keep strainer submerged.

VI. Manmade Static Water Sources
   A. Cisterns/Underground Draft Tanks
      1. Underground water storage receptacle found in none hydrant areas
      2. Typically receive water from a well or rain water runoff.
      3. Cisterns typically range from 10,000 to 100,000 gallons.
      4. Accessed by removing a utility cover that allows drafting.
      5. Cisterns may feature a dry hydrant that allows more rapid drafting ops.
   B. Private Water Storage Tanks
      1. Large residential, industrial, or agricultural locations may feature private water storage tanks.
      2. Tanks may range in size from several hundred to tens of thousands of gallons of water.
   C. Swimming Pools
      1. May provide a ready source of water for drafting operations
      2. Access to some pools may be difficult
      3. Fire departments should pre-plan operations for swimming pools.
      4. A typical residential swimming pool may contain adequate water supply for a fire in a single family dwelling.
   D. Agricultural Irrigation System
      1. May flow in excess of 1,000 GPM and may function as a potential water source for fire protection.
      2. Generally supply water via open canals and portable pipes.

VII. Drafting Practical
   A. Identify a suitable Static Water Source
      1. Inspect site and make provisions necessary to insure the safety of students.
   B. Position pumper(s)
   C. Assemble hose and strainers.
      1. Connect the sections of intake hose.
      2. Align each section of hose before turning it.
      3. Hand tighten connections.
      4. Use a rubber mallet as necessary to make connections airtight.
      5. Connect the strainer to the end of the intake hose.
      6. Tie the guide rope to the strainer securely.
   D. Connect intake hose to apparatus, ensuring all connections are tight.
   E. Place the intake hose and strainer into the water slowly to avoid stirring up the sediment and dirt in the water.
   F. Close all valves and tighten all caps to minimize air leaks (including intake relief valves).
   G. Place pump in gear.
   H. Operate primer until water flow is established (operate no longer than manufacturer recommendations).
      1. If prime is not established in manufacture's recommended prime time, recheck connections and all valves and caps for leaks.

2. After waiting manufacturer's recommended time between priming attempts, operate primer again.

VIII. Flowing a Master Stream (Optional depending on time)

A. Set up Deck Gun
   1. Secure the device
   2. Connect hose lines to device and pumper
   3. Install stack tips and select proper size for GPM desired.
B. Slowly charge hose lines while monitoring the Deck Gun
C. Set the pump pressure for the desired flow.
D. Check the nozzle discharge pressure utilizing the pitot gauge

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