

Pumps Refresher - Relay Operations

Instructor Guide

Session Reference: 1

Level of Instruction:

Time Required: 3 Hours

Materials:

- Three Fully Equipped Pumpers
- Portable Master Stream Device
- Pitot Gauge

References:

- Pump Operator Student Manual, Maryland Fire & Rescue Institute

PREPARATION:

Motivation:

Objective (SPO): 1-1

The student will demonstrate an understanding of the pump operator's responsibilities while operating in a relay situation and provide an adequate flow and intake pressure to the next pumper during practical evolutions, to the satisfaction of the instructor.

Overview:

Relay Operations Practical

- Designing a Relay
- Knowledge of apparatus & hose capacities
- Fireground hydraulics
- Relay Operating Practices

Session 1

Relay Operations Practical

- SPO 1-1 The student will demonstrate an understanding of the pump operator's responsibilities while operating in a relay situation and provide an adequate flow and intake pressure to the next pumper during practical evolutions, to the satisfaction of the instructor.
- EO 1-1 Identify what information is required to design a relay
- EO 1-2 Demonstrate an understanding of apparatus pump capacities and the flow capacities of various size hose lines.
- EO 1-3 Demonstrate an understanding of basic fireground hydraulics.
- EO 1-4 Describe the basic operating principles for a relay operation.

I. Designing a Relay (1-1)

- A. Based on the amount of water needed
 - 1. Relay capability will determine fire ground flow
 - 2. Estimate total number of attack lines that may be required as the fire progresses.
 - 3. Size of supply line equals number of attack lines
- B. Amount and size of supply hose available
- C. Number of pumpers available and their rated capacity

II. Capacity of Apparatus Pumps & Supply Hose (1-2)

- A. Rated capacity of pumpers
 - 1. 750 gpm ---- 2000 gpm
 - 2. Largest pump should be at water source
 - 3. Ability of apparatus to lay dual supply lines (split hosebed)
- B. Rated capacity of various size supply hose (Based on 1000' hose)
 - 1. 2 1/2" = 250 gpm
 - 2. 3" = 400 gpm
 - 3. 4" = 750 gpm
 - 4. 5" = 1500 gpm

III. Fireground Hydraulics (1-3)

- A. Relay Losses
 - 1. Friction Loss Factors
FL = $Q \times Q$ for 100' of 3" hose
(Q = GPM / 100)
 - a. Quantity of water flowing (GPM)
 - b. Hose size
 - c. Length of hose line

2. Head pressure due to elevation
 - a. Add 5 psi for each 10' of plus elevation
 - b. Deduct 5 psi for each 10' of minus elevation

B. Net Pump Pressure

1. The difference between intake pressure and the discharge pressure of the pump (A measure of how much work the pump is doing).
2. Maximum net pump pressure that a pumper operating at its rated capacity can supply is 150 psi. If more than 150 psi is required, the capacity of the pump will be reduced. (200 psi = 70% of pump capacity).

C. Fire Ground Rules of Thumb

1. Intake pressure — Ideal is 50 psi at pump intake. (Could vary from 20 psi to 100 psi)
2. Maximum working pressure for 2 1/2" & 3" hose is 200 psi. (Hose test pressure is 250 psi)
3. Maximum working pressure for 4" & 5" hose is 150 psi (Hose test pressure is 200 psi)
4. Maximum distance between pumpers – 1000'
5. Always start out at 150 psi pump pressure - you can always adjust up or down!

D. Fire Ground Hydraulics Problems

1. Have students practice figuring friction loss in 3" , 4" & 5" hose.
2. Have students calculate friction loss for dual supply lines.
3. Use various examples of gpm flow to show limitations of hose.

E. Operating Principles for a Relay

1. Position pumper in a safe location
2. Connect hoselines to intake and discharge of pumper.
3. Engage pump

4. Put pump transmission in proper gear.
5. Set transfer valve to volume if using a two stage pump
6. Set throttle to desired pump pressure when water is received. May have to bleed air from supply line.
7. Adjust pump pressure to give next pumper 50 psi intake pressure.
8. Set relief valve or governor
9. To shut down relay, reverse procedures. Always shut down at attack pumper first.

IV. Practical Evolutions (1-4)

- A. Utilizing three pumpers, set up a relay evolution using various sizes and lengths of supply hose between apparatus.
 1. Water source can be a hydrant or draft source.
 2. Utilize a portable master stream device for the fire ground flow. Check nozzle pressure with Pitot gauge to maintain desired flow.
- B. Rotate the apparatus so students can practice operating as source pumper, relay pumper, and attack pumper.

SUMMARY:

Review:

Relay Operations Practical

- Designing A Relay
- Apparatus & Hose Capacity
- Fire Ground Hydraulics
- Relay Operating Practices

Remotivation:

Assignment:

EVALUATION