

SECTION 24 PUMP OPERATIONS/HYDRAULICS

The Certification Board suggest it will take a class of 40 individuals 24 hours to cover the following objectives in this section (actual time may vary based on class size).

BASIC

- 24-01.01 Trainee shall identify the operating principles of single stage and multi-stage centrifugal fire pumps as follows:
- A. Trainee shall list the percentages of rated capacity rated pressures and capacity in gallons per minute at the rated pressures of a fire department pump.
 - B. Trainee, given a pump model/diagram, shall identify the main components indicating pump capacity, number of discharges and number of suction inlets.
 - C. Trainee shall explain the difference between series/parallel operations of centrifugal fire pumps.
 - D. Trainee, given the proper information, shall list three (3) advantages of a centrifugal fire pump as compared to other types of fire pumps (i.e. positive displacement, rotary vane).
- 24-01.02 Trainee shall demonstrate the use of mathematical calculations as required to solve fire department pumper hydraulic problems as follows:
- A. Trainee shall list the mathematical orders of operation concerning addition, subtraction, multiplication, and division.
 - B. Trainee shall solve mathematical problems finding the square root, and decimal/fraction conversions.
 - C. Trainee shall list formulas used in finding GPM rates, friction loss of fire hose, engine pressure for hose layouts of nozzles, standpipe/sprinkler, master streams, and elevation operations.
 - D. Trainee, given the proper information, shall list conversion factors of fire hose that are smaller/larger than 2½ inches.
 - E. Trainee shall calculate the correct engine pressures for a specific situation.
- 24-01.03 Trainee shall set up and perform pumping operations as follows:
- A. Trainee shall list conditions that may result in pump damage.
 - B. Trainee, given a pump model or diagram, shall demonstrate the proper test/check inspection routines required to assure operational readiness.
 - C. Trainee, given a pump panel or diagram, shall identify all gauges and valves, and demonstrate their usage.
 - D. Trainee, given a pump panel or diagram, shall identify the proper usage of valves and gauges to obtain a flow of water from the following:
 1. a 1 inch (booster line) discharge outlet
 2. a 1½ or 1¾ inch discharge outlet
 3. a 2½ inch discharge outlet
 4. master stream discharge outlet (if applicable)
 - E. Trainee, given a pump panel or diagram, shall demonstrate the proper technique of hooking up or connecting intake hoses to the pumps.
 - F. Trainee, given an engine apparatus or diagram, shall demonstrate/list the engagement procedure of the PTO (power take-off) systems for the pumping apparatus.
 - G. Trainee, given a pump panel or diagram, shall demonstrate the proper procedure of valve manipulation to produce water from:
 1. a positive water source
 2. a static water source by drafting
 3. booster tank

INTERMEDIATE

- 24-02.01 Trainee shall identify the type, design, operation, nozzle pressure and flow in GPM of various types of nozzles.
- 24-02.02 Trainee shall list the different types of fire streams.
- 24-02.03 Trainee, given a 2½ inch straight stream nozzle, shall demonstrate the proper opening and closing techniques and line movement procedures.
- 24-02.04 Trainee shall calculate nozzle reaction for various nozzle pressures.
- 24-02.05 Trainee, given the proper information, shall list advantages and disadvantages of various nozzles:
 - A. straight stream
 - B. fog
 - C. master stream
- 24-02.06 Trainee shall define water hammer and list ways of preventing water hammer.
- 24-02.07 Trainee shall calculate the water flow rate needed to control fire in a room that is 20'x20'x 8'.
- 24-02.08 Trainee, given a diagram of various nozzles, shall list major parts and trace flow routes through each.
- 24-02.09 Trainee shall list factors that influence fire streams.
- 24-02.10 Trainee shall list the proper procedures for inspection and maintenance of fire fighting nozzles.
- 24-02.11 Trainee shall demonstrate the operations of the pumper pressure relief system and/or pressure control valve as follows:
 - A. Trainee, given a pump panel, shall identify a pressure relief system.
 - B. Trainee shall list the reasons a pressure relief system is used.
 - C. Trainee shall list the different types of pressure relief systems used in the fire service.
 - D. Trainee shall list three (3) reasons of how excessive pressure develops in fire hose.

ADVANCED

- 24-03.01 Trainee shall identify terms relating to the principles of fire service hydraulics as follows:
 - A. Trainee shall list the forms water takes and advantages water exhibits as an extinguishing agent.
 - B. Trainee shall list six (6) types of pressure, which affect the properties of water in fire service hydraulics.
 - C. Trainee, given a pump diagram and flow chart, shall explain the theory of drafting and principle component uses in a drafting operation.
 - D. Trainee shall calculate the available water supply from a fire hydrant.
 - E. Trainee shall demonstrate assembly and connection of the equipment necessary for drafting from a static water supply source and demonstrate drafting operations.