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Pumping Apparatus DRIVER/OPERATOR Handbook
NFPA 1901, Reference Material:
F-2 Design & Performance Standards of Fire Apparatus

LEARNING OBJECTIVES FOR THE F-2 EXAM

1. Definitions: The technician shall define the terms and phrases commonly used in connection with fire apparatus to include the following:
   a. Acceptance tests
do. Drafting operation
   b. Angle of approach
   c. Angle of departure
   d. Authority having jurisdiction
   e. Automatic electrical load management
   f. Auxiliary braking system
g. Bonding
   h. Cascade system
   i. Cavitation
   j. Certification test
   k. Combination fire apparatus
   l. Compound gauge
   m. Continuous electrical load
   n. Contractor
   o. Drafting operation
   p. Eductor
   q. Fire apparatus
   r. Fire pump
   s. FMVSS
   t. Grade
   u. Gross axle weight (GAWR)
v. Gross combination weight (GCWR)
w. Gross vehicle weight rating (GVWR)
x. Ground clearance
   y. Hard suction (intake) hose
   z. Initial attack fire apparatus
   aa. Intake relief valve
   bb. Interlock
   cc. Line voltage circuits
   dd. Lugging

2. General The Technician shall understand the design & performance requirements for Aerial, Pumper, and Initial Attack Fire Apparatus such as:
   a. General Design requirements
   (1) Responsibility
      (a) Contractor Responsibility
      (b) Purchaser Responsibility
   (2) Controls & Instructions
   (3) Mounting height of gauges
   (4) Vehicle Data Recorder
      (a) Storage capacity
      (b) data recorded
   (5) Vehicle Stability
      (a) Center of Gravity
      (b) Control System sensor
      (c) Side to side load variation
      (d) Load Distribution
   (6) Roadability
      (a) performance loaded
      (b) top speed
   (7) Serviceability
      (a) routine maintenance
      (b) special tool requirement
   (8) Road Tests
      (a) Stopping Distance
      (b) Signage for occupants in Motion
      (c) Angle of Approach and Departure
      (d) Angle of Departure
      (e) Axle housing road clearance
      (f) Angle of Approach and Departure
      (g) Bearing Systems
         (a) braking systems
         (b) electric fuel priming systems operation
         (c) diesel particulate filter
      (h) HEST icon for regen
   (4) Vehicle Components
      (a) Braking Systems
      (i) pressure protection valve .pressure drop
      (ii) quick build-up time
      (iii) parking brake inter-locks
      (b) Parking Brakes
      (i) GVWR & auxiliary braking system
      (ii) parking brake-20% grade requirement
      (c) Suspension & Wheels
      (i) Axle housing road clearance
      (ii) Angle of Approach and Departure
      (d) Steering
      (i) radius of axes
      (ii) power steering provision
      (e) Fuel Tank
      (i) labeling
      (ii) capacity and time
      (iii) maintenance
      (f) Midship Location
      (g) Upper-level Location
      (h) Lower-Level Location
      (i) split shaft PTO
      (j) ESS icon for regen
      (k) split shaft PTO
      (l) split shaft PTO
   (5) Exhaust
   (6) Diesel particulate filter
   d. Low Voltage Systems
   (1) Voltage Drops
   (2) Minimum Continuous Electrical Load
      (a) alarm monitoring
   (3) Batteries
      (a) reserve capacity
      (b) Who sets Minimum CCA
      (c) alternator wiring through ammeter shunts
      (d) Voltage Drops
         (a) Flash Rate
         (b) Permissible/Non Permissible Colors
         (c) Upper-level Location
         (d) Lower-Level Location
         (e) Midship Location
         (f) conform with SAE J845 criteria
   (5) Audible Warning Equipment
      (a) Back Up Alarm dBa
      (b) Stop, Tail, & Directional Light mounting
      (c) Low Voltage Alarm after voltage drop
   e. Driver and Crew area
      (1) Seat belt color
      (2) Signage for occupants in Motion
      (3) Seat belt warning activation
      (4) Noise levels
      (5) Equipment & SCBA Mounting requirements
      (6) # of Means of escape and size
      (7) Cab tilt systems and parking brake
      (8) Driving Compartment seating capacity
      (9) Instrumentation and Controls visible to driver

Reference Material:
NFPA 1901, Standard for Automotive Fire Apparatus, Chapters 1-26 www.nfpa.org or call (800) 344-3555
Pumping Apparatus DRIVER/OPERATOR Handbook, 3rd edition. International Fire Service Training Association (IFSTA) Chapters 2,9,10, Glossary
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f. Body, Compartments & Equipment Mounting
   (1) Powered Equipment Racks
      (a) locking requirements
   (2) SCBA cylinder mounting
   (3) Pump Plumbing Access size
   (4) Stepping, Walking Surface minimum load
   (5) Access Handrails size and clearance
   (6) Reflective Striping coverage and size
   (7) External Compartment Ventilation
   (8) Receivers and anchors for tope and removable winches

g. Fire Pumps and Associated Equipment
   (1) Pumps < 1500 gpm suction discharge time
   (2) Pumping Engine drain for heat exchanger
      (a) Heat exchanger
   (3) Intake Strainers requirements
      (a) minimum valve & piping size
      (b) bleeder valve minimum size
      (c) pressure relief for >3” valve
   (4) Pump discharge Outlets
      (a) minimum # outlets
      (b) Connections size
      (c) Slow Operation Valve size
      (d) Location
   (5) Pump Drains access
   (6) Pump Controls
      (a) Engine brake disengagement
      (b) Speedometer operation during pump
   (7) Pressure Control System
      (a) rise in water pressure
   (8) Pump Operator Panel
      (a) required Instrumentation
      (b) Minimum Numeral Size Master Gauges
      (c) Test Gauges
         (i) Discharge pressure gauge range
   h. Auxiliary Pumps & Associated Equipment
      (1) Pump Drive Systems
         (a) Pump Engine Running Light
      (2) Engine Control
         (a) Throttle control location
   i. Water Tanks
      (1) baffles and swash partitions
         (a) distance between walls and/or baffles
         (b) partition arrangement
      (2) Tank-to-Pump rate
         (a) <500 gal (2000L)
         (b) >500 gal (2000L)
      (3) Tank Fill Line
         (a) <1000 gal (400L)
         (b) > 1000 gal (400L)

3. Test requirements: The Technician shall understand the test and delivery data requirements for a Pumper Fire Apparatus
a. Fire Pumps and Associated Equipment
   (1) Pumping System Capacity
      (a) Pumps 3000 gpm or less
         (i) 100% rated capacity at 150 psi
         (b) Pumps < 1500 gpm
            (i) suction hose length and lift for 1250 gpm
      (2) Vacuum loss %
   b. Construction Requirements
      (1) Hydrostatic Test gauge pressure & time
      (2) Test Points
   c. Discharge Outlet Connections
      (1) Hydrostatic gauge pressure reading
   d. Required Testing
      (1) Apparatus Pump System Certification
         (a) > 750 gpm
         (b) Third Party Certification
      (2) Pump Test Conditions for Test
         (a) depth of water
         (b) Water temperature
         (c) engine-driven accessories
      (3) Test Gauges for certification test
         (a) calibration time requirement
      (4) Engine Speed Check
         (a) % change allowed of Manufacturer no-load governed speed
      (5) Pumps rated at 750 gpm or greater but <3000 gpm
         (a) total time of pump test
         (b) time & % at rated capacity of 150psi
         (c) time & % at rated capacity of 200 psi
         (d) time & % at rated capacity of 250 psi
   e. Pumping Engine Overload Test
      (1) Pump Rated Capacity of 750 or greater but <3000
         (a) test for net pump pressure at 165 psi for 10 min
   f. Pressure Control System Test
      (1) Pumps rated at 3000 gpm or less
         (a) gauge pressure of 150 psi
         (b) gauge pressure at 90 psi
         (c) gauge pressure at 250 psi
         (d) time allowance to prime pump
         (e) additional time for 4+” intake pipe
   g. Vacuum Test
      (1) vacuum
      (2) vacuum drop
   h. Volume Discharge Calculation
      (1) Rated Tank-to-flow till what % of discharge
   i. Gauge and Flowmeter Test
      (1) Test capacity
      (2) re-calibration requirement
   j. Manufacturer’s Pre-delivery Test
      (1) Hydrostatic test requirements