

**Reference Material:**

**NFPA 1900:** Standard for Aircraft Rescue and Firefighting Vehicles, Automotive Fire Apparatus, Wildland Fire Apparatus, and Automotive Ambulances (**NFPA 1901 Chapters**) 2024 edition [www.nfpa.org](http://www.nfpa.org) or call (800) 344-3555  
**Pumping Apparatus DRIVER/OPERATOR Handbook**, 3<sup>rd</sup> edition. International Fire Service Training Association (IFSTA) Chapters 2,9,10, Glossary  
 To order, call (800) 654-4055 or [www.ifsta.org](http://www.ifsta.org)

**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:
 

<ol style="list-style-type: none"> <li>a. Acceptance/ acceptance tests</li> <li>b. Angle of approach</li> <li>c. Angle of departure</li> <li>d. Authority having jurisdiction</li> <li>e. Automatic electrical load management</li> <li>f. Auxiliary braking system</li> <li>g. Bonding</li> <li>h. Cascade system</li> <li>i. Cavitation</li> <li>j. Certification test</li> <li>k. Combination fire apparatus</li> <li>l. Compound gauge</li> <li>m. Continuous electrical load               <ol style="list-style-type: none"> <li>(1) Minimum</li> <li>(2) Total</li> </ol> </li> <li>n. Contractor</li> </ol>	<ol style="list-style-type: none"> <li>o. Drafting operation</li> <li>p. Eductor</li> <li>q. Fire apparatus</li> <li>r. Fire pump</li> <li>s. FMVSS</li> <li>t. Grade</li> <li>u. Gross axle weight (GAWR)</li> <li>v. Gross combination weight (GCWR)</li> <li>w. Gross vehicle weight rating (GVWR)</li> <li>x. Ground clearance</li> <li>y. Hard suction (intake) hose</li> <li>z. Initial attack fire apparatus</li> <li>aa. Intake relief valve</li> <li>bb. Interlock</li> <li>cc. Line voltage circuits</li> <li>dd. Manufacture's tests</li> </ol>	<ol style="list-style-type: none"> <li>ee. Net pump discharge pressure</li> <li>ff. Override</li> <li>gg. Pre-service test</li> <li>hh. Pressure governor</li> <li>ii. Pressure relief device</li> <li>jj. Pump and roll</li> <li>kk. Pumper</li> <li>ll. Ramp breakover angle</li> <li>mm. Relay pumping</li> <li>nn. Responsibility of purchaser</li> <li>oo. Shall</li> <li>pp. Slow operating valve</li> <li>qq. Split shaft PTO</li> <li>rr. Static water source</li> <li>ss. Vehicle carrying capacity</li> </ol>
		<ol style="list-style-type: none"> <li>tt. Anti-Electrocution platform</li> <li>uu. Curb Weight</li> <li>vv. Diesel Particulate Filter (DPF)</li> <li>ww. Hydrodynamic</li> <li>xx. Hydrostatic</li> <li>yy. Load management</li> <li>zz. Pump discharge classification</li> <li>aaa. Optical Source</li> </ol>
  
2. **General:** The Technician shall understand the design & performance requirements for Aerial, Pumper, and Initial Attack Fire Apparatus such as:
 

<ol style="list-style-type: none"> <li>a. <b>General Design requirements</b> <ol style="list-style-type: none"> <li>(1) Responsibility               <ol style="list-style-type: none"> <li>(a) Contractor Responsibility</li> <li>(b) Purchaser Responsibility</li> </ol> </li> <li>(2) Controls &amp; Instructions</li> <li>(3) Mounting height of gauges</li> <li>(4) Vehicle Data Recorder               <ol style="list-style-type: none"> <li>(a) Storage capacity</li> <li>(b) data recorded</li> </ol> </li> <li>(5) Vehicle Stability               <ol style="list-style-type: none"> <li>(a) Center of Gravity</li> <li>(b) Control System sensor</li> <li>(c) Side to side load variation</li> <li>(d) Load Distribution</li> </ol> </li> <li>(6) Roadability               <ol style="list-style-type: none"> <li>(a) performance loaded</li> <li>(b) top speed</li> </ol> </li> <li>(7) Serviceability               <ol style="list-style-type: none"> <li>(a) routine maintenance</li> <li>(b) special tool requirement</li> </ol> </li> <li>(8) Road Tests               <ol style="list-style-type: none"> <li>(a) Stopping Distance</li> </ol> </li> <li>(9) Load distribution               <ol style="list-style-type: none"> <li>(a) tire pressure</li> </ol> </li> </ol> </li> <li>b. <b>Apparatus</b> <ol style="list-style-type: none"> <li>(1) Pumper               <ol style="list-style-type: none"> <li>(a) Minimum rated capacity</li> <li>(b) Misc Equipment                   <ol style="list-style-type: none"> <li>(i) number of traffic vests</li> <li>(ii) AED</li> </ol> </li> </ol> </li> <li>(2) Initial Attack Fire Apparatus               <ol style="list-style-type: none"> <li>(a) Pump Minimum rated capacity</li> <li>(b) Water Tank minimum rated cap.</li> </ol> </li> <li>(3) Mobile Water Supply Fire Apparatus               <ol style="list-style-type: none"> <li>(a) Water Tank/Rated Flow Min. cap.</li> <li>(b) Tank fill rate</li> </ol> </li> <li>(4) Quint Fire Apparatus               <ol style="list-style-type: none"> <li>(a) Minimum Tank Capacity</li> <li>(b) Minimum ladders and sizes</li> </ol> </li> <li>(5) Special Service Fire Apparatus               <ol style="list-style-type: none"> <li>(a) Ground Ladder NFPA 1931 requirements</li> <li>(b) Minimum size of suction and supply hoses</li> <li>(c) Suction strainer</li> </ol> </li> <li>(6) Mobile Foam Fire Apparatus               <ol style="list-style-type: none"> <li>(a) Min. rated capacity for fire pump</li> </ol> </li> </ol> </li> <li>c. <b>Chassis and Vehicle Components</b> <ol style="list-style-type: none"> <li>(1) Labeling for size and GVWR</li> <li>(2) Engine               <ol style="list-style-type: none"> <li>(a) Cooling System</li> </ol> </li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>(b) Air intake system               <ol style="list-style-type: none"> <li>(i) separate water and embers</li> </ol> </li> <li>(c) Engine Shutdowns               <ol style="list-style-type: none"> <li>(d) Engine Derate</li> <li>(e) Hour meter</li> <li>(f) Tow hooks</li> </ol> </li> <li>(3) Fuel Systems               <ol style="list-style-type: none"> <li>(a) Diesel Engines                   <ol style="list-style-type: none"> <li>(i) Fuel supply lines and fuel filters</li> <li>(ii) filters and strainers accessibility</li> </ol> </li> <li>(b) Electric Fuel Priming Systems op.</li> <li>(c) Diesel Particulate Filter                   <ol style="list-style-type: none"> <li>(i) HEST icon for regen</li> </ol> </li> </ol> </li> <li>(4) Vehicle Components               <ol style="list-style-type: none"> <li>(a) Braking Systems                   <ol style="list-style-type: none"> <li>(i) pressure protection valve ,pressure drop</li> <li>(ii) quick build-up time</li> <li>(iii) parking brake inter-locks</li> <li>(iv) Auxiliary Brake</li> </ol> </li> <li>(b) Parking Brakes                   <ol style="list-style-type: none"> <li>(i) GVWR &amp; auxiliary braking system</li> </ol> </li> <li>(c) Suspension &amp; Wheels                   <ol style="list-style-type: none"> <li>(i) Axle housing road clearance</li> <li>(ii) Angle of Approach and Departure</li> </ol> </li> <li>(d) Steering                   <ol style="list-style-type: none"> <li>(i) radius of axles</li> <li>(ii) power steering provision</li> </ol> </li> <li>(e) Fuel Tank                   <ol style="list-style-type: none"> <li>(i) labeling</li> <li>(ii) capacity and time</li> <li>(iii) maintenance</li> </ol> </li> </ol> </li> <li>(5) Exhaust Systems</li> <li>(6) Diesel particulate filter               <ol style="list-style-type: none"> <li>(a) Exhaust Tip Outlet Temp</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>(f) conform with SAE J845 criteria</li> <li>(5) Audible Warning Equipment mounting               <ol style="list-style-type: none"> <li>(a) Back Up Alarm dBa</li> <li>(b) Stop, Tail, &amp; Directional Light mounting</li> </ol> </li> <li>(c) Low Voltage Alarm after voltage drop</li> <li>(6) Wiring</li> <li>(7) Grounding &amp; Bonding</li> </ol>
		<ol style="list-style-type: none"> <li>e. <b>Driver and Crew area</b> <ol style="list-style-type: none"> <li>(1) Seat belt color</li> <li>(2) Signage for occupants in Motion</li> <li>(3) Seat belt warning activation</li> <li>(4) Noise levels</li> <li>(5) Equipment &amp; SCBA Mounting requirements</li> <li>(6) # of Means of escape and size</li> <li>(7) Cab Tilt Systems and parking brake</li> <li>(8) Driving Compartment seating capacity</li> <li>(9) Instrumentation and Controls visible to driver</li> <li>(10) Seat Height</li> <li>(11) Helmet Storage</li> </ol> </li> <li>f. <b>Body, Compartments &amp; Equipment Mounting</b> <ol style="list-style-type: none"> <li>(1) Powered Equipment Racks               <ol style="list-style-type: none"> <li>(a) locking requirements</li> </ol> </li> <li>(2) SCBA cylinder mounting</li> <li>(3) Pump Plumbing Access size</li> <li>(4) Stepping, Walking Surface minimum load</li> <li>(5) Access Handrails size and clearance</li> <li>(6) Reflective Striping coverage and size</li> <li>(7) External Compartment Ventilation</li> <li>(8) Receivers and anchors for rope and removable winches</li> </ol> </li> <li>g. <b>Fire Pumps and Associated Equipment</b> <ol style="list-style-type: none"> <li>(1) pumps &lt; 1500 gpm suction discharge time</li> <li>(2) Pumping Engine drain for heat exchanger               <ol style="list-style-type: none"> <li>(a) Heat exchanger</li> </ol> </li> <li>(3) Intake Strainers requirements               <ol style="list-style-type: none"> <li>(a) minimum valve &amp; piping size</li> <li>(b) bleeder valve minimum size</li> <li>(c) pressure relief for &gt;3" valve</li> </ol> </li> <li>(4) Pump discharge Outlets               <ol style="list-style-type: none"> <li>(a) minimum # outlets</li> <li>(b) Connections size</li> <li>(c) Slow Operation Valve size</li> <li>(d) Location</li> </ol> </li> </ol> </li> </ol>

- (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
    - (d) Gauge and visual display location
- (9) Ultra High Pressure Pumps
  - (a) engine governor system
  - (b) engine control throttle
  - (c) gauges & instruments
  - (d) pump body integrity test

**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 (4000L)
  - (b) > 1000 gal (4000L)

**j. Aerial Devices**

- (1) Obstructions Below Ladder
  - (a) Folding step load
  - (b) ladder rotation
    - (i) rated height & seconds of rotation
- (2) Aerial Ladder Rated Capacity
- (3) Aerial Ladder Water Delivery flow
- (4) Hydraulics System bursting strength

**k. Foam Proportioning Systems**

- (1) Water Backflow prevention
- (2) Swash Partitions
  - (a) pressure vacuum vent
- (3) Test Points
  - flow capacity at minimum pressure

**l. Line Voltage Electrical systems**

- (1) AC current Hz
- (2) Max voltage to portable equipment
- (3) Instrumentation on Operator's Panel
- (4) Power Supply Assembly
  - (a) Overcurrent protection
  - (b) Branch Circuit Overcurrent Protection
- (5) Cord reels
  - (a) Distribution Box
- (6) Power-Operated Light Masts
  - (a) Sustained wind requirement
- (7) Line Bonding & Grounding

**m. Command and Communications**

- (1) Location
- (2) Climate Control
- (3) Noise Levels
- (4) Lighting

**n. Air Systems**

- (1) General Piping & Installation
  - (a) threads
- (2) Compressor Drive System, Controls, Air Monitoring
- (3) Audible and Visual Alarms
- (4) SCBA/SCUBA Fill Station protection
- (5) Piping Systems low air warning %
- (6) Breathing Air Quality Std. NFPA 1989
  - (a) charging requirements of delivery

**o. Winches**

- (1) Winch Wire length
- (2) Load rating/line pull capacity

**p. Trailers**

- (1) Classification
  - (a) Type I, II & III
- (2) Wheel Chocks
  - (a) grade %
  - (b) requirements
- (3) Power Supply
  - (a) Combined electrical load for Type II & III trailer
- (4) Wheel chocks mounting

**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

**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, 750 to <3000 gpm, & >3000 gpm,
  - (a) total time of pump test
  - (b) time & % at rated capacity of 150psi, 200 psi and 250 psi
- (6) Ultra high pressure pumps
  - (a) Water tank capacity test
  - (b) Gauge & Flowmeter test accuracy
  - (c) Priming system test
  - (d) Conditions for test

**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 at 90 psi, 150 psi, 250 psi
  - (b) time allowance to prime pump
  - (c) 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