

CHAPTER SEVEN
DRIVER/OPERATOR-PUMPER
CURRICULUM OUTLINE

SECTION	SUBJECT	RECOMMENDED HOURS
700-4.1	General	2
700-4.2	Preventive Maintenance	8
700-4.3	Driving/Operating	16
700-5.1	General	8
700-5.2	Operations	26
	TOTAL RECOMMENDED HOURS*	60

*Actual hours required will depend on the number of students, the number of examiners, availability of equipment, and the student skill level.

RECOMMENDED REFERENCE LIST FOR THE DRIVER/OPERATOR-PUMPER CURRICULUM

Certified Training Facilities approved to teach this curriculum, must have the following reference materials:

~~NFPA 13: Standard for the Installation of Sprinkler Systems (2007ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.~~

~~NFPA 13D: Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes (2007ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.~~

~~NFPA 13E: Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems (2005ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.~~

~~NFPA 13R: Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height (2007ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.~~

~~NFPA 14: Standard for the Installation of Standpipe and Hose Systems (2007ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.~~

Fire Service Pump Operator: Principles and Practice (2nd ed.) (2014). Sudbury, MA: Jones and Bartlett Publishers.

NFPA 1002: Standard on Fire Apparatus Driver/Operator Professional Qualifications (2009 ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.

NFPA 1901, Standard for Automotive Fire Apparatus, (2009 ed.) Quincy, MA: National Fire Protection Association. NFPA Publications.

*Pumping Apparatus Driver/Operator Handbook (2nd 3rd ed.) (2006 **2014**). Stillwater, OK: Fire Protection Publications. International Fire Service Training Association.*

Standards Manual for Fire Protection Personnel. Austin, TX: Texas Commission on Fire Protection.

SECTION 700

DRIVER/OPERATOR-PUMPER

A Fire Apparatus Driver is the firefighter who has met the requirements defined in 700-4.2 and 700-4.3.

A Pump Operator is the fire apparatus driver/operator who has met the requirements of 700-5.1 and 5.2 for the operation of apparatus equipped with an attack or fire pump.

700-4.1 General

Prior to operating fire department vehicles, the fire apparatus driver/operator shall meet the job performance requirements defined in Sections 700-4.2 and 700-4.3.

700-4.2 Preventive Maintenance

700-4.2.1 Perform routine tests, inspections, and servicing functions on the systems and components specified in the following list, given a fire department vehicle, its manufacturer's specifications, and policies and procedures of the jurisdiction, so that the operational status of the vehicle is verified:

- 1) Routine tests, inspections and servicing functions contribute to the goal of emergency-response readiness
- 2) Battery(ies)
 - a) Determine maintenance/maintenance-free
 - i. Check water level if applicable
 - ii. Check overall cleanliness
 - b) Terminals
 - i. Tightness
 - ii. Corrosion
 - c) General appearance and condition
 - i. Damage
 - a. Bulging
 - b. Cracks
 - c. Case deterioration
 - ii. Battery tie-down
- 3) Braking system
 - a) Air actuated
 - i. Check for leaks

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- ii. Ensure manual or automatic purging of any excess condensation
 - iii. Determine that system meets NFPA requirements for recovery
 - b) Hydraulic system
 - i. Check for leaks
 - ii. Check hydraulic fluid level
 - c) Check for obvious contamination (e.g. fluid color change, excessive metallic particulates)
- 4) Coolant system
 - a) Check for leaks
 - b) Check condition of coolant hoses or lines
 - c) Check fluid level
 - d) Check for obvious contamination (e.g. fluid color change, excessive metallic particulates)
- 5) Electrical system
 - a) Charging system
 - b) Gauges
 - c) Ignition system
 - d) Lights (e.g. headlights, turning signals, brake lights)
 - e) Emergency warning devices (visual and audible)
 - f) General condition of wires and connections
- 6) Fuel
 - a) Fuel gauge level
 - b) Check for leaks
- 7) Hydraulic fluids
 - a) Check for leaks
 - b) Check fluid level
- 8) Oil
 - a) Check for leaks
 - b) Check fluid level
 - c) Check for obvious contamination (e.g. milky appearance, fuel odor, excessive metallic particulates)
 - d) Check oil pressure gauge
- 9) Tires
 - a) Condition of valve
 - b) Condition of tread (e.g. wear patterns)
 - c) Depth of tread
 - d) Damage

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- e) Check air pressure
- f) Lug nuts
 - i. Tightness
 - ii. Rust
 - iii. Missing lug nuts

10) Steering system

- a) Check fluid level
- b) Check for excessive play

11) Belts

- a) Proper adjustment
- b) Excessive wear
- c) Cracking

12) Tools, appliances, and equipment

- a) Ensure required tools, appliances and equipment are present as determined by policies of the authority having jurisdiction
- b) Ensure required tools, appliances and equipment are in good working order for response readiness

13) Transmission

- a) Manual
 - i. Check for leaks
 - ii. Check clutch fluid level (if applicable)
 - iii. Check clutch pedal
 - iv. Check shift linkage
- b) Automatic
 - i. Check for leaks
 - ii. Check fluid level
 - iii. Check for obvious contamination (e.g. fluid color change, odor)

14) NFPA 1915 Standard for Fire Apparatus Preventive Maintenance Program, Chapter 3 General Inspection and Maintenance

700-A.4.2.1 Routine tests, inspections, and servicing functions should be performed on a daily, weekly, monthly, or other periodic basis as determined by departmental policy. The specifications provided by the manufacturer for these functions should be followed.

Requisite Knowledge: Manufacturer specifications and requirements, policies, and procedures of the jurisdiction.

- 1) Manufacturer specifications and requirements
- 2) Policies, and procedures of the jurisdiction

Requisite Skills: The ability to use hand tools, recognize system problems, and correct any deficiency noted according to policies and procedures.

- 700-4.2.2 Document the routine tests, inspections, and servicing functions, given maintenance and inspection forms, so that all items are checked for operation and deficiencies are reported.

Requisite Knowledge: Departmental requirements for documenting maintenance performed and the importance of keeping accurate records.

- 1) Departmental requirements for documenting maintenance performed
 - a) Paper-based
 - b) Electronic
- 2) The importance of keeping accurate records
 - a) Safety
 - b) Risk management
 - c) Training opportunities
 - d) Warranty issues
 - e) Vehicle longevity

Requisite Skills: The ability to use tools and equipment and complete all related departmental forms.

700-4.3 **Driving/Operating**

- 700-4.3.1 Operate a fire department vehicle, given a vehicle and a predetermined route on a public way that incorporates the maneuvers and features, specified in the following list, that the driver/operator is expected to encounter during normal operations, so that the vehicle is operated in compliance with all applicable state and local laws, departmental rules and regulations., and the requirements of NFPA 1500, Section 4.2.

- 1) Four left turns and four right turns
- 2) A straight section of urban business street or a two-lane rural road at least 1 mile (1.6 km) in length
- 3) One through-intersection and two intersections where a stop has to be made

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- 4) One railroad crossing
- 5) One curve, either left or right
- 6) A section of limited-access highway that includes a conventional ramp entrance and exit and a section of road long enough to allow two lane changes
- 7) A downgrade steep enough and long enough to require down-shifting and braking
- 8) An upgrade steep enough and long enough to require gear changing to maintain speed
- 9) One underpass or a low clearance or bridge

700-A.4.3.1 ~~The maneuvers and features specified for this job performance requirement include driving situations that the NFPA committee has determined to be essential. The NFPA committee recognizes that each of these situations might not exist in all areas. Where this occurs, those specific requirements can be omitted.~~

The committee's intent is to have the following maneuvers and features accomplished by the driver/operator. The committee recognizes that each of these situations might not exist within the authority having jurisdiction. The committee considers the following driving situations essential to driver/operator skills:

- (1) Four left turns and four right turns**
- (2) A straight section of urban business street or a two-lane rural road at least 1 mi (1.6 km) in length**
- (3) One through-intersection and two intersections where a stop has to be made**
- (4) One railroad crossing**
- (5) One curve, either left or right**
- (6) A section of limited-access highway that includes a conventional ramp entrance an exit and a section of road long enough to allow two lane changes**
- (7) A downgrade steep enough and long enough to require down-shifting and braking**
- (8) An upgrade steep enough and long enough to require gear changing to maintain speed**
- (9) One underpass or a low clearance or bridge**

Requisite Knowledge: The importance of donning passenger restraint devices and ensuring crew safety; the common causes of fire apparatus accidents and the recognition that drivers of fire apparatus are responsible for the safe and prudent operation of the vehicle under all conditions; the effects on vehicle control of liquid

surge, braking reaction time, and load factors; effects of high center of gravity on roll-over potential, general steering reactions, speed, and centrifugal force; applicable laws and regulations; principles of skid avoidance, night driving, shifting, and gear patterns; negotiating intersections, railroad crossings, and bridges; weight and height limitations for both roads and bridges; identification and operation of automotive gauges; and operational limits.

- 1) **The importance of donning passenger restraint devices and ensuring crew safety**
 - a) **Personnel safety**
 - b) **Equipment failure**
 - c) **Policy and procedure compliance**
 - d) **National standards**

- 2) **The common causes of fire apparatus accidents**
 - a) **Improper backing of the apparatus**
 - b) **Reckless driving by the public**
 - c) **Excessive speed by the fire apparatus driver/operator**
 - d) **Lack of driving skill and experience**
 - e) **Poor apparatus design or maintenance**
 - f) **Weather conditions**

- 3) **Recognition that drivers of fire apparatus are responsible for the safe and prudent operation of the vehicle under all conditions**
 - a) **Road traffic awareness**
 - b) **Weather**
 - c) **Defensive driving**
 - d) **Road conditions**
 - e) **Emergency response**
 - f) **Psychological and physiological limitations of driver**

- 4) The effects on vehicle control of liquid surge (Newton's Three Laws of Motion)
 - a) An object in motion tends to stay in motion unless acted upon by an outside force
 - i. Weight transfer
 - ii. Greater stopping distance
 - iii. Overturning fire apparatus
 - b) An object at rest tends to stay at rest unless acted upon by an outside force
 - i. Acceleration/deceleration
 - ii. Outside curves

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- c) For every action there is an equal and opposite reaction
 - i. Braking
 - ii. Skidding

- 5) The effects on vehicle control of braking reaction time
 - a) Braking reaction time defined
 - b) Methods to improve braking reaction time
 - i. Scanning
 - ii. Look ahead
 - iii. Use mirrors
 - iv. Cover the brake
 - v. Prepare to yield the right of way
 - c) Under the influence
 - i. Prescription medications
 - ii. Over the counter medications
 - iii. Exposure to products of incomplete combustion/toxins
 - iv. Illicit drugs/alcohol
 - d) Driver fatigue

- 6) The effects on vehicle control of load factors
 - a) Acceleration/deceleration
 - b) Weight distribution
 - i. Emergency maneuvers
 - ii. Normal handling characteristics
 - c) Exceeding load limits
 - i. Personnel
 - ii. Equipment
 - iii. After market modifications

- 7) Effects of high center of gravity on roll-over potential
 - a) Momentum
 - b) Inertia
 - c) Centrifugal force

- 8) Effects of high center of gravity on general steering reaction
 - a) Over steering
 - b) Under steering
 - c) Plowing/pushing (Newton's first law)

- 9) Effects of high center of gravity on speed
 - a) Grades
 - b) Curves

- 10) Effects of high center of gravity on centrifugal force

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- a) Skidding
 - b) Overturning
 - c) Plowing/pushing
- 11) Applicable laws and regulations
- a) Governmental
 - b) Authority having jurisdiction
 - c) Departmental policies
- 12) Principles of skid avoidance
- a) Influencing factors
 - i. Driver error
 - a. Driving too fast for road conditions
 - b. Apparatus weight shifts
 - c. Failure to anticipate obstacles
 - d. Improper use of auxiliary braking devices
 - e. Improper maintenance of tire pressure
 - f. Tread depth
 - ii. Environmental
 - a. Rain
 - b. Snow
 - c. Ice
 - d. Fog
 - e. Wind
 - iii. Skid recovery
 - a. Steer into the skid
 - b. Accelerate or decelerate
 - c. Do not push the clutch pedal if equipped
- 13) Principles of night driving
- a) Reduced speed
 - b) Reduced visibility
 - c) Safety features on fire apparatus (e.g. strobe light dimmer)
 - d) Driver/Operator fatigue
- 14) Principles of shifting and gear patterns
- a) Downshifting
 - b) Up shifting
 - c) Premature shifting
- 15) Negotiating
- a) Intersections
 - i. Be prepared to yield
 - ii. Scan for hazards

- iii. Observe traffic
- iv. Cover brake pedal
- b) Railroad crossings
 - i. Be prepared to yield
 - ii. Scan for rail traffic
 - iii. Cover brake pedal
- c) Bridges
 - i. Remain cognizant of weather hazards
 - ii. Recognize bridge width

16) Weight and height limitations for both roads and bridges according to the Authority Having Jurisdiction (AHJ).

17) Identification and operation of automotive gauges

- a) Oil pressure gauge
- b) Coolant temperature gauge
- c) Speedometer
- d) Tachometer
- e) Fuel gauge
- f) Voltmeter
- g) Air pressure gauge(s)
- h) Automatic transmission temperature gauge

18) Operational limits

- a) Operational limits including, but not limited to the following:
 - i. Acceleration
 - ii. Braking
 - iii. Turning radius
 - iv. Steering wheel play
 - v. Tilt test
 - vi. Air pressures
 - vii. Weight and height limitations
 - viii. Normal operating ranges for automotive gauges
- b) Manufacturer's specified operating limits
- c) NFPA 1901, as applicable to operational limits

Requisite Skills: The ability to operate passenger restraint devices; maintain safe following distances; maintain control of the vehicle while accelerating, decelerating, and turning, given road, weather, and traffic conditions; operate under adverse environmental or driving surface conditions; and use automotive gauges and controls.

700-4.3.2 Back a vehicle from a roadway into restricted spaces on both the right and left sides of the vehicle, given a fire department vehicle, a spotter, and

restricted spaces 12 ft. (3.7 m.) in width, requiring 90-degree right-hand and left-hand turns from the roadway, so that the vehicle is parked within the restricted areas without having to stop and pull forward and without striking obstructions.

Requisite Knowledge: Vehicle dimensions, turning characteristics, spotter signaling, and principles of safe vehicle operation.

- 1) Vehicle dimensions
 - a) Length
 - b) Width
 - c) Height
 - d) Wheel base

- 2) Turning characteristics
 - a) Wheel base
 - b) Front wheel cramp angle
 - c) Rear axle pivot points
 - d) Speed
 - e) Steering wheel gear ratio

- 3) Spotter signaling
 - a) Headset
 - b) Hand signals per department standard practice
 - c) Radio

- 4) Principles of safe vehicle operation
 - a) Adjustment of cab features
 - b) Wearing of occupant restraints
 - c) Verification of personnel locations before proceeding
 - d) Right of way considerations

Requisite Skills: The ability to use mirrors and judge vehicle clearance.

- 700-4.3.3 Maneuver a vehicle around obstructions on a roadway while moving forward and in reverse, given a fire department vehicle, a spotter for backing, and a roadway with obstructions, so that the vehicle is maneuvered through the obstructions without stopping to change the direction of travel and without striking the obstructions.

Requisite Knowledge: Vehicle dimensions, turning characteristics, the effects of liquid surge, spotter signaling, and principles of safe vehicle operation.

- 1) Vehicle dimensions
 - a) Length
 - b) Width
 - c) Height
 - d) Wheel base

- 2) Turning characteristics
 - a) Wheel base
 - b) Front wheel cramp angle
 - c) Rear axle pivot points
 - d) Speed
 - e) Steering wheel gear ratio

- 3) The effects of liquid surge (Newton's Three Laws of Motion)
 - a) An object in motion tends to stay in motion unless acted upon by an outside force
 - i. Weight transfer
 - ii. Greater stopping distance
 - iii. Overturning fire apparatus
 - b) An object at rest tends to stay at rest unless acted upon by an outside force
 - i. Acceleration/deceleration
 - ii. Outside curves
 - c) For every action there is an equal and opposite reaction
 - i. Braking
 - ii. Skidding

- 4) Spotter signaling
 - a) Headset
 - b) Hand signals per department standard practice
 - c) Radio

- 5) Principles of safe vehicle operation
 - a) Adjustment of cab features
 - b) Wearing of occupant restraints
 - c) Verification of personnel locations before proceeding
 - d) Right of way considerations

Requisite Skills: The ability to use mirrors and judge vehicle clearance.

- 700-4.3.4 Turn a fire department vehicle 180 degrees within a confined space, given a fire department vehicle, a spotter for backing up, and an area in which the vehicle cannot perform a U-turn without stopping and backing up, so

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that the vehicle is turned 180 degrees without striking obstructions within the given space.

Requisite Knowledge: Vehicle dimensions, turning characteristics, the effects of liquid surge, spotter signaling, and principles of safe vehicle operation. (Reference requisite knowledge in 700-4.3.3 for clarification)

Requisite Skills: The ability to use mirrors and judge vehicle clearance.

700-4.3.5 Maneuver a fire department vehicle in areas with restricted horizontal and vertical clearances, given a fire department vehicle and a course that requires the operator to move through areas of restricted horizontal and vertical clearances, so that the operator accurately judges the ability of the vehicle to pass through the openings and so that no obstructions are struck.

Requisite Knowledge: Vehicle dimensions, turning characteristics, the effects of liquid surge, spotter signaling, and principles of safe vehicle operation. (Reference requisite knowledge in 700-4.3.3 for clarification)

Requisite Skills: The ability to use mirrors and judge vehicle clearance.

700-4.3.6 Operate a vehicle using defensive driving techniques ~~under emergency conditions~~, given **an assignment and** a fire department vehicle **apparatus** and ~~emergency conditions~~, so that control of the vehicle is maintained.

700-A.4.3.6 **Simulated** emergency driving ~~simulation~~ **conditions** should be restricted to a driving track or similar controlled area. ~~Emergency driver training should not be conducted on~~ Public ways **should not be used for these activities.**

Requisite Knowledge: **The importance of donning passenger restraint devices and ensuring crew safety; the common causes of fire apparatus accidents and the recognition that drivers of fire apparatus are responsible for the safe and prudent operation of the vehicle under all conditions;** the effects on vehicle control of liquid surge, braking reaction time, and load factors; the effects of high center of gravity on roll-over potential, general steering reactions, speed, and centrifugal force; applicable laws and regulations; principles of skid avoidance, night driving, shifting, gear patterns; and automatic braking systems in wet and dry conditions; negotiation of intersections, railroad crossings, and bridges; weight and height limitations for both roads and

bridges; identification and operation of automotive gauges; and operational limits.

- 1) **The importance of donning passenger restraint devices and ensuring crew safety**
 - a) **Personnel safety**
 - b) **Equipment failure**
 - c) **Policy and procedure compliance**
 - d) **National standards**

- 2) **The common causes of fire apparatus accidents**
 - a) **Improper backing of the apparatus**
 - b) **Reckless driving by the public**
 - c) **Excessive speed by the fire apparatus driver/operator**
 - d) **Lack of driving skill and experience**
 - e) **Poor apparatus design or maintenance**
 - f) **Weather conditions**

- 3) **Recognition that drivers of fire apparatus are responsible for the safe and prudent operation of the vehicle under all conditions**
 - a) **Road traffic awareness**
 - b) **Weather**
 - c) **Defensive driving**
 - d) **Road conditions**
 - e) **Emergency response**
 - f) **Psychological and physiological limitations of driver**

- 4) The effects on vehicle control of liquid surge (Newton's Three Laws of Motion)
 - a) An object in motion tends to stay in motion unless acted upon by an outside force
 - i. Weight transfer
 - ii. Greater stopping distance
 - iii. Overturning fire apparatus
 - b) An object at rest tends to stay at rest unless acted upon by an outside force
 - i. Acceleration/deceleration
 - ii. Outside curves
 - c) For every action there is an equal and opposite reaction
 - i. Braking
 - ii. Skidding

- 5) The effects on vehicle control of braking reaction time
 - a) Braking reaction time defined

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- b) Methods to improve braking reaction time
 - i. Scanning
 - ii. Look ahead
 - iii. Use mirrors
 - iv. Cover the brake
 - v. Prepare to yield the right of way
 - c) Under the influence
 - i. Prescription medications
 - ii. Over the counter medications
 - iii. Exposure to products of incomplete combustion/toxins
 - iv. Illicit drugs/alcohol
 - d) Driver fatigue
- 6) The effects on vehicle control of load factors
- a) Acceleration/deceleration
 - b) Weight distribution
 - i. Emergency maneuvers
 - ii. Normal handling characteristics
 - c) Exceeding load limits
 - i. Personnel
 - ii. Equipment
 - iii. After market modifications
- 7) Effects of high center of gravity on roll-over potential
- a) Momentum
 - b) Inertia
 - c) Centrifugal force
- 8) Effects of high center of gravity on general steering reaction
- a) Over steering
 - b) Under steering
 - c) Plowing/pushing (Newton's first law)
- 9) Effects of high center of gravity on speed
- a) Grades
 - b) Curves
- 10) Effects of high center of gravity on centrifugal force
- a) Skidding
 - b) Overturning
 - c) Plowing/Pushing
- 11) Applicable laws and regulations
- a) Governmental

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- b) Authority having jurisdiction
- c) Departmental policies

12) Principles of skid avoidance

- a) Driver error
 - i. Driving too fast for road conditions
 - ii. Apparatus weight shifts
 - iii. Failure to anticipate obstacles
 - iv. Improper use of auxiliary braking devices
 - v. Improper maintenance of tire pressure
 - vi. Tread depth
- b) Environmental
 - i. Rain
 - ii. Snow
 - iii. Ice
 - iv. Fog
 - v. Wind
- c) Skid recovery
 - i. Steer into the skid
 - ii. Accelerate or decelerate
 - iii. Do not push the clutch pedal if equipped

13) Principles of night driving

- a) Reduced speed
- b) Reduced visibility
- c) Safety features on fire apparatus (e.g. strobe light dimmer)
- d) Driver/Operator fatigue

14) Principles of shifting and gear patterns

- a) Downshifting
- b) Up shifting
- c) Premature shifting

15) Automatic braking systems

- a) Wet conditions
- b) Dry conditions

16) Negotiating

- a) Intersections
 - i. Be prepared to yield
 - ii. Scan for hazards
 - iii. Observe traffic
 - iv. Cover brake pedal
- b) Railroad crossings

- i. Be prepared to yield
 - ii. Scan for rail traffic
 - iii. Cover brake pedal
 - c) Bridges
 - i. Remain cognizant of weather hazards
 - ii. Recognize bridge width
- 17) Weight and height limitations for both roads and bridges (AHJ)
- 18) Identification and operation of automotive gauges
 - a) Oil pressure gauge
 - b) Coolant temperature gauge
 - c) Speedometer
 - d) Tachometer
 - e) Fuel gauge
 - f) Voltmeter
 - g) Air pressure gauge(s)
 - h) Automatic transmission temperature gauge
- 19) Operational limits
 - a) Operational limits including, but not limited to the following:
 - i. Acceleration
 - ii. Braking
 - iii. Turning radius
 - iv. Steering wheel play
 - v. Tilt test
 - vi. Air pressures
 - vii. Weight and height limitations
 - viii. Normal operating ranges for automotive gauges
 - b) Manufacturer's specified operating limits
 - i. Gross Vehicle Weight (GVW)
 - ii. Operating curb weight
 - c) NFPA 1901, as applicable to operational limits
- 20) Psychological effects of emergency warning devices
 - a) Driver/Operator
 - b) General public

Requisite Skills: The ability to operate passenger restraint devices; maintain safe following distances; maintain control of the vehicle while accelerating, decelerating, and turning, given road, weather, and traffic conditions; operate under adverse environmental or driving surface conditions; and use automotive gauges and controls.

700-4.3.7 Operate all fixed systems and equipment on the vehicle not specifically addressed elsewhere in this standard, given systems and equipment, manufacturer's specifications and instructions, and departmental policies and procedures for the systems and equipment, so that each system or piece of equipment is operated in accordance with the applicable instructions and policies.

700-A.4.3.7 The NFPA committee's intent for this job performance requirement is for the driver/operator to be able to operate all major equipment and mechanical systems that are attached to the apparatus, other than those specifically covered in Chapters 5 through 10 of this standard. These types of equipment and systems include, but are not limited to, electric generation equipment, floodlighting systems, air compressors, air cascade systems, hydraulic rescue tool systems, power reels for air or hydraulic hose, cranes and stabilizers, and A-frames or other lifting equipment.

Requisite Knowledge: Manufacturer's specifications and operating procedures, and policies and procedures of the jurisdiction.

- 1) Manufacturer's specifications and operating procedures (AHJ)
- 2) Policies and procedures of the jurisdiction (AHJ)

Requisite Skills: The ability to deploy, energize, and monitor the system or equipment and to recognize and correct system problems.

700-5.1 **General**

The requirements of Fire Fighter I as specified in NFPA 1001 (or the requirements of Advanced Exterior Industrial Fire Brigade Member or Interior Structural Fire Brigade Member as specified in NFPA 1081) and the job performance requirements defined in Sections 5.1 and 5.2 shall be met prior to qualifying as a fire department driver/operator — pumper.

700-5.1.1 Perform the routine tests, inspections, and servicing functions specified in the following list in addition to those in 700-4.2.1, given a fire department pumper, its manufacturer's specifications, and policies and procedures of the jurisdiction, so that the operational status of the pumper is verified:

- 1) Water tank
 - a) Direct visual
 - b) Remote sensor level
- 2) Other extinguishing agent levels (if applicable)

- a) Direct visual
 - b) Remote sensor level
- 3) Pumping systems
- a) Positive displacement
 - i. Piston pumps
 - ii. Rotary pumps
 - a. Rotary gear
 - b. Rotary vane
 - b) Centrifugal
 - i. Single stage
 - ii. Two stage
 - a. Series (Pressure)
 - b. Parallel (Volume)
- 4) Foam systems
- a) Induction
 - b) Injection
 - c) Batch mix
 - d) Premix
 - e) Compressed Air Foam System (CAFS)

Requisite Knowledge: Manufacturer's specifications and requirements, and policies and procedures of the jurisdiction.

- 1) Manufacturer's specifications and requirements
- 2) Policies and procedures of the jurisdiction

Requisite Skills: The ability to use hand tools, recognize system problems, and correct any deficiency noted according to policies and procedures.

700-5.2 **Operations**

700-5.2.1 Produce effective hand or master streams, given the sources specified in the following list, so that the pump is engaged, all pressure control and vehicle safety devices are set, the rated flow of the nozzle is achieved and maintained, and the apparatus is continuously monitored for potential problems:

- 1) Internal tank
- 2) Pressurized source

- a) Connection to a hydrant
 - b) Supply line from another pumping source
- 3) Static source
- 4) Transfer from internal tank to external source

Requisite Knowledge: Hydraulic calculations for friction loss and flow using both written formulas and estimation methods, safe operation of the pump, problems related to small-diameter or dead-end mains, low-pressure and private water supply systems, hydrant coding systems, and reliability of static sources.

- 1) Hydraulic calculations for friction loss and flow using both written formulas and estimation methods
- a) Theoretical written formulas
 - i. Friction loss
 - ii. Gallons per minute (flow)
 - iii. Nozzle reaction
 - iv. Pump discharge pressure
 - v. Elevation
 - b) Fire ground estimation methods
 - i. Friction loss
 - ii. Gallons per minute (flow)
 - iii. Pump discharge pressure
 - iv. Elevation
 - c) Elements of hydraulic calculations
 - i. Appliances
 - ii. Hose
 - a. Diameter
 - b. Length
 - c. Construction
 - d. Layouts
 - (1) Simple
 - (2) Complex
 - iii. Master streams
 - iv. Sprinklers
 - v. Standpipes
- 2) Safe operation of the pump
- a) Relief valves
 - i. Discharge
 - a. Governor
 - (1) Electronic

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- (2) Mechanical
 - b. Spring-actuated pressure relief
 - ii. Intake
 - a. Manufacturer pressure relief
 - b. Add-on pressure relief
 - b) Transfer valve
 - i. Electronic (to include override procedures)
 - ii. Manual
 - iii. Manufacturer's recommendations
 - c) Cavitation
 - i. Indicators
 - a. Auditory signals (e.g. gravel sounds)
 - b. Gauge readings
 - c. Throttle increase with no pressure increase
 - ii. Prevention
 - a. Bleeder valve
 - b. Maintain adequate residual
 - d) Priming
 - i. Positive displacement primers
 - a. Rotary vane
 - (1) Mechanical
 - (2) Electric
 - b. Rotary gear
 - (1) Mechanical
 - (2) Electric
 - ii. Exhaust primers
 - iii. Vacuum primers
 - e) Opening/closing valves
 - i. Water hammer
 - ii. Cavitation
 - iii. Pressure fluctuation
- 3) Problems related to small-diameter or dead-end mains
 - a) Limited flow
 - i. Encrustation
 - ii. Sedimentation
 - iii. Silt and debris
 - b) Greater susceptibility to water hammer damage
- 4) Low-pressure water supply systems
 - a) Access
 - b) Limited flow
 - c) Relay pumping

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- 5) Private water supply systems
 - a) Industrial
 - b) Non-potable water
 - c) Static pressure
 - d) Access
 - i. Thread compatibility
 - ii. Locked/covered hydrants

- 6) Hydrant coding systems
 - a) NFPA
 - b) American Water Works Association
 - c) Local jurisdiction

- 7) Reliability of static sources
 - a) Principles of lift
 - i. Theoretical
 - ii. Practical
 - b) Natural
 - i. Types
 - ii. Adequacy
 - a. $Q=A(V)(7.5)$
 - b. Capacity
 - iii. Accessibility
 - c) Man-made
 - i. Types
 - ii. Adequacy
 - a. $Q=A(V)(7.5)$
 - b. Capacity
 - iii. Accessibility

Requisite Skills: The ability to position a fire department pumper to operate at a fire hydrant and at a static water source, power transfer from vehicle engine to pump, draft, operate pumper pressure control systems, operate the volume/pressure transfer valve (multistage pumps only), operate auxiliary cooling systems, make the transition between internal and external water sources, and assemble hose lines, nozzles, valves, and appliances.

- 700-5.2.2 Pump a supply line of 2 1/2 in. (65 mm) or larger, given a relay pumping evolution, the length and size of the line and the desired flow and intake pressure, so that the correct pressure and flow are provided to the next pumper in the relay.

Requisite Knowledge: Hydraulic calculations for friction loss and flow using both written formulas and estimation methods, safe operation of the pump, problems related to small-diameter or dead-end mains, low-pressure and private water supply systems, hydrant coding systems, and reliability of static sources. (Reference requisite knowledge in 700-5.2.1)

Requisite Skills: The ability to position a fire department pumper to operate at a fire hydrant and at a static water source, power transfer from vehicle engine to pump, draft, operate pumper pressure control systems, operate the volume/pressure transfer valve (multistage pumps only), operate auxiliary cooling systems, make the transition between internal and external water sources, and assemble hose lines, nozzles, valves, and appliances.

700-5.2.3 Produce a foam fire stream, given foam-producing equipment, so that properly proportioned foam is provided.

Requisite Knowledge: Proportioning rates and concentrations, equipment assembly procedures, foam system limitations, and manufacturer's specifications.

- 1) Proportioning rates and concentrations
- 2) Equipment assembly procedures (if applicable)
- 3) Foam system operations
- 4) Foam system limitations
- 5) Manufacturer's specifications

Requisite Skills: The ability to operate foam proportioning equipment and connect foam stream equipment.

700-5.2.4 Supply water to fire sprinkler and standpipe systems, given specific system information and a fire department pumper, so that water is supplied to the system at the correct volume and pressure.

Requisite Knowledge: Calculation of pump discharge pressure; hose layouts; location of fire department connection; alternative supply procedures if fire department connection is not usable; operating principles of sprinkler systems as defined in NFPA 13, NFPA 13D, and NFPA 13R; fire department operations in sprinklered properties as defined

in NFPA 13E; and operating principles of standpipe systems as defined in NFPA 14.

- 1) Calculation of pump discharge pressure
- 2) Hose layouts
- 3) Location of fire department connection
- 4) Alternative supply procedures if fire department connection is not usable
- 5) Operating principles of sprinkler systems as defined in NFPA 13, NFPA 13D, and NFPA 13R
- 6) Fire department operations in sprinklered properties as defined in NFPA 13E
- 7) Operating principles of standpipe systems as defined in NFPA 14

Requisite Skills: The ability to position a fire department pumper to operate at a fire hydrant and at a static water source, power transfer from vehicle engine to pump, draft, operate pumper pressure control systems, operate the volume/pressure transfer valve (multistage pumps only), operate auxiliary cooling systems, make the transition between internal and external water sources, and assemble hose line, nozzles, valves, and appliances.