

DRIVER/OPERATOR - AIRCRAFT RESCUE FIRE FIGHTING NFPA 1002

The following detailed lesson plans for Apparatus Driver/Operator - Aircraft Rescue Fire Fighter are based on NFPA 1002, Standard for Fire Department Vehicle Driver/Operator Professional, 1993 Edition. These lesson plans contain the same material that is covered in the Career Development Course for Driver/Operator ARFF. The material in these lesson plans follows natural learning simple to complex sequencing practices. Therefore, mastery of the material in the beginning is required before advancing to the latter lesson plans. The sequence of material in these detailed lesson plans is different from the Career Development Course and NFPA 1002 sequence, which were designed to serve other purposes.

It is recommended that you become familiar with NFPA 1002, Standard for Fire Department Vehicle Driver/Operator Professional Qualifications prior using these lesson plans. The following list identifies all Lesson Plans and the related NFPA 1002 Job Performance Requirements. Note that if some of the numbers appear more than once; this is because several of the Job Performance Requirements or their prerequisites have to be broken in parts and taught at different times. Finally, if only the Job Performance Requirement number is identified, then all the prerequisite knowledge and skills are covered in that lesson.

Lesson Plan 1

2-2.1
2-2.2

Lesson Plan 2

2-3.1 2-3.3.2
2-3.1.1 2-3.4
2-3.1.2 2-3.5
2-3.2.1 2-3.6
2-3.2.2 2-3.6.1
2-3.3 2-3.8
2-3.3.1

Lesson Plan 3

7-1.2
7-1.3
7-1.4
7-1.5

Lesson Plan 4

7-2

Lesson Plan 5

7-3 7-3.3
7-3.1 7-3.4
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Lesson Plan 6

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Lesson Plan 7

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7-5.1
7-5.2

DOD FIRE SERVICE CERTIFICATION SYSTEM

LESSON PLAN 1

Personnel Classification: Apparatus Driver/Operator - Aircraft Rescue and Fire Fighting Apparatus

Subject: Preventive Maintenance

NFPA 1002 Objectives

2-2.1

2-2.2

Training Materials/Equipment:

ARFF vehicle, service records used by the agency, including fire apparatus history card

References:

NFPA 1002: Fire Vehicle Operator Professional Qualifications, 1993 National Fire Protection Association, Quincy, Massachusetts

NFPA 414: Standard for Aircraft Rescue and Fire Fighting Vehicles, 1995 National Fire Protection Association, Quincy, Massachusetts.

NFPA 1500: Standard on Fire Department Occupational Safety and Health Programs. 1992 National Fire Protection Association, Quincy, Massachusetts

IFSTA, Aircraft Fire Protection and Rescue Procedures, 2nd Edition, 1992, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Department Pumping Apparatus, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Stream Practices, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Water Supplies for Fire Protection, 4th Edition, 1988, Fire Protection Publications, Oklahoma State University.

Technical Order: Aircraft Crash and Structural Fire Fighting Truck (P-19, P-19A, P-19B) (TO 36A12-8-17-1, TM 08674A-10/1, TM 5-2410-219-10, NAVFAC P-8-262.16-1), 16 June 1984, Departments of the Air Force, Army, and Navy, Washington, D.C.

NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual (NAVAIR 00-80R-14). 1 May 1988, Naval Air Technical Services, Philadelphia, Pennsylvania.

Aircraft Emergency Rescue Information
(Fire Protection)
T.O. 003-105E-9
15 May 1995
Warner Robins AFB, GA

Additional Information:

Applicable Technical Manuals

IFSTA Pumping Apparatus Series Videotapes, Fire Protection Publications, Oklahoma State University

Instructor Tasks

- ¥ Review lesson outline to ensure understanding of contents and procedures.
- ¥ Review references for lesson.
- ¥ Use additional references and your knowledge to enrich lesson outline.
- ¥ Select and prepare any additional audio-visual aids that may assist in the presentation of the lesson.
- ¥ Ensure that all equipment needed, including any audio-visual equipment, is available.
- ¥ Review lesson at end of session to ensure student understanding.
- ¥ Ensure that the topics and objectives of the lesson have been adequately covered.

INTRODUCTION AND OBJECTIVES

- I. Greet class
- II. State purpose of the lesson
- III. Establish relation to previous and following lessons
- IV. Review NFPA 1002 objectives for this lesson
- V. Review any additional materials for this lesson

PRESENTATION

LESSON OUTLINE

INSTRUCTOR NOTES

2-2.1. Preventive Maintenance

- A. Routine Tests, Inspections, and Servicing Functions
 1. Approach to an apparatus check

The majority of the information presented here is by automotive system: battery, coolant system, electrical system, etc. However, as ARFF Driver/Operators become more familiar with vehicle, it may be easier and quicker to approach the vehicle location by location: inside the cab, around the body, under the hood, etc.
- B. Battery check procedure
 1. Corrosion
 - a. Check for corrosion around terminals and other areas surrounding the battery
 - b. Wipe these clean to ensure maximum contact between battery and wires
 2. Cell electrolyte level
 - a. Check the water level of the battery and fill, if needed
 - b. The fill point should at least cover plates
 - c. Be sure water is between minimum and maximum fill levels
 3. Specific gravity
 - a. It is the density of the water which tells the driver/operator how charged the battery is
 - b. To check; draw water from battery into a hydrometer

LESSON OUTLINE

INSTRUCTOR NOTES

- c. Read the measurement on the hydrometer which indicates whether the battery is charged enough to operate
 - d. This must be done cell by cell
 - 4. Test for voltage
 - a. Touch the voltmeter to the two terminals of the battery; be sure that the polarity is correct: red on red (positive) and black on black (negative)
 - b. Be sure voltmeter is set to the appropriate scale
 - 5. Charging the battery
 - a. Charge the battery if the hydrometer indicates the battery is low
 - b. Identify polarity of battery to be charged (positive or negative ground)
 - c. Attach red charger cable to positive battery post
 - d. Attach black charger cable to negative battery post
 - e. Connect battery charger to a reliable power source (away from gasoline and other flammable vapors)
 - f. Set desired battery charging voltage and charging rate (if so equipped); switches on battery chargers should be in the OFF position when not in use
 - g. Use caution because hydrogen gas is produced during charging
 - h. Reverse procedure to disconnect the charger
 - B. Brake system
 - 1. Air brakes
 - a. Pressure test by tapping the brake pedal
 - b. Check low air warning system
 - c. Check air chuck on rear of apparatus
 - 2. Emergency brakes
 - a. Check emergency brakes (hand brakes) for hold

LESSON OUTLINE

INSTRUCTOR NOTES

- C. Coolant system
 - 1. The coolant system protects both engine and pump
 - 2. For safety, be sure coolant is checked when the engine is entirely cool
 - 3. Procedure
 - a. Check the coolant color and level in the radiator and add fluid (if applicable)
 - b. Inspect the hoses for cracks or leaks
 - c. Flush the coolant system and add rust inhibitor (if applicable)
 - d. Check the radiator fan for loose or cracked blades
 - e. Check temperature gage reading with engine running
- D. Electrical system
 - 1. There are numerous electrical connections in an apparatus; damage from moisture or corrosion can render an electrical connection inoperative
 - 2. Lights
 - a. Operate headlight dimmer switch
 - b. Operate clearance, stop, and back up lights
 - c. Operate all compartment lights and switches
 - d. Operate warning lights and switches
 - e. Operate the floodlights and switches
 - 3. All motor-driven equipment should be started and run once a week
 - a. Operate rotating lights
 - b. Operate hose reel rewind
 - c. Operate apparatus controls
 - d. Operate header and defroster fan
 - e. Operate heater and/or air conditioner (if applicable)
 - f. Operate public address system and radio
 - g. Operate horn
 - h. Check audible and usual warning devices

LESSON OUTLINE

INSTRUCTOR NOTES

- E. Fuel system
 - 1. A full tank of fuel; ensures maximum running time
 - 2. Procedure
 - a. Check fuel level, add fuel if needed
 - b. Check fuel pumps and filters periodically
 - c. Check fuel tank cap vent for blockage, clear if necessary
 - d. Drain moisture from fuel/water separator
- F. Hydraulic fluids
 - 1. Be certain the fluid added is compatible with the fluid already in the reservoir; type of fluid needed is often printed on reservoir or check appropriate technical order
 - 2. Procedure
 - a. Wipe off lid of reservoir before opening to prevent contamination from water or other contaminants
 - b. Amount to be filled is also found in the appropriate technical order
 - c. Check master cylinder reservoir
 - d. Check power steering fluid reservoir (if applicable)
- G. Lubrication/oil levels
 - 1. General
 - a. Prime objective of good maintenance
 - b. Proper lubrication saves maintenance and repair dollars; reduces out-of-service time
 - c. Oil gives protection against corrosion, foaming, sludging, and carbon accumulation
 - d. To protect oil from contamination, prevent any unnecessary engine starts

LESSON OUTLINE

INSTRUCTOR NOTES

2. Procedure
 - a. Check technical order for correct viscosity of the oil
 - b. Check engine oil level
 - c. Check exterior of engine for leaks
 - d. Check transmission oil level
 - e. Check exterior of transmission for leaks
 - f. Check all oil lines for leaks, corrosion or damage
 - g. Check differential oil levels
 - h. Check oil pressure with engine running
- H. Tires
 1. Check tires for cuts, breaks, and proper inflation and uneven wear
 2. Check valve stems for corrosion or damage
 3. Inflate tires to proper level as noted on tire
 4. Check lugs for tightness and rims for damage
- I. Steering system
 1. Check steering gear for excessive motion and periodically lubricate steering gear
 2. Check seals on steering gear
 3. Check fluid reservoir, add fluid if needed
 4. Check all lines and hoses for damage
- J. Belts
 1. Check to make sure belts are present
 2. Check belts for wear
 3. Check for proper tension
- K. Tools, appliances, and equipment
 1. General
 - a. Tools, appliances, and equipment refer to those items carried on the fire apparatus but not permanently attached to or a part of the apparatus
 - b. Most removable equipment is common to all fire equipment and should be checked daily

LESSON OUTLINE

INSTRUCTOR NOTES

2. Procedure
 - a. Remove and (if applicable) clean any equipment attached to the apparatus
 - b. Check portable extinguishers by weighing or checking pressure gauge
 - c. Check hose loads for correct finishes
 - d. Inventory all nozzles and appliances
 - e. Check air pressure in self-contained breathing apparatus and spare bottles
 - f. Examine regulators and face pieces
 - g. Operate hand lights
 - h. Operate power tools
 - i. Operate hand tools
 - j. Check ground ladders
 - k. Check that the first-aid kit is complete
 - l. Check all tool mountings
 - m. Check fluid levels of all power tools/equipment
- L. Agent tank level
 1. Check the level by shining a flashlight onto surface
 2. Fill the agent tank to capacity
 - a. This should be done daily
 - b. At no time should tank be less than full
 3. Check the inside surface for corrosion and cleanliness
 4. Check the accuracy of agent level gauges compared to actual agent levels in the tank
 - a. If there is a difference between the two, alert appropriate maintenance facility immediately

LESSON OUTLINE

INSTRUCTOR NOTES

- M. Cab and Body
 - 1. Check operation and condition of compartment doors
 - 2. Check weather seals around cab and compartment doors
 - 3. Check windshield washer solvent, add if needed
 - 4. Operate windshield wipers and washers
 - 5. Check mirror adjustment
 - 6. Inspect all glass for breaks or discoloration
 - 7. Check operation of seat adjusting mechanisms
 - 8. Check condition and operation of seat belts
- N. Other components to check while inside cab
 - 1. Check mirrors for cracks and cleanliness
 - 2. Check map case is complete with grid maps and other applicable maps
 - 3. Check seats for tears and adjustability
- O. Water and Foam Piping
 - 1. Check underside of apparatus for leaks
 - 2. Check drain valves
 - 3. Check oil level for priming pump
- P. Other components to check on the body of the apparatus
 - 1. General
 - a. Fire apparatus must be kept clean.
 - b. A clean apparatus engine permits proper inspection and ensures efficient operation as needed
 - 2. Procedure
 - a. Check the body for cleanliness and wash away any visible dirt
 - b. Check for oil, moisture, dirt, and grime
 - c. Check body panels for rust, dents, or exposed areas needing touch-up paint
 - d. Check weather seals around cab and compartment doors for looseness, damage, and deterioration
 - e. Inspect windows for cracks and discoloration

LESSON OUTLINE

INSTRUCTOR NOTES

- 2-2.2 Document routine tests, inspections, and service functions
 - A. Fire apparatus record
 - 1. Maintain as required
 - B. Fire apparatus data and history
 - 1. Maintain as required
 - C. Gasoline, oil and mileage record
 - 1. Maintain as required
 - D. Apparatus inspection report
 - 1. Complete as required
 - a. Daily
 - b. Weekly
 - c. Periodic
 - E. Fire equipment record
 - 1. Complete as required
 - a. Daily
 - b. Weekly
 - c. Periodic

REVIEW

- I. Discuss key lesson points.
- II. Ask questions on the material covered.
- III. Review material that may be unclear.
- IV. Administer test or quiz.
- V. Critique test or quiz.

SUMMARY

- I. Summarize what has been covered.
- II. Relate what has been covered to the next lesson.

DOD FIRE SERVICE CERTIFICATION SYSTEM

LESSON PLAN 2

Personnel Classification: Apparatus Driver/Operator - Aircraft Rescue Fire Fighting Apparatus

Subject: Driving Operating

NFPA 1002 Objectives

2-3.1	2-3.3.2
2-3.1.1	2-3.4
2-3.1.2	2-3.5
2-3.2.1	2-3.6
2-3.2.2	2-3.6.1
2-3.3	2-3.8
2-3.3.1	

Training Materials/Equipment:

Fully equipped and operational ARFF vehicle, chalkboard, hydrometer, voltmeter, traffic cones, 50 foot tape measure

References:

NFPA 1002: Fire Vehicle Operator Professional Qualifications, 1993 National Fire Protection Association, Quincy, Massachusetts

NFPA 414: Standard for Aircraft Rescue and Fire Fighting Vehicles, 1995 National Fire Protection Association, Quincy, Massachusetts.

NFPA 1500: Standard on Fire Department Occupational Safety and Health Programs. 1992 National Fire Protection Association, Quincy, Massachusetts

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Aircraft Emergency Rescue Information
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PRESENTATION

LESSON OUTLINE

INSTRUCTOR NOTES

- 2-3.1 Operate fire department vehicle
 - A. Operate a fire department vehicle over a predetermined route
 - 1. Predetermined route
 - a. Incorporated
 - 1) Maneuvers
 - 2) Features
 - 2. Vehicle must be operated in compliance with
 - a. Federal laws
 - b. State laws
 - c. Local laws
 - d. Department rules and regulations
 - e. Requirements of NFPA 1500
 - 3. Predetermined route must include
 - a. 4 left and 4 right turns
 - 1) Approach point of turn
 - 2) Activate turn signal
 - 3) Insure path is clear of traffic or obstructions
 - 4) Check rearview mirrors
 - 5) Slow vehicle
 - 6) Apply brakes, if necessary
 - 7) Make smooth turn to new path of travel

LESSON OUTLINE

INSTRUCTOR NOTES

- b. Straight section of urban business street
 - 1) Drive at posted speed limit or
 - 2) Drive based on conditions
 - 3) Stay in correct lane
 - 4) Move eyes to check
 - a) ahead
 - b) side streets and roads
 - c) other traffic
 - d) rear view mirrors
 - e) observe all traffic laws
- c. 2 lane rural road
 - 1) Drive at posted speed limit or
 - 2) Drive based on conditions
 - 3) Stay in correct lane
 - 4) Move eyes to check
 - a) ahead
 - b) side streets and roads
 - c) other traffic
 - d) rear view mirrors
 - e) observe all traffic laws
- d. Intersections
 - 1) 1 Traveling through
 - a) Approach with vehicle under control
 - b) Observe cross streets/roads
 - c) Slow apparatus
 - d) Be prepared for controlled stop
 - e) Yield to traffic on the right
 - f) Proceed through intersection when safe to do so

LESSON OUTLINE

INSTRUCTOR NOTES

- 2) 2 intersections where a stop is required
 - a) Approach with vehicle under control
 - b) Observe cross streets/roads
 - c) Slow apparatus
 - d) Bring apparatus to smooth stop
 - e) Yield to traffic that has right of way
 - f) Proceed through intersection when safe to do so
- e. railroad crossing
 - 1) Approach crossing with vehicle under control
 - 2) Bring apparatus to complete stop
 - 3) Look in both directions
 - 4) Cross tracks when safe to do so
- f. Curve -right or left
 - 1) Approach curve at safe speed with apparatus under control
 - 2) Slow apparatus, if necessary
 - 3) Stay in proper lane
 - 4) Maintain control of apparatus through curve
 - 5) Accelerate out of curve
- g. Section of limited access highway
 - 1) Conventional ramp entrance
 - a) Approach ramp at safe speed
 - b) Activate turn signal
 - c) Maintain safe ramp speed
 - d) Check rearview mirror prior to merge
 - e) Adjust speed to merge safely with traffic in acceleration lane

LESSON OUTLINE

INSTRUCTOR NOTES

- 2) Conventional ramp exit
 - a) Activate turn signal
 - b) Check rearview mirror
 - c) Steer into deceleration lane
 - d) Slow apparatus
 - e) Maintain control on exit ramp
- 3) Long stretch to allow lane changes
 - a) Activate turn signal
 - b) Check rearview mirror to make sure lane is clear
 - c) Gradually change lanes when safe to do so
- h. Downgrade that requires down shifting and braking
 - 1) Maintain safe speed on approach to downgrade
 - 2) Apply brakes to slow apparatus, if necessary
 - 3) Shift to next lower gear, if applicable
 - 4) Use grade retarder, if applicable
 - 5) Observe engine tachometer to prevent engine overspeeding
 - 6) Use brakes and shift to lower gear, if necessary
 - 7) Maintain control of apparatus
- i. Upgrade that requires shifting to maintain speed
 - 1) Maintain safe speed on approach to upgrade
 - 2) Accelerate when starting up hill
 - 3) Shift to next lower gear when speed slows, or engine rpms fall
 - 4) Change gears to maintain proper rpm
 - 5) Remain in proper lane

engine

LESSON OUTLINE

INSTRUCTOR NOTES

- j. Underpass or low clearance or bridge
 - 1) Approach underpass or bridge slowly
 - 2) Insure that clearance is adequate for apparatus
 - 3) Stop apparatus and check height, if not sure
 - 4) Spotter should be used
- 1.
- C. NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, Section 4-2
(Review NFPA 1500, Section 4-2) including the following paragraphs
 - 4-2.2
 - 4-2.3
 - 4-2.4
 - 4-2.5
 - 4-2.6
 - 4-2.7
 - 4-2.8
 - 4-2.9
 - 4-2.10

LESSON OUTLINE
INSTRUCTOR NOTES

2-3.1.1 Prerequisite Knowledge

A. Effect on vehicle control

1. Braking reaction time

- a. Speed directly affects time required to stop
- b. Driver should know stopping distances for specific apparatus

- 1) Total stopping distance: Sum of driver/operator reaction distance and vehicle braking distance
- 2) Reaction distance: distance traveled while driver transfers foot from accelerator to brake pedal after perceiving need to stop
- 3) Braking distance: distance vehicle travels from time brakes are applied until it comes to a complete stop

LESSON OUTLINE

INSTRUCTOR NOTES

2. Load (weight) factors
 - a. Loads must be considered by all drivers
 - b. Laws of physics
 - 1) When vehicle undergoes change in velocity of direction - transfer takes place relative to change
 - c. Position of weight has effect on vehicle
 - 1) The lower the weight the easier to control on turns
 - 2) The higher the weight the more the greater the potential for skidding or rollover
 - 3) Avoid high speed turns
 - 4) Steer smoothly to avoid abrupt changes
 - 5) Be extremely careful on slopes and hills
3. General steering reactions
 - A. Be alert to foresee situations in advance in order to prevent rapid steering movements and loss of control
 - B. Adjust speed for conditions to maintain control while maneuvering the vehicle
 - C. Keep both hands on the wheel at all times, except when shifting or using other controls
 - D. Hands should be positioned at ten and two o'clock
4. Speed
 - A. Adjust speed to compensate for conditions
 - 1) Weather
 - 2) Darkness
 - 3) Traffic
 - 4) Area

LESSON OUTLINE

INSTRUCTOR NOTES

5. Centrifugal force
 - A. Force which acts or impels an object out from a center of rotation.
 - B. Related factors
 - 1) Speed of travel
 - 2) Radius of curve
 - 3) Road and tire conditions
 - 4) Grade
 - 5) Superelevation (banked, flat, crowned)
- B. Applicable laws and regulations
 1. Identify all applicable laws related to the operation of emergency vehicles
 - a. Local
 - b. State
 - c. Federal
 2. Identify all applicable rules and regulations of the department
 3. General
 - a. Emergency vehicle operators are subject to all traffic regulations unless a specific exemption is made. Applied to emergency conditions only.
 - b. Legal decisions have held that driver/operators who do not obey state, local, or department regulations can be subject to criminal and civil prosecution if the apparatus is involved in an accident.
 - c. If the driver/operator is negligent and is involved in an accident, both the driver/operator and the department may be held responsible
 - d. Follow all laws regarding direction of travel, direction of turns, and parking unless under emergency conditions

LESSON OUTLINE

INSTRUCTOR NOTES

- e. Regardless of conditions - stop for school buses with flashing lights
- f. Obey all traffic laws and signals when returning to quarters

2-3.1.2 Prerequisite Skills

- A. Safe vehicle operation
- B. Operate passenger restraining devices
 - 1. Fasten seat belts
 - 2. Make sure that all personnel are seated and belted before moving apparatus

2-3.2 Use automotive gauges and controls

- A. Monitor gauges while operating the ARFF vehicle
- B. All applicable controls will be used during the performance of the driving and operations functions required by this standard

2-3.2.1 Prerequisite Knowledge

- A. Identification and operation of automotive gauges and proper operation limits
 - 1. Gauges are required to ensure proper operation of engine and components and to warn of malfunctions when gauges do not show normal operating ranges
 - 2. Necessary when under way and when operating on the fire ground
 - 3. Some gauges are duplicated
 - a. Dashboard
 - b. Pump panel
 - 4. Speedometer
 - a. Shows vehicle speed
 - 5. Odometer
 - a. Shows miles traveled
 - 6. Tachometer
 - a. Measures engine RPM (revolutions per minute)

LESSON OUTLINE

INSTRUCTOR NOTES

- b. Provides the driver/operator with information on how to operate the vehicle efficiently without harming the engine
 - c. Provides the driver/operator with information on engine operation when pumping
 - d. Provides an indication of safe operating limits of the engine
 - 1) Consult tech manuals for proper operating range
7. Oil pressure gauge
- a. Measures oil pressure
 - b. Indicates that oil is being supplied to the engine at the proper pressure
 - c. Normal operating pressures are specified in operations and maintenance manuals
 - d. Significant deviations from normal pressures is an indication of a problem
 - e. Consult tech manuals for proper operating range
- P-19 10-30 psi @ idle
8. Ammeter
- a. Measures and shows the amount of current drawn from the battery to operate electrical equipment, or the amount of current being supplied to the battery for charging
 - b. Consult tech manuals for proper operating range
9. Voltmeter
- a. Indicates battery conditions - low or high
 - b. Provides a relative indications of battery condition by showing the amount of drop in voltage that is measured when some of the more demanding electrical accessories are used.
 - c. Indicates the top voltage available when the battery is fully charged

range

range

LESSON OUTLINE

INSTRUCTOR NOTES

- range
- d. Consult tech manuals for proper operating
10. Air pressure gauge
- a. Indicates air pressure available to operate air brakes
 - b. Consult tech manuals for proper operating
- range
11. Water temperature gauge
- a. Indicates temperature of engine coolant
 - b. Provides an indication of when the engine is overheating
 - c. Consult tech manuals for proper operating
- range
- P-19 160-190° F
12. Fuel gauge
- a. Indicates the level of fuel in the tank
13. Transmission oil temperature
- a. Shows temperate of transmission oil
 - b. Temperature should not exceed 250° F
- 2-3.2.2 Prerequisite Skills
- A. Operate vehicle controls
- 1. Set parking brake knob to apply brakes
 - 2. Place transmission gear selector in neutral
 - 3. Turn master switch on
 - 4. Turn on ignition switch
 - 5. Engage starter switch
 - 6. After start-up observe engine gauges and warning lights for proper readings
 - 1) Run engine at 800 to 1,000 rpm to obtain proper operating temperatures and gauge readings
 - 7. Turn on all necessary lights, communications equipment, and warning equipment
 - 8. Select proper gear range
 - 9. Move vehicle forward
 - 10. Come to a complete stop
 - 11. Shift into reverse

12. Come to a complete stop

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LESSON OUTLINE

INSTRUCTOR NOTES

13. Place transmission selector in neutral
 14. Apply parking brake
 15. Allow engine to idle for at least 2 minutes before shut down
 16. Reduce engine speed to low idle
 17. Shut off all lights and other equipment
 18. Turn ignition switch off
 19. Place electrical master switch in the off position
- 2-3.3 Back a fire department vehicle from a roadway
- A. Into a restricted space on right and left side
 1. Measures driver/operators ability to drive past a space and to back the apparatus into the space without having to stop and pull forward
 2. Spotter must be used
 3. Restricted space 12 ft in width
 4. Exercise requires a 90 degree right and left hand turns from roadway
 5. Vehicle must be parked
 - a. Without having to stop and pull forward
 - b. Without striking obstructions
 6. Steps
 - a. Driver/operator should drive forward and pass the dock on the left
 - b. Stop the apparatus
 - c. Back the apparatus into the dock
 - d. Repeat the steps by driving forward with the dock on the right

LESSON OUTLINE

INSTRUCTOR NOTES

2-3.3.1 Prerequisite Knowledge

- A. Vehicle dimensions P-19
 1. Length 325 inches
 2. Width 96 inches
 3. Wheel base 170 inches
 4. Overall height 120 inches
- B. Turning characteristics
 1. Turning circle 80 feet

2-3.3.2 Prerequisite Skills

- A. Use mirrors for backing
 1. Make sure all mirrors are adjusted properly
 2. Sit straight with both hands on the steering wheel
 3. Move head from side to side to check mirrors
 4. Make sure that you can see the spotter
 5. Back apparatus following the directions of the spotter
 6. If you cannot see the spotter - stop
 7. Check each mirror from time to time while backing, but always look for the spotter.

2-3.4 Maneuver a fire department vehicle around obstructions

- A. Measures ability to steer apparatus in close limits without stopping
- B. Spotter must be used
- C. On a roadway around obstructions
- D. Move in forward and reverse
- E. Maneuver through obstructions without
 1. Stopping to change direction of travel
 2. Striking obstructions

LESSON OUTLINE

INSTRUCTOR NOTES

- G. Steps
 1. Drive apparatus forward in a straight line with the markers on the left
 2. Stop the apparatus just beyond the last marker
 3. Back the apparatus between the markers by passing to the left of marker number 1, to the right of marker number 2 and the left of marker number 3
 4. After clearing marker number 3 stop the apparatus
 5. Drive forward between the markers leaving marker number three on the left, marker number 2 on the right and marker 3 on the left
- 2-3.5 Turn a fire department vehicle 180 degrees within a confined space
 - A. Measures driver/operators ability to turn apparatus around in a confined space
 - B. Spotter must be used
 - C. Vehicle must be stopped and backed up to complete turn
 - D. Continuous U-turn is not allowed
 - E. Vehicle must be turned 180 degrees without striking obstructions within an area measuring 50 ft x 100 ft
 - F. Steps
 1. Move apparatus through 12 ft opening in one of the 50 ft legs
 2. Turn the apparatus 180 degrees and return through the same opening
 3. No limitation on the number of times the vehicle may be maneuvered

LESSON OUTLINE

INSTRUCTOR NOTES

- 2-3.6 Maneuver fire department vehicle in areas with restricted horizontal and vertical clearances
 - A. Measures driver/operators ability to steer apparatus in a straight line, judge distances from wheel to object, and stop on a finish line.
 - B. Operator accurately judges ability of vehicle to pass through openings
 - C. Operator accurately judges ability of vehicle so that no obstructions are struck
 - D. Steps
 - 1. Drive forward through the prop without striking anything
 - 2. Drive is reverse through the prop without striking anything
- 2-3.8 Operate systems and equipment
 - A. Operate in accordance with
 - 1. Manufacturers instructions and specifications
 - 2. Department policies and procedures
 - B. Systems
 - 1. Set relief valve
 - a. Pump in operation
 - b. All lines flowing at desired flow rate
 - c. Set relief valve at desired relief pressure
 - d. Check to make sure discharge pressure is maintained
 - 2. Set pressure governor
 - a. Set governor for desired discharge pressure
 - b. Check to make sure discharge pressure is maintained
 - C. Equipment
 - 1. Operate each piece of equipment that is carried.

LESSON OUTLINE

INSTRUCTOR NOTES

2-3.6.1 Prerequisite Skills

- A. Judging vehicle clearances
 - 1. Skill development
 - a. Practice judging distances while driving and maneuvering at slow speeds.
 - b. Stop periodically get out of vehicle and look at actual distances
 - c. Perform maneuvers that will develop skill at judging distance to the:
 - 1) Front
 - 2) Back
 - 3) Height
 - 4) Width/sides
 - d. Use spotter

REVIEW

- I. Discuss key lesson points.
- II. Ask questions on the material covered.
- III. Review material that may be unclear.
- IV. Administer test or quiz.
- V. Critique test or quiz.

SUMMARY

- I. Summarize what has been covered.
- II. Relate what has been covered to the next lesson.

DOD FIRE SERVICE CERTIFICATION SYSTEM

LESSON PLAN 3

Personnel Classification: Apparatus Driver/Operator - Aircraft Rescue Fire Fighting Apparatus

Subject: ARFF Vehicles - General

NFPA 1002 Objectives

7-1.2

7-1.3

7-1.4

7-1.5

Training Materials/Equipment:

Fully equipped and operational ARFF vehicle.

References:

NFPA 1002: Fire Vehicle Operator Professional Qualifications, 1993 National Fire Protection Association, Quincy, Massachusetts

NFPA 414: Standard for Aircraft Rescue and Fire Fighting Vehicles, 1995 National Fire Protection Association, Quincy, Massachusetts.

NFPA 1500: Standard on Fire Department Occupational Safety and Health Programs, 1992 National Fire Protection Association, Quincy, Massachusetts

IFSTA, Aircraft Fire Protection and Rescue Procedures, 2nd Edition, 1992, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Department Pumping Apparatus, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Stream Practices, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Water Supplies for Fire Protection, 4th Edition, 1988, Fire Protection Publications, Oklahoma State University.

Technical Manual: Aircraft Crash and Structural Fire Fighting Truck (P-19, P-19A, P-19B) (TO 36A12-8-17-1, TM 08674A-10/1, TM 5-2410-219-10, NAVFAC P-8-262.16-1), 16 June 1984, Departments of the Air Force, Army, and Navy, Washington, D.C.

NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual (NAVAIR 00-80R-14). 1 May 1988, Naval Air Technical Services, Philadelphia, Pennsylvania

Aircraft Emergency Rescue Information
(Fire Protection)
T.O. 003-105E-9
15 May 1995
Warner Robins AFB, GA

Additional Information:

Applicable Technical Manuals

IFSTA Pumping Apparatus Series Videotapes, Fire Protection Publications, Oklahoma State University

Instructor Tasks

- ¥ Review lesson outline to ensure understanding of contents and procedures.
- ¥ Review references for lesson.
- ¥ Use additional references and your knowledge to enrich lesson outline.
- ¥ Select and prepare any additional audio-visual aids that may assist in the presentation of the lesson.
- ¥ Ensure that all equipment needed, including any audio-visual equipment, is available.
- ¥ Review lesson at end of session to ensure student understanding.
- ¥ Ensure that the topics and objectives of the lesson have been adequately covered

INTRODUCTION AND OBJECTIVES

- I. Greet class
- II. State purpose of the lesson
- III. Establish relation to previous and following lessons
- IV. Review NFPA 1002 objectives for this lesson
- V. Review any additional materials for this lesson

PRESENTATION

LESSON OUTLINE

INSTRUCTOR NOTES

- 7-1.2 Perform routine tests, inspections and service functions
- A. Agent dispensing systems (foam)
 - 1. Check level of foam agent tank
 - 2. Check foam piping for leaks
 - 3. Check operation of roof turret
 - a. Pattern control lever
 - b. Rotation control lever
 - 4. Check operation of bumper turret
 - a. Check directional control handle
 - b. Check oscillation of turret
 - c. Check pattern control lever
 - 5. Check hoseline and nozzle
 - B. Secondary extinguishing systems (halon)
 - 1. Check condition of tanks, hoses, and parts
 - 2. Check nitrogen cylinder pressure
 - a. Read pressure gauge
 - b. Gauge should read between 1750 - 2215 psi at 70° F
 - c. Recharge if below 1700 psi at 70° F
 - d. Check halon level gauge.
 - e. Should be above mark at 70° F

LESSON OUTLINE

INSTRUCTOR NOTES

- f. Check valves
 - 1) Vent valve - normally closed
 - 2) Tank valve - normally open
 - 3) Hose clean out valve - normally closed
 - 4) Quick-Opening nitrogen cylinder valve normally closed
 - 5) Halon valve - normally closed
 - 6) Check hose and nozzle
 - 7) Check all halon hose connections
- 7-1.3 Practical driving exercises
 - See Lesson Plan 2, 2-3.3 through 2-3.6
- 7-1.4 Operate fire department vehicle over predetermined route under the following conditions
 - See Lesson Plan 2, 2-3.1
- 7-1.5 Operate fire department vehicle over predetermined route - unimproved surface
 - A. Loose or wet soil
 - 1. Approach area slowly
 - 2. Engage all wheel drive prior to entering area
 - 3. Maintain safe continuous speed
 - B. Steep grades (30 percent fore and aft)
 - 1. Maintain safe speed
 - 2. Continually monitor vehicles motion
 - 3. Do not stop while on grade
 - C. Limited sight distance
 - 1. Reduce speed to compensate for sight distance
 - 2. Do not drive beyond stopping capabilities
 - D. Vehicle clearance obstacles - undercarriage
 - 1. Insure terrain is passable
 - 2. Use spotter to check for clearance
 - 3. Adjust speed for conditions
 - 4. Do not harm the apparatus
 - E. Side slopes (20 percent side to side)
 - 1. Monitor speed
 - 2. Monitor indicators

REVIEW

- I. Discuss key lesson points.
- II. Ask questions on the material covered.
- III. Review material that may be unclear.
- IV. Administer test or quiz.
- V. Critique test or quiz.

SUMMARY

- I. Summarize what has been covered.
- II. Relate what has been covered to the next lesson.

DOD FIRE SERVICE CERTIFICATION SYSTEM

LESSON PLAN 4

Personnel Classification: Apparatus Driver/Operator - Aircraft Rescue Fire Fighting Apparatus

Subject: Water Supply

NFPA 1002 Objectives

7-2

Training Materials/Equipment:

ARFF vehicle, service records used by the agency, including fire apparatus history card

References:

NFPA 1002: Fire Vehicle Operator Professional Qualifications, 1993 National Fire Protection Association, Quincy, Massachusetts

NFPA 414: Standard for Aircraft Rescue and Fire Fighting Vehicles, 1995 National Fire Protection Association, Quincy, Massachusetts.

NFPA 1500: Standard on Fire Department Occupational Safety and Health Programs. 1992 National Fire Protection Association, Quincy, Massachusetts

IFSTA, Aircraft Fire Protection and Rescue Procedures, 2nd Edition, 1992, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Department Pumping Apparatus, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Stream Practices, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Water Supplies for Fire Protection, 4th Edition, 1988, Fire Protection Publications, Oklahoma State University.

Technical Manual: Aircraft Crash and Structural Fire Fighting Truck (P-19, P-19A, P-19B) (TO 36A12-8-17-1, TM 08674A-10/1, TM 5-2410-219-10, NAVFAC P-8-262.16-1), 16 June 1984, Departments of the Air Force, Army, and Navy, Washington, D.C.

NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual (NAVAIR 00-80R-14). 1 May 1988, Naval Air Technical Services, Philadelphia, Pennsylvania

Aircraft Emergency Rescue Information
(Fire Protection)
T.O. 003-105E-9
15 May 1995
Warner Robins AFB, GA

Additional Information:

Applicable Technical Manuals

IFSTA Pumping Apparatus Series Videotapes, Fire Protection Publications, Oklahoma State University

Instructor Tasks

- ¥ Review lesson outline to ensure understanding of contents and procedures.
- ¥ Review references for lesson.
- ¥ Use additional references and your knowledge to enrich lesson outline.
- ¥ Select and prepare any additional audio-visual aids that may assist in the presentation of the lesson.
- ¥ Ensure that all equipment needed, including any audio-visual equipment, is available.
- ¥ Review lesson at end of session to ensure student understanding.
- ¥ Ensure that the topics and objectives of the lesson have been adequately covered

INTRODUCTION AND OBJECTIVES

- I. Greet class
- II. State purpose of the lesson
- III. Establish relation to previous and following lessons
- IV. Review NFPA 1002 objectives for this lesson
- V. Review any additional materials for this lesson

PRESENTATION

LESSON OUTLINE

INSTRUCTOR NOTES

- 7-2 Determine duration of fire flow based on
- A. P19 Fire Fighting System
 - 1. 1,000 gallons of water
 - 2. 130 gallons of foam concentrate
 - 3. 950 gpm pump
 - 4. 3% or 6% foam proportioning system
 - 5. Roof turret 500 gpm
 - 6. Bumper turret 250 gpm
 - 7. Handline 60 gpm
 - 8. Duration of pumping system
 - a. Roof turret only
 - 1) 500 gpm
 - 2) 1,000 gallons of water
 - 3) 2 minutes
 - b. Bumper turret
 - 1) 250 gpm
 - 2) 1,000 gallons of water
 - 3) 4 minutes
 - c. Combined totals
 - 1) Roof turret, bumper turret, handline
 - 2) $500 \text{ gpm} + 250 \text{ gpm} + 60 \text{ gpm} = 810 \text{ gpm}$
 - 3) $1000 \text{ gallons} / 810 \text{ gpm} = 1.2 \text{ minutes}$
 - 9. Halon system
 - a. 500 lb. of halon 1211
 - b. Handline nozzle 5 lb. per second
 - c. Duration 1 minute 40 seconds

LESSON OUTLINE

INSTRUCTOR NOTES

- B. Rate of discharge - internal supplies
1. Water
 - a. Determine length of time the P19 can discharge water using roof turret only
 - 1) $1000 \text{ gal} / 500 \text{ gpm} = 2 \text{ minutes}$
 - b. Determine length of time the P19 can discharge water using roof and bumper turret using the internal water supply
 - 1) $1000 \text{ gal} / 500 + 250 \text{ gpm} = 1.3 \text{ minutes}$
 - c. Determine length of time the P19 can discharge water using roof, bumper turret, and handline
 - 1) $1000 \text{ gal} / 500 + 250 + 60 \text{ gpm} = 1.2 \text{ min.}$
 2. Foam
 - a. Determine how long the 130 gallons of foam concentrate will last while discharging the roof turret when proportioning at 3%
 - 1) discharge rate of 500 gpm
 - 2) 3% of 500 = 15 gallons foam
 - 3) 15 gpm of foam concentrate per minute
 - 4) $130 \text{ gallons} / 15 \text{ gpm} = 8.6 \text{ minutes}$
 - 5) $8.66 \text{ minutes} \times 500 \text{ gpm} = 4,330 \text{ gal}$
 - b. Determine how long the 130 gallons of foam concentrate will last while discharging the roof and bumper turret when proportioning at 6%
 - 1) discharge rate of 750 gpm
 - 2) 6% of 750 = 45 gallons foam
 - 3) 45 gpm of foam concentrate per minute
 - 4) $130 \text{ gallons} / 45 \text{ gpm} = 2.8 \text{ minutes}$
 - 5) $2.88 \text{ minutes} \times 750 \text{ gpm} = 2160 \text{ gal}$

LESSON OUTLINE

INSTRUCTOR NOTES

3. Halon
- a. Determine maximum discharge time
 - 1) 500 lb. carried
 - 2) 5 lb./second handline discharge rate
 - 3) $500 \text{ lb.} / 5 \text{ lb./sec} = 100 \text{ seconds}$
 - 4) $100 \text{ seconds} / 60 \text{ seconds/min.} = 1.6$
min.
 - 5) maximum time at full discharge
- C. Rate of discharge - external supply
- 1. Water
 - a. Determine length of time the P19 can discharge water using roof turret only
 - b. Source of external water available at 700 gpm for 30 minutes
 - c. $700 \text{ gpm} \times 30 \text{ minutes} = 21,000 \text{ gallons}$
 - 1) $21,000 \text{ gal} / 500 \text{ gpm} = 42 \text{ minutes}$
 - d. Determine length of time the P19 can discharge water using roof and bumper turret using the same external water supply
 - 1) $21,000 \text{ gal} / 500 + 250 \text{ gpm} = 28 \text{ minutes}$
 - e. Determine length of time the P19 can discharge water using roof, bumper turret, and handline using the same external water source
 - 1) $21,000 \text{ gal} / 500 + 250 + 60 \text{ gpm} = 26 \text{ min.}$

REVIEW

- I. Discuss key lesson points.
- II. Ask questions on the material covered.
- III. Review material that may be unclear.
- IV. Administer test or quiz.
- V. Critique test or quiz.

SUMMARY

- I. Summarize what has been covered.
- II. Relate what has been covered to the next lesson.

DOD FIRE SERVICE CERTIFICATION SYSTEM

LESSON PLAN 5

Personnel Classification: Apparatus Driver/Operator - Aircraft Rescue Fire Fighting Apparatus

Subject: Operations

NFPA 1002 Objectives

7-3
7-3.1
7-3.2
7-3.3
7-3.4
7-3.4.1

Training Materials/Equipment:

ARFF vehicle, service records used by the agency, including fire apparatus history card

References:

NFPA 1002: Fire Vehicle Operator Professional Qualifications, 1993 National Fire Protection Association, Quincy, Massachusetts

NFPA 403: Standard for Aircraft Rescue and Fire Fighting Services at Airports, 1993 National Fire Protection Association, Quincy, Massachusetts.

NFPA 414: Standard for Aircraft Rescue and Fire Fighting Vehicles, 1995 National Fire Protection Association, Quincy, Massachusetts.

NFPA 1500: Standard on Fire Department Occupational Safety and Health Programs. 1992 National Fire Protection Association, Quincy, Massachusetts

IFSTA, Aircraft Fire Protection and Rescue Procedures, 2nd Edition, 1992, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Department Pumping Apparatus, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Stream Practices, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Water Supplies for Fire Protection, 4th Edition, 1988, Fire Protection Publications, Oklahoma State University.

Technical Manual: Aircraft Crash and Structural Fire Fighting Truck (P-19, P-19A, P-19B) (TO 36A12-8-17-1, TM 08674A-10/1, TM 5-2410-219-10, NAVFAC P-8-262.16-1), 16 June 1984, Departments of the Air Force, Army, and Navy, Washington, D.C.

NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual (NAVAIR 00-80R-14). 1 May 1988, Naval Air Technical Services, Philadelphia, Pennsylvania

Aircraft Emergency Rescue Information
(Fire Protection)
T.O. 003-105E-9
15 May 1995
Warner Robins AFB, GA

Additional Information:

Applicable Technical Manuals

IFSTA Pumping Apparatus Series Videotapes, Fire Protection Publications, Oklahoma State University

Instructor Tasks

- ¥ Review lesson outline to ensure understanding of contents and procedures.
- ¥ Review references for lesson.
- ¥ Use additional references and your knowledge to enrich lesson outline.
- ¥ Select and prepare any additional audio-visual aids that may assist in the presentation of the lesson.
- ¥ Ensure that all equipment needed, including any audio-visual equipment, is available.
- ¥ Review lesson at end of session to ensure student understanding.
- ¥ Ensure that the topics and objectives of the lesson have been adequately covered.

INTRODUCTION AND OBJECTIVES

- I. Greet class
- II. State purpose of the lesson
- III. Establish relation to previous and following lessons
- IV. Review NFPA 1002 objectives for this lesson
- V. Review any additional materials for this lesson

PRESENTATION

LESSON OUTLINE

INSTRUCTOR NOTES

- | | |
|---|--|
| <p>7-3 Produce effective fire stream</p> <ol style="list-style-type: none">A. Produce an effective fire stream using the following sources<ol style="list-style-type: none">1. Internal tank2. Pressurized source3. Static sourceB. For each of the items listed above the:<ol style="list-style-type: none">1. Pump must be safely engaged2. The vehicle safety devices are set3. Turrets are properly deployed4. Agent is delivered to the target5. Agent is delivered at the proper rate6. Rate of discharge determined7. Apparatus is monitored for potential problems | |
|---|--|

LESSON OUTLINE

INSTRUCTOR NOTES

7-3.1 Prerequisite Knowledge

- A. Principles of:
 - 1. Agent management
 - 2. Agent application rate
 - a. Based on requirements of NFPA 403
 - 1) Rate for AFFF is 0.13 gpm/ft²
 - 2) See NFPA 403 Appendix for information on calculating the total water requirements for an aircraft of a specific size
 - b. Density of foam (AFFF)
 - 1) Based on proportioning rates
 - a) 3% or 6%
 - 2) Raindrop effect
 - a) Covers area at rate and density required for bleeding effect to occur
- B. Effects of:
 - 1. Wind on agent management
 - a. Wind will affect aerial streams
 - b. Wind may affect blanketing
 - 2. Terrain on agent applications
 - a. Terrain may affect blanketing
- C. Turrets
 - 1. Capabilities and limitations
 - a. Flow
 - b. Reach
- D. Tower light signals
 - 1. Flashing green light - clear to proceed across or down runway
 - 2. Steady red - Stop
 - 3. Flashing red or flashing runway - clear active runway or landing area immediately
 - 4. Flashing white - return to fire station or starting point

LESSON OUTLINE

INSTRUCTOR NOTES

- 5. Alternating green/red flashing
 - a. General warning
 - b. Exercise extreme caution
- E. Airport markings
 - 1. Runway and taxiway lighting
 - a. Blue - taxiways
 - b. White
 - 1) Outline edges of runway
 - 2) Centerline of runway
 - c. Green
 - 1) Approach end of runways
 - 2) Taxiway centerlines
 - d. Red - marks obstructions
 - 1) Structures
 - 2) Parked aircraft
 - 3)1 Construction work
 - e. Amber - Hold bars which require permission from control tower to cross
 - 2. Markings
 - a. White
 - 1) Runway identifier numbers/letters
 - 2) Landing zone bars
 - 3) Centerline stripes
 - b. Yellow
 - 1) Hold bars
 - 2) Taxiways
- F. Aircraft recognition
 - 1. Military aircraft
 - a. NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual (NAVAIR 00-80R-14). 1 May 1988, Naval Air Technical Services, Philadelphia, Pennsylvania
 - b. Aircraft Emergency Rescue Information (Fire Protection) T.O. 003-105E-9 15 May 1995 Warner Robins AFB, GA

LESSON OUTLINE

INSTRUCTOR NOTES

G. Aircraft danger areas

1. Based on the type of aircraft
2. Military aircraft

NATOPS U.S. Navy Aircraft Firefighting and
Rescue Manual (NAVAIR 00-80R-14).
1 May 1988, Naval Air Technical Services,
Philadelphia, Pennsylvania

3. Aircraft Emergency Rescue Information
(Fire Protection)
T.O. 003-105E-9
15 May 1995
Warner Robins AFB, GA

LESSON OUTLINE

INSTRUCTOR NOTES

- H. Critical fire areas
 - 1. Based on the type of aircraft
NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual (NAVAIR 00-80R-14).
1 May 1988, Naval Air Technical Services,
Philadelphia, Pennsylvania
 - I. Aircraft entry points and egress points
 - 1. Based on the type of aircraft
NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual (NAVAIR 00-80R-14).
1 May 1988, Naval Air Technical Services,
Philadelphia, Pennsylvania
- 7-3.2 Prerequisite Skills
- A. Method(s) of providing the pump with power
 - 1. In the cab procedures
 - a. Move Agent Selector Valve to:
 - 1) Water or
 - 2) Foam
 - b. Open any discharge valve
 - c. Observe Pump Engaged Light
 - 2. Structural panel (if applicable)
 - a. Structural panel control switch
 - 1) Located on structural panel
- 7-3.3 Safely modulating the vehicle, both forward and reverse operating the pump
- A. Discharge roof turret at maximum capacity of 500 gpm
 - B. Discharge at designated target
 - 1. Safely engage the pump
 - 2. Deliver agent to intended target
 - 3. Monitor vehicle for safe operation

LESSON OUTLINE

INSTRUCTOR NOTES

- A. Drive the vehicle to designated point
 - 1. Never proceed until commanded by officer in charge
 - 2. Safely operate vehicle and maneuver turns
 - 3. Control the vehicle at all times
 - a. While speed is essential to any emergency procedure, response of fire fighting vehicles must be tempered with discretion
 - b. Control must be maintained with consideration given to conditions such as weather, visibility, terrain, traffic, and other existing situations
 - c. Promptness and safety are both objects of response
- B. Engage pump system to begin fire fighting operation
 - 1. Engage the pump briefly with a short burst at least 1,000 ft. from designated point to make certain pump system is operational
 - a. This will prevent safety hazard of approaching a crash site without operational agent delivery systems
 - b. Agent can be applied by turrets or bumper-turrets, which are operated from inside cab
 - c. Operation of turrets may be either manual or by remote control; should have varied discharge patterns from straight streams to fog patterns
 - 2. Discharge agent as soon as CFR vehicle is within range of the designated point
- C. Stopping, moving forward, reversing, and moving the CFR vehicle forward again while continuing to discharge agent
 - 1. Do not interrupt agent flow while repositioning
 - 2. The power divider enables a CFR vehicle to maintain agent flow no matter which direction truck is moving or whether it is stopped

LESSON OUTLINE

INSTRUCTOR NOTES

7-3.4 Given a description and location of an incident involving the largest aircraft assigned

- A. Maneuver and position the ARFF vehicle
 - 1. For safe operation
 - 2. Properly position at each operational point on the aircraft
 - a. Position depends upon type of aircraft

7-3.4.1 Prerequisite Skills

- A. Vehicle positioning for fire fighting
 - 1. First vehicle on scene
 - 2. Second vehicle on scene
 - 3. Follow-on vehicles
- B. Vehicle positioning for rescue operation
 - 1. Maintain optimum view

REVIEW

- I. Discuss key lesson points.
- II. Ask questions on the material covered.
- III. Review material that may be unclear.
- IV. Administer test or quiz.
- V. Critique test or quiz.

SUMMARY

- I. Summarize what has been covered.
- II. Relate what has been covered to the next lesson.

DOD FIRE SERVICE CERTIFICATION SYSTEM

LESSON PLAN 6

Personnel Classification: Apparatus Driver/Operator - Airport Rescue Fire Fighting

Subject: Principles of Hydraulics

NFPA 1002 Objectives

- 7-4 *The ARFF Driver/Operator shall identify the following terms that relate to the basic principles of fire service hydraulics.*
- | | |
|---------------------------------|---------------------------|
| 1. Atmospheric pressure | 8. Net engine pressure |
| 2. Capacity | 9. Nozzle reaction |
| 3. Displacement | 10. Pound per square inch |
| 4. Flow (gpm) | 11. Pump discharge |
| 5. Friction Loss | 12. Vacuum |
| 6. Head pressure (gain or loss) | 13. Velocity |
| 7. Hydrant pressure | 14. Water hammer |

psi

pressure

Training Materials/Equipment:

ARFF vehicle, service records used by the agency, including fire apparatus history card

References:

NFPA 1002: Fire Vehicle Operator Professional Qualifications, 1993 National Fire Protection Association, Quincy, Massachusetts

NFPA 414: Standard for Aircraft Rescue and Fire Fighting Vehicles, 1995 National Fire Protection Association, Quincy, Massachusetts.

NFPA 1500: Standard on Fire Department Occupational Safety and Health Programs, 1992 National Fire Protection Association, Quincy, Massachusetts

IFSTA, Aircraft Fire Protection and Rescue Procedures, 2nd Edition, 1992, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Department Pumping Apparatus, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Stream Practices, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Water Supplies For Fire Protection, 4th Edition, 1988, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Service Orientation and Terminology, 3rd Edition, 1993, Fire Protection Publications, Oklahoma State University.

Technical Manual: Aircraft Crash and Structural Fire Fighting Truck (P-19, P-19A, P-19B) (TO 36A12-8-17-1, TM 08674A-10/1, TM 5-2410-219-10, NAVFAC P-8-262.16-1), 16 June 1984, Departments of the Air Force, Army, and Navy, Washington, D.C.

Additional Information:

Applicable Technical Manuals

IFSTA Pumping Apparatus Series Videotapes, Fire Protection Publications, Oklahoma State University

Instructor Tasks

- ¥ Review lesson outline to ensure understanding of contents and procedures.
- ¥ Review references for lesson.
- ¥ Use additional references and your knowledge to enrich lesson outline.
- ¥ Select and prepare any additional audio-visual aids that may assist in the presentation of the lesson.
- ¥ Ensure that all equipment needed, including any audio-visual equipment, is available.
- ¥ Review lesson at end of session to ensure student understanding.
- ¥ Ensure that the topics and objectives of the lesson have been adequately covered.

INTRODUCTION AND OBJECTIVES

- I. Greet class
- II. State purpose of the lesson
- III. Establish relation to previous and following lessons
- IV. Review NFPA 1002 objectives for this lesson
- V. Review any additional materials for this lesson

PRESENTATION

NOTES	LESSON OUTLINE	INSTRUCTOR
7-4 the distribution of the	<ul style="list-style-type: none">A. Identify the following terms<ul style="list-style-type: none">1. Atmospheric pressure<ul style="list-style-type: none">a. The pressure exerted by the atmosphere at the surface of the earth.b. Atmospheric pressure at sea level is about 14.7 psi2. Capacity<ul style="list-style-type: none">a. Maximum ability of a pump or water system to deliver waterb. Fire pumps are rated for capacity at a specific pressurec. Most apparatus pumps are rated for maximum capacity at 150 psi3. Displacement<ul style="list-style-type: none">a. Volume or weight of a fluid displaced by a floating body of equal weightb. Amount of water forced into a pump thus displacing air4. Flow (gpm)<ul style="list-style-type: none">a. Motion characteristic of waterb. Amount of water measured in gallons per minute5. Friction Loss<ul style="list-style-type: none">a. Loss of pressure created by the turbulence of water moving against the interior walls of the hose or pipe	

NOTES

LESSON OUTLINE

INSTRUCTOR

- 6. Head pressure (gain or loss)
 - a. Water pressure due to elevation
 - b. Pressure exerted by a stationary column of water
 - c. A stationary column of water 1 foot high exerts a pressure of 0.434 psi
- 7. Hydrant pressure
 - a. The amount of water pressure in a hydrant
- 8. Net engine pressure
 - a. Actual amount of pressure being produced by the pump
 - b. When taking water from a hydrant the net engine pressure is the difference between the intake pressure and the discharge pressure
 - c. When taking draft it is the sum of the intake pressure and the discharge pressure
 - d. Calculation when supplied by a hydrant
 - 1) $NPDP_{HYD} = PDP$ minus intake reading
 - 2) $NPDP_{HYD} =$ Net pump discharge pressure at hydrant
 - 3) $PDP =$ Pump discharge pressure
 - e. Calculation when drafting
 - 1) Pressure correction (PC)
 $PC = \text{lift} + \text{total intake hose friction loss}/2.3$
 - 2) $PC =$ pressure correction in psi
 - 3) $\text{Lift} =$ height from water to pump
 - 4) Intake hose friction loss = obtain from table (IFSTA Fire Streams)
 - 5) 2.3 = factor
 - 6) Result is used in NPDP formula
 - 7) $NPDP_{Draft} = PDP +$ Pressure correction

between the
discharge pressure

intake

correction

- 8) $NPDP_{Draft}$ = Net pump discharge pressure at draft
- 9) PDP = Pump discharge pressure

NOTES

LESSON OUTLINE

INSTRUCTOR

of

- 9. Nozzle reaction
 - a. Reaction produced as a result of the velocity the water discharging from a nozzle
 - b. The greater the nozzle discharge pressure the greater the nozzle reaction
 - c. Calculation for solid stream nozzles
 - 1) $NR = 1.57 d^2 NP$
 - 2) NR = Nozzle reaction in pounds
 - 3) 1.57 = constant
 - 4) d = diameter of the nozzle
 - 5) NP = nozzle pressure in psi
 - d. Calculation for fog stream nozzles
 - 1) $NR = 0.0505 Q NP$
 - 2) NR = Nozzle reaction in pounds
 - 3) 0.0505 = constant
 - 4) Q = flow in gpm
 - 5) NP = nozzle pressure in psi

fire pumps

- 10. Pound per square inch (psi)
 - a. Unit for measuring pressure
 - b. Used for measuring pressure in hydraulic systems including water supplies and

and

- 11. Pump discharge pressure
 - a. The pressure of water as it leaves the pump enters the hoseline
 - b. Pressure measured on the discharge side of pump

the

- 12. Vacuum
 - a. Space devoid of matter or pressure
 - b. Less than atmospheric pressure
 - c. Vacuum is required in fire pump to initiate drafting water from a static source

NOTES

LESSON OUTLINE

INSTRUCTOR

- 13. Velocity
 - a. Speed
 - b. Rate of motion in a given direction
 - c. Measured in feet per second or miles per hour
 - d. Used in the study of hydraulics - feet per second

- 14. Water hammer
 - a. Resulting force created by the rapid deceleration of water in a hose or pipe system
 - b. Caused by the rapid closing of valves or nozzles

REVIEW

- I. Discuss key lesson points.
- II. Ask questions on the material covered.
- III. Review material that may be unclear.
- IV. Administer test or quiz.
- V. Critique test or quiz.

SUMMARY

- I. Summarize what has been covered.
- II. Relate what has been covered to the next lesson.

DOD FIRE SERVICE CERTIFICATION SYSTEM

LESSON PLAN 7

Personnel Classification: Apparatus Driver/Operator - Aircraft Rescue Fire Fighting Apparatus

Subject: Apparatus Systems

NFPA 1002 Objectives

7-5 The ARFF Driver/Operator shall identify the theory and principle of systems.

7-5.1 The ARFF Driver/Operator shall identify the theory and principles of pressure relief systems and pressure control governors.

7-5.2 The ARFF Driver/Operator shall identify the auxiliary cooling system and/or winterization system if so equipped).

Training Materials/Equipment:

ARFF vehicle, service records used by the agency, including fire apparatus history card

References:

NFPA 1002: Fire Vehicle Operator Professional Qualifications, 1993 National Fire Protection Association, Quincy, Massachusetts

NFPA 414: Standard for Aircraft Rescue and Fire Fighting Vehicles, 1995 National Fire Protection Association, Quincy, Massachusetts.

NFPA 1500: Standard on Fire Department Occupational Safety and Health Programs

IFSTA, Aircraft Fire Protection and Rescue Procedures, 2nd Edition, 1992, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Department Pumping Apparatus, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Fire Stream Practices, 7th Edition, 1989, Fire Protection Publications, Oklahoma State University.

IFSTA, Water Supplies For Fire Protection, 4th Edition, 1988, Fire Protection Publications, Oklahoma State University.

Technical Manual: Aircraft Crash and Structural Fire Fighting Truck P-19, P-19A, P-19B) TO 36A12-8-17-1, TM 08674A-10/1, TM 5-2410-219-10, NAVFAC P-8-262.16-1), 16 June 1984, Departments of the Air Force, Army, and Navy, Washington, D.C.

NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual (NAVAIR 00-80R-14). 1 May 1988, Naval Air Technical Services, Philadelphia, Pennsylvania.

Aircraft Emergency Rescue Information
(Fire Protection)
T.O. 003-105E-9
15 May 1995
Warner Robins AFB, GA

Additional Information:

Applicable Technical Manuals

IFSTA Pumping Apparatus Series Videotapes, Fire Protection Publications, Oklahoma State University

Instructor Tasks

- ¥ Review lesson outline to ensure understanding of contents and procedures.
- ¥ Review references for lesson.
- ¥ Use additional references and your knowledge to enrich lesson outline.
- ¥ Select and prepare any additional audio-visual aids that may assist in the presentation of the lesson.
- ¥ Ensure that all equipment needed, including any audio-visual equipment, is available.
- ¥ Review lesson at end of session to ensure student understanding.
- ¥ Ensure that the topics and objectives of the lesson have been adequately covered.

INTRODUCTION AND OBJECTIVES

- I. Greet class
- II. State purpose of the lesson
- III. Establish relation to previous and following lessons
- IV. Review NFPA 1002 objectives for this lesson
- V. Review any additional materials for this lesson

PRESENTATION

LESSON OUTLINE

INSTRUCTOR NOTES

- | | |
|--|--|
| <p>7-5 Identify the theory and principles of priming systems</p> <p>A. Positive displacement pumps</p> <p>1. Largely used as priming pumps; not as main source</p> <p>of pressure</p> <p>a. The safest and most reliable primers available</p> <p>2. Operate on principle that when pressure is applied to a confined liquid, same outward pressure is equally transmitted within liquid in all directions</p> <p>3. Two basic types of positive displacement pumps piston and rotary</p> <p>4. Piston pumps</p> <p>a. All piston pumps contain a piston that moves back and forth inside a cylinder</p> <p>b. As the piston is driven forward, air within cylinder is compressed, creating a higher pressure inside pump than atmospheric pressure in discharge manifold</p> <p>c. This pressure causes discharge valve to open and air to escape through discharge lines</p> | |
|--|--|

LESSON OUTLINE

INSTRUCTOR NOTES

completes

d. This action continues until piston
its travel on forward stroke and stops

e. At that point pressures equalize and
discharge valve closes

f. As the piston begins return stroke, area in
cylinder behind piston increases and
pressure decreases, creating partial
vacuum

g. At this time, intake valve opens, allowing
air
from suction hose to enter pump

h. Atmospheric pressure forces water to rise
within hose until piston completes its
travel
and intake valve closes

i. More air is discharged until all is removed
and water enters

j. The pump is now considered to be primed

5. Rotary pumps

a. Rotary gear pump

1) Consists of two gears that rotate
in
a tightly meshed pattern inside a
watertight case

2) The gears are constructed so
they
contact each other and are in
close
proximity to the case

3) With this arrangement, watertight
and airtight pockets are formed by
gears within case as they turn
from
intake to outlet

can

- 4) The total amount of water that
be pumped depends on size of
pockets

LESSON OUTLINE

INSTRUCTOR NOTES

- b. Rotary vane pump
- 1) The rotor is mounted off-center inside housing
 - 2) The vanes are free to move within slot where they are mounted
 - 3) As the rotor turns, vanes are forced against housing by centrifugal force
 - 4) When the surface of vane that is in contact with the casing becomes worn, centrifugal force causes it to extend further, thus automatically maintaining a tight fit
 - 5) This self-adjusting feature makes rotary vane pump much more efficient at pumping air than a standard rotary gear pump
 - 6) As the rotor turns, air is trapped between rotor and casing in the pockets formed by adjacent vanes
 - 7) As the vanes turn, this pocket becomes smaller, which compresses air and causes pressure to build up
 - 8) This pocket becomes even smaller as vanes progress toward discharge
 - 9) At this point, pressure reaches its

air

maximum level, forcing trapped

out of pump

- 10) Water is forced into pump by atmospheric pressure until pump fills with water
- 11) At this point, pump is primed

LESSON OUTLINE

INSTRUCTOR NOTES

- B. Use of oil in primers
 - 1. Oil used for:
 - a. Lubricate positive displacement pumps which have close tolerances
 - b. Provide a good seal between the metal parts in the pump
 - c. Prevent corrosion because the pumps are not used on a regular basis

- C. Priming Time
 - 1. Time established by acceptance and annual pump tests
 - a. All times are based on the pump taking draft from a static water source
 - 1) Lift must not exceed 10 feet
 - 2) Length of intake hose shall be no more than 20 feet
 - b. Priming test is timed from the time the priming device is actuated until water flows onto the ground under the pump
 - c. Time requirements
 - 1) Time 30 seconds or less for pumps rated less than 1,500 gpm
 - 2) Time 45 seconds or less for pumps rated more than 1,500 gpm

LESSON OUTLINE

INSTRUCTOR NOTES

7-5.1 Pressure Relief Systems (Structural System P-19B)

A. Automatic pressure control

rapidly
gallonage

1. The volume of water moving through pump may change suddenly when a nozzle is shut down or when setting is changed on a variable

nozzle

2. The fire fighter on the nozzle cannot tolerate any sudden changes in pressure.

change

3. During critical stages of the attack, a sudden

in pressure can be disastrous

4. A shutdown of one line can mean a surge on the others so that some type of automatic pressure regulation is essential to ensure safety of

personnel

operating hoselines.

B. Relief valve

intake

1. Relieves excess pressure within pump discharge
2. An adjustable spring-loaded pilot valve actuates relief valve to bypass water from discharge to

chamber of pump

operation

3. The rerouting permits pump to continue in operation when pressure rises above working pressure
4. When the discharge pressure rises higher than allowed by pilot valve setting, spring in pilot valve moves; permits water to dump back into pump intake

LESSON OUTLINE

INSTRUCTOR NOTES

- C. Pressure governor
 - 1. For centrifugal pumps only
 - 2. It is pressure actuated to adjust engine throttle
 - 3. The main feature is that it regulates power output of engine to match set pump discharge requirements
 - 4. When the pressure in the discharge chambers of the pump exceeds the pressure necessary to maintain safe fire streams, engine speed is reduced since speed of the impellers is dependent on engine speed
- 7-5.2 Auxiliary Cooling and the Winterization System
 - A. Cooling system
 - 1. Description
 - a. The engine cooling system is a normal type system where thermostat regulates hot coolant flow from engine to radiator
 - 2. How the cooling system works
 - a. The coolant is cooled in radiator by air from fan; returned to engine
 - b. An expansion tank on radiator top section contains a pressure control and fill cap which prevents loss of coolant
 - c. A fill line connects expansion tank to suction side of engine water pump
 - d. When filling the cooling system, a vent line releases trapped air in engine to expansion tank

LESSON OUTLINE

INSTRUCTOR NOTES

- B. Winterization system
1. General
 - a. The winterization system is self-contained and consists of the following
 - (1) Water heater
 - (2) Circulating pump
 - (3) Small heater cores
 - (4) Electric fans
 - (5) Plumbing
 2. Function
 - a. To maintain temperature in cab, several compartments, and engine
 - b. The system is filled with antifreeze
 - c. Each heater core uses an electric fan to pass air through the heater core and
warm it
 - d. This prevents pipes from freezing; keeps truck ready for emergency operation in sub-freezing weather
 3. Power
 - a. The system draws fuel from truck's fuel
tank
 - b. Electrical power can come from the batteries; however, if heater is to be operated for a long period of time without engine running, an external power source must be connected to one of power receptacles on back of truck
 - c. Controls for this system are all located on the dash panel

LESSON OUTLINE

INSTRUCTOR NOTES

4. Running the system
 - a. After initial ignition, heater will operate automatically as determined by water temperature thermostat
 - b. If ignition does not occur on first start, check circuit breakers in heater compartment, and reset breakers if necessary to restart unit
 - c. Never operate booster heater in confined spaces such as a workshop without

exhaust ventilation. The exhaust gas can build up and cause serious illness or death
- C. Refer to applicable technical order for specific information

proper

death

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