Apparatus Operator Refresher

Instructor Manual

Alabama Fire College

July 2013

Apparatus Operator Refresher
How to Use the
LESSON OUTLINE

This course is a non-certification course designed to assist in refresher and remedial training. The content of this course is based on the text *IFSTA Pumping Apparatus Driver/Handbook 2nd edition,* and should be utilized as an adjunct resource. This course is designed as a 24-hour delivery program but can be adjusted to an increased hourly format if the authority having jurisdiction requires. The following resources are recommended as an adjunct to classroom training: (a) The included quiz and written test based on each lesson, (b) utilize the Apparatus Operator skills sheets that are applicable to the authority having jurisdiction, skills 1-6 are recommended as a minimum. Skill sheets can be accessed at www.alabamafirecollege.org under course resources.

Apparatus Operator Refresher
Lesson 1 — The Driver/Operator
LESSON OUTLINE

PRESENTATION OUTLINE	VISUALS/NOTES
Objective 1 — List responsibilities of the fire apparatus driver/operator. A. Safely transporting firefighters, apparatus, and equipment to and from the scene of an emergency or other call for service B. Vehicle maintenance C. Vehicle safety checks D. Operating the apparatus properly, swiftly, and safely E. Ensuring that the apparatus and the equipment it carries are ready at all times	**Slide 2** **Responsibilities**
Objective 2 — List the NFPA standards that set qualifications for fire apparatus driver/operators. A. NFPA 1002, *Standard for Fire Apparatus Driver/Operator Professional Qualifications* B. NFPA 1001, *Standard for Fire Fighter Professional Qualifications* (for Fire Fighter I)	**Slide 3** **Training Requirements**

Objective 3 — List the skills and physical abilities needed by the fire apparatus driver/operator.

Slide 4
Needed Skills and Physical Abilities

A. Reading skills, used for:
   1. Reading maps
   2. Reviewing manufacturer's operating instructions
   3. Studying prefire plans
   4. Reviewing printed computer dispatch instructions
   5. Reading and working on a mobile data terminal (MDT)

Slide 5
Needed Skills and Physical Abilities

B. Writing skills, used for:
   1. Completing maintenance reports
   2. Completing equipment repair requests
   3. Completing incident reports

C. Mathematical skills, used for:
   1. Hydraulic calculations
   2. Equations such as those used in friction loss problems

Slide 6
Needed Skills and Physical Abilities

D. Physical fitness, including:
   1. Connecting to a hydrant with an intake hose
   2. Stretching a supply line to a hydrant by hand
   3. Deploying a portable water tank

   Note: The driver/operator must be subjected to a periodic medical evaluation in accordance with NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*

E. Vision requirements required by NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments*

   Note: NFPA 1582 requires that firefighters have a corrected far visual acuity of 20/30 with contact lenses or spectacles.

F. Hearing requirements required by NFPA 1582

   Note: NFPA 1582 recommends rejecting any firefighter candidate who has a hearing loss of 25 decibels or more in 3 of 4 frequencies in the unaided worst ear. It also recommends rejecting any candidate who has a loss greater than 30 decibels in any one of three frequencies and an average loss greater than 30 decibels for four frequencies.

Slide 7
Selection of Fire Apparatus Driver/Operators

Objective 4 — Answer questions about the selection of fire apparatus driver/operators.

A. Driver/Operators are most often promoted from the rank of firefighter, based upon:
   1. A required time of service with the department
   2. Written or performance tests
   3. A combination of service and tests

B. All fire departments must have an established and thorough training program for prospective fire apparatus driver/operators.

   Note: For more direction on establishing a driver/operator training program, consult NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program*

Objective 5 — Select facts about driving regulations and licensing requirements for driver/operators.

A. Driving regulations
   1. Fire apparatus driver/operators are regulated by:
      a. State or provincial laws
      b. City ordinances
      c. Departmental standard operating procedures (SOPs)
      d. All statutes, laws, and ordinances that govern any vehicle operator

Slide 8
Driving Regulations

   2. Some states or provinces may exempt emergency vehicles from certain laws or statutes, such as following posted speed limits and parking requirements. Consult your state's laws.
   3. Driver/Operators must obey all traffic signals and rules in nonemergency driving, including when returning to quarters from an alarm.

Slide 9
Driving Regulations

B. Licensing requirements
   1. United States — The basic requirements for licensing of drivers is established by the federal Department of Transportation (DOT).
   2. Canada — Transport Canada (TC) establishes the requirements for licensing of drivers.
   3. Special requirements for licensing drivers of trucks and other large vehicles are determined by each individual

Slide 10
Licensing Requirements

state or province.

4. Most Canadian provinces require drivers to obtain an air brake endorsement to drive vehicles equipped with air brakes.

Summary

Slide 11
Summary

A. The position of driver/operator is one that demands certain mental and physical aptitudes or skills and abilities.

B. Driver/Operator candidates must possess the required licenses or be able to obtain them within their probationary period.

Discussion Questions

Slide 12
Discussion Questions

1. What are the responsibilities of the fire apparatus driver/operator?
2. Which NFPA standards are requirements of the fire apparatus driver/operator?
3. What are reading skills used for?
4. What are writing skills used for?
5. What are mathematical skills used for?
6. What types of physical tasks should the driver/operator be able to perform?
7. What are fire apparatus driver/operators regulated by?
8. Who determines the requirements for licensing of driver/operators in the United States? Canada?

Pumping Apparatus Driver/Operator

Lesson 1 — The Driver/Operator

Lesson Quiz

Name _____ **Date** _____

_____ 1. Which of the following is NOT a responsibility of the fire apparatus driver/operator?

A. Detailed maintenance procedures
B. Operating the apparatus properly, swiftly, and safely
C. Ensuring that the apparatus and the equipment it carries are ready at all times
D. Safely transporting firefighters, apparatus, and equipment to and from the scene of an emergency or other call for service

_____ 2. All driver/operators are required to meet NFPA ___, *Standard for Fire Apparatus Driver/Operator Professional Qualifications.*

A. 1001
B. 1002
C. 2001
D. 2002

_____ 3. Which of the following is NOT a basis for promotion to driver/operator?

A. Age and current position
B. Time of service with the department
C. Written or performance tests
D. A combination of service and tests

_____ 4. Some states or provinces may exempt emergency vehicles from certain traffic laws or statutes.

A. True
B. False

_____ 5. In the United States, what government authority establishes the basic requirements for licensing of drivers?

A. Transit Authority
B. American Highway Commission
C. Department of Transportation
D. National Traffic Safety Board

_____ 6. In general, to what vehicular statutes, laws, and ordinances is the driver/operator subject?

A. Only those concerning fire service driver/operators
B. All statutes, laws, and ordinances that govern any vehicle operator
C. Only those concerning emergency equipment operation
D. None of the statutes, laws, and ordinances that govern general motor vehicle operation

_____ 7. Which of the following is an activity that a driver/operator is NOT ordinarily expected to perform at a fire scene?

A. Deploying a portable water tank
B. Using a chainsaw for ventilation
C. Stretching a supply line to a hydrant by hand
D. Connecting to hydrant with an intake hose

_____ 8. Special requirements for licensing drivers of trucks and other large vehicles are determined by the Federal Department of Transportation.

A. True
B. False

_____ 9. Which NFPA standard requires that driver/operators be subjected to a periodic medical evaluation?

A. 1451
B. 1452
C. 1500
D. 1582

_____10. What does NFPA 1582 require as the corrected far vision acuity for a firefighter with contact lenses or spectacles?

A. 20/20
B. 20/30
C. 20/40
D. 20/50

Pumping Apparatus Driver/Operator

Lesson 1 — The Driver/Operator

Lesson Quiz Answers

1. A
2. B
3. A
4. A
5. C
6. B
7. B
8. B
9. C
10. B

Pumping Apparatus Driver/Operator

Lesson 1 — The Driver/Operator

Written Test

Name _____ **Date** _____

Note: For each tested objective, you must achieve the specified number of points. For example, in a test item designated *(9/12)*, you must achieve at least 9 of the 12 points possible.

Objective 1:
List responsibilities of the fire apparatus driver/operator. *(1 pt. each, 4/5)*

1. _____
2. _____
3. _____
4. _____
5. _____

Objective 2:
List the NFPA standards that set qualifications for fire apparatus driver/operators. *(1 pt. each, 2/2)*

1. _____
2. _____

Objective 3:
List the skills and physical abilities needed by the fire apparatus driver/operator. *(1 pt. each, 4/6)*

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Objective 4:
Answer questions about the selection of fire apparatus driver/operators. Write the correct letters on the blanks. *(1 pt. each, 2/3)*

_____ 1. Driver/Operators are most often promoted from the rank of:

A. rookie.
B. firefighter.
C. lieutenant.
D. captain.

_____ 2. Which NFPA standard gives direction for establishing a driver/operator training program?

A. 1450
B. 1451
C. 1560
D. 1561

_____ 3. Which of the following is NOT a basis for promotion to driver/operator?

A. Age and current position
B. Time of service with the department
C. Written or performance tests
D. A combination of service and tests

Objective 5:
Select facts about driving regulations and licensing requirements for driver/operators. Write the correct letters on the blanks. *(1 pt. each, 4/5)*

_____ 1. Some states or provinces may exempt emergency vehicles from certain traffic laws or statutes.

A. True
B. False

_____ 2. In the United States, what government authority establishes the basic requirements for licensing of drivers?

A. Transit Authority
B. American Highway Commission
C. Department of Transportation
D. National Traffic Safety Board

_____ 3. In general, to what vehicular statutes, laws, and ordinances is the driver/operator subject?

A. Only those concerning fire service driver/operators
B. All statutes, laws, and ordinances that govern any vehicle operator
C. Only those concerning emergency equipment operation
D. None of the statutes, laws, and ordinances that govern general motor vehicle operation

_____ 4. Special requirements for licensing drivers of trucks and other large vehicles are determined by the Federal Department of Transportation.

A. True
B. False

_____ 5. Which Canadian authority establishes the requirements for licensing of drivers?

A. Transport Canada
B. Canadian Transit Authority
C. Department of Transportation
D. Canadian Highway Department

Pumping Apparatus Driver/Operator

Lesson 1 — The Driver/Operator

Written Test Answers

Objective 1 *Answers should include any four of the following:*

- Safely transporting firefighters, apparatus, and equipment to and from the scene of an emergency or other call for service
- Vehicle maintenance
- Vehicle safety checks
- Operating the apparatus properly, swiftly, and safely
- Ensuring that the apparatus and the equipment it carries are ready at all times

Objective 2 *Answers should include the following in any order:*

- NFPA 1002, *Standard for Fire Apparatus Driver/Operator Professional Qualifications*
- NFPA 1001, *Standard for Fire Fighter Professional Qualifications* (for Fire Fighter I)

Objective 3 *Answers should include any four of the following:*

- Reading skills
- Writing skills
- Mathematical skills
- Physical fitness
- Vision requirements
- Hearing requirements

Objective 4

1. B
2. B
3. A

Objective 5

1. A
2. C
3. B
4. B
5. A

Apparatus Operator Refresher

Lesson 2 — Introduction to Apparatus Inspection and Maintenance

Lesson Outline

PRESENTATION OUTLINE	VISUALS/NOTES
Objective 1 — Define maintenance. **Objective 2 — Define repair.** A. Maintenance — Keeping apparatus in a state of usefulness or readiness B. Repair — To restore or replace that which has become inoperable	**Slide 5** **Maintenance and Repair**
Objective 3 — List reasons for preventive maintenance. **Objective 4 — State the purpose of preventive maintenance.** A. Reasons for preventive maintenance 1. Ensures apparatus reliability 2. Reduces the frequency and cost of repairs 3. Lessens out-of-service time B. Purpose of preventive maintenance — To try to eliminate unexpected and catastrophic apparatus failures that could put both firefighters and the public in mortal jeopardy and property at risk	**Slide 6** **Preventive Maintenance**
Objective 5 — List information that should be included in fire department maintenance SOPs. A. Who performs certain maintenance functions B. When maintenance is to be performed C. How detected maintenance problems are corrected or reported	**Slide 7** **Information Included in Fire Department Maintenance SOPs**

D. How the maintenance process is documented

E. Which items that driver/operators are responsible for checking and which conditions they are allowed to correct on their own

F. How maintenance and inspection results should be documented and transmitted to the proper person in the fire department administrative system

Slide 8
Information Included in Fire Department Maintenance SOPs

Objective 6 — Identify the functions of apparatus maintenance and inspection records.

Slide 9
Function of Apparatus Maintenance and Inspection Records

A. May be needed in a warranty claim to document that the necessary maintenance was performed

B. Are likely to be scrutinized by investigators in the event of an accident

C. Can assist in deciding whether to purchase new apparatus in lieu of continued repairs

Objective 7 — Explain reasons for keeping fire apparatus clean.

Slide 10
Reasons for Keeping Fire Apparatus Clean

A. Maintains good public relations

B. Permits proper inspection, thus ensuring efficient operations

C. Promotes a longer vehicle life

Objective 8 — Discuss how over cleaning fire apparatus can have negative effects.

Slide 11
Negative Effects of Over cleaning

A. Over cleaning can lead to the removal of lubrication from chassis, engine, pump, and other vehicle components, causing unnecessary wear on the apparatus.

Objective 9 — Answer questions about proper washing guidelines for fire apparatus.

Slide 12
Proper Washing Guidelines

Note: During the first six months after an apparatus is received, while the paint and protective coating are new and unseasoned, the vehicle should be washed frequently with cold water to harden

the paint and keep it from spotting. To ensure the best appearance of the vehicle in the future and to reduce the chance of damaging new paint and protective coatings, the following washing instructions are recommended:

A. Never remove dust or grit by dry rubbing.

Slide 13
Proper Washing Guidelines

B. Do not wash with extremely hot water or while the surface of the vehicle is hot.

C. Rinse as much of the loose dirt from the vehicle as possible before applying the shampoo and water. This reduces the chance of scratching the surface when applying shampoo.

Slide 14
Proper Washing Guidelines

D. Try to wash mud, dirt, insects, soot, tar, grease, and road salts off the vehicle before they have a chance to dry.

E. Never use gasoline or other solvents to remove grease or tar from painted surfaces. Use only approved solvents to remove grease or tar from painted and non-painted surfaces.

Slide 15
Proper Washing Guidelines

Note: Once a new vehicle's finish is properly cured (according to the owner's manual), either a garden hose with a nozzle or a pressure washer may be used to speed cleaning of the apparatus. However, soapy water and hand washing on a regular basis are still required to assure proper cleanliness.

Objective 10 — Answer questions about glass and interior cleaning of fire apparatus.

A. Glass care

1. Use warm soapy water or commercial glass cleaners.
2. Do not use dry towels or rags by themselves, because they may allow grit to scratch the surface of the glass.
3. Do not use putty knives, razor blades, steel wool, or other metal objects to remove deposits from the glass.

Slide 16
Glass Care

B. Interior cleaning

Note: It is important to keep seat upholstery, dashboard and engine compartment coverings, and floor finishes clean because an accumulation of dirt may cause deterioration of these finishes.

1. Use warm soapy water or commercial cleaning products to clean the surfaces of seat upholstery, dashboard and engine compartment coverings, and floor finishes.
2. Use particular cleaning agents or protective dressings if

Slide 17
Interior Cleaning

specified by the manufacturer.

3. Be sure that the vehicle is well ventilated when using any cleaning products inside the cab or crew-riding area.

Slide 18
Interior Cleaning

WARNING! Do not use the following products to clean interior surfaces: cleaning solvents such as acetone, lacquer thinner, enamel reducer, and nail polish remover; corrosive or caustic substances such as laundry soap or bleach; and hazardous substances such as gasoline, naphtha, or carbon tetrachloride.

Slide 19
Interior Cleaning

Objective 11 — Recall information about waxing fire apparatus.

Slide 20
Waxing Fire Apparatus

A. Is no longer necessary on many newer apparatus

B. Should not be done until the paint is at least six months old

C. Should be done only after washing and drying the apparatus

D. Should be applied with a soft cloth and buffed using a soft cloth or mechanical buffer

Objective 12 — Clean the interior and wash and wax the exterior of a fire department apparatus.

Objective 12 is measured in Skill Sheet.

Objective 13 — Select facts about apparatus inspection procedures.

A. The driver/operator should follow a systematic procedure based on departmental SOPs, NFPA standards, and manufacturer's recommendations for inspecting the apparatus.

Slide 21
Apparatus Inspection Procedures

B. The information in this manual is based on the requirements contained in *NFPA 1002* and the government pretrip inspection requirements for obtaining a commercial driver's license.

C. The inspection information following are the types of checks that career personnel should perform at the beginning of each tour of duty and volunteer personnel should do on a weekly or biweekly basis.

D. One particular method of performing an apparatus/pretrip

Slide 22-23
Apparatus Inspection

inspection, referred to as the *circle* or *walk-around* method, starts at the driver's door on the cab and works around the apparatus in a clockwise pattern.

Procedures

E. If records from previous inspections are available, the driver/operator may wish to review them to see if any problems were noted at that time.

F. Parts of the inspection
   1. Approaching the vehicle
   2. Left- and right-front side (also called street and curb side or driver and officer side) inspection
   3. Front inspection
   4. Left- and right-rear side inspection
   5. Rear inspection
   6. In-cab inspection

Slide 24
Parts of an Apparatus Inspection

Objective 14 — Perform a walk-around routine maintenance inspection.

Objective 14 is measured in Skill Sheet.

Objective 15 — Select facts about maintenance of specific components and systems.

A. Clutch free play

1. Clutch free play (free travel) is the distance that the pedal must be pushed before the throw-out bearing actually contacts the clutch release fingers.
2. Insufficient free play shortens the life of the throw-out bearing and causes the clutch to slip, overheat, and wear out sooner than necessary.
3. Excessive free play may result in the clutch not releasing completely, which can cause harsh shifting, gear clash, and damage to gear teeth.

Slide 25
Clutch Free Play

Slide 26
Clutch Free Play

B. Steering wheel free play

1. In general, steering wheel play should be no more than about 10 degrees in either direction.
2. On a steering wheel with a 20-inch (500 mm) diameter, this will mean a play of about 2 inches (50 mm) in either direction.
3. Play that exceeds these parameters could indicate a serious steering problem that could result in the driver/operator losing control of the apparatus under otherwise reasonable driving conditions.

Slide 27-28
Steering Wheel Free Play

C. Braking system

1. Most large, modern fire apparatus are equipped with air-operated braking systems.
2. Smaller late-model apparatus and some older large apparatus are equipped with hydraulic braking systems.
3. Most newer apparatus, regardless of the brake system, are equipped with antilock braking systems (ABS).
4. Antilock brake systems reduce the possibility of the apparatus being thrown into a skid when the brakes are fully applied.
5. On apparatus equipped with air brakes, the air pressure should build to a sufficient level to allow vehicle operations within 60 seconds of starting.
6. New apparatus should be able to come to a complete stop from a speed of 20 mph (32 km/h) in a distance not to exceed 35 feet (10.7 m).
7. The parking brake should hold the apparatus in place on grades up to 20 percent.

Slide 29
Braking System

Slide 30
Braking System

Slide 31
Braking System

Slide 32
Braking System

8. Apparatus with air brakes are to be equipped with an air pressure protection valve that prevents the air horns from being operated when the pressure in the air reservoir drops below 80 psi (552 kPa).

Slide 33
Electrical Load Management System

D. Electrical load management system
   1. The purpose of apparatus electrical load management systems is to prevent an overload of the vehicle's electrical generation system.
   2. The *load sequencer* turns various lights on at specified intervals so that the start-up electrical load for all of the devices does not occur at the same time.
   3. The *load monitor* "watches" the system for added electrical loads that threaten to overload the system.
   4. When an overload condition occurs, the load monitor shuts down less important electrical equipment to prevent overloading. This process is called *load shedding.*

Slide 34
Electrical Load Management System

Slide 35
Automatic Chains

E. Automatic chains — During periods of inclement weather, it may be desirable to activate the chains and make sure they are operating properly.

Slide 36
Windshield Washer Fluid Reservoir

F. Windshield washer fluid reservoir
   1. It is recommended that the windshield washer fluid reservoir be refilled any time it is less than one-half full.
   2. Windshield washer fluids are commercially available, and compatibility from one brand to another is usually not a concern.

Slide 37
Chassis

G. Chassis
   1. To select the proper chassis lubricant, consider the requirements of the unit to be lubricated, the characteristics of lubricants, and the manufacturer's recommendations.
   2. The manufacturer's manual will "recommend" the Society of Automotive Engineers (SAE) numbers for the engine oil. The SAE number indicates only the engine oil's viscosity.
   3. Some essential characteristics of oil are corrosion protection, foaming, sludging, and carbon accumulation, which may be controlled by the refiner.
   4. Different types of engine oils should not be mixed.

Slide 38
Chassis

Slide 39
Fire Pumps

H. Fire pump
   1. Any time a pump has been operated at draft from a static water supply, the pump and piping should be thoroughly flushed before the apparatus is placed back in service.
   2. If untreated water has been used to fill the apparatus water tank, it should be drained, and the tank should be flushed and refilled with clean water as soon as possible.

Objective 16 — Perform an in-cab operational inspection.

Objective 17 — Test new apparatus road and parking brakes.

Objectives 16 and 17 are measured in Skill Sheets.

Objective 18 — Answer questions about an engine compartment inspection.

Slide 40
Engine Compartment Inspections

A. Once the exterior of the apparatus has been inspected and the in-cab checks have been completed, the driver/operator should shut down the vehicle and prepare to perform some routine checks and preventive maintenance procedures in the engine compartment.

Slide 41
Engine Compartment Inspections

B. While it is acceptable to perform routine checks either before or after the engine has been run, most checks (with the exception of automatic transmission fluid level) should not be done while the engine is running.

   Note: Never rely solely on warning lights or gauges; all fluid levels should be visually inspected.

Objective 19 — Perform engine compartment inspection and routine preventive maintenance.

Objective 20 — Charge an apparatus battery.

Objective 21 — Perform daily and weekly apparatus inspections.

Objective 22 — Lubricate chassis components.

Objectives 19 through 22 are measured in Skill Sheets.

Summary

Slide 42
Summary

A. To ensure that in-service pumping apparatus is always ready to perform as designed, the assigned driver/operator must

regularly inspect the vehicle and either perform any required maintenance or report it through channels so that it can be performed by others.

Slide 43
Summary

B. The driver/operator must be thoroughly familiar with all aspects of their particular vehicle, as well as the department's SOPs for vehicle inspection and maintenance.

C. Using a systematic approach to the vehicle inspection process helps ensure that the vehicle is checked in the same way every time, and reduces the chances of anything being overlooked.

Discussion Questions

Slide 44
Discussion Questions

1. What is maintenance?
2. What is repair?
3. What types of information should be included in fire department maintenance SOPs?
4. Why should fire apparatus be kept clean?
5. How should a new fire apparatus be cleaned?
6. What materials should never be used to clean the interior of an apparatus?
7. What are the parts of a walk-around inspection? In what order should these steps be completed?
8. What is clutch free play?
9. Describe the elements of an electrical load management system.
10. What should be done when a fire pump has been operated at draft from a static water supply?

Slide 45
Discussion Questions

Pumping Apparatus Driver/Operator

Lesson 3 — Introduction to Apparatus Inspection and Maintenance

Lesson Quiz

Name _____ **Date** _____

_____ 1. How is *maintenance* defined?

A. Being in good repair
B. Following a program of reactive upkeep
C. Restoring or replacing that which has become inoperable
D. Keeping apparatus in a state of usefulness or readiness

_____ 2. How is *repair* defined?

A. Providing a program of proactive upkeep
B. Properly maintaining all fire service apparatus
C. Keeping apparatus in a state of usefulness or readiness
D. Restoring or replacing that which has become inoperable

_____ 3. What water temperature should be used to wash an apparatus during its first six months?

A. Hot
B. Warm
C. Cold
D. Room temperature

_____ 4. What is the first portion of the vehicle that should be specifically checked by the driver/operator during the walk-around inspection?

A. Back
B. Pump panel
C. Driver's side of the cab
D. Passenger's side of the cab

_____ 5. Which of the following terms is defined as "the distance that the pedal must be pushed before the throw-out bearing actually contacts the clutch release fingers?”

A. Bearing free travel
B. Bearing burnout
C. Clutch free play
D. Clutch tolerance

_____ 6. How much steering wheel play should there be in either direction from the normal center position?

A. No less than 10 degrees
B. No more than 10 degrees
C. No less than 15 degrees
D. No more than 15 degrees

_____ 7. On how steep a grade must the parking brake be able to hold the apparatus?

A. 20%
B. 25%
C. 30%
D. 35%

_____ 8. It is recommended that the windshield washer fluid reservoir be refilled when it becomes:

A. completely empty.
B. less than one-half full.
C. less than one-fourth full.
D. less than three-fourths full.

_____ 9. What is the function of a load sequencer?

A. Detecting added electrical loads that threaten to overload the system
B. Shutting down less important electrical equipment to prevent overloading
C. Turning on various lights at specified intervals to prevent start-up overloading
D. Turning off various lights at specified intervals to prevent start-up overloading

_____10. What is the function of the load monitor?

A. Detecting added electrical loads that threaten to overload the system
B. Shutting down less important electrical equipment to prevent overloading
C. Turning on various lights at specified intervals to prevent start-up overloading
D. Turning off various lights at specified intervals to prevent start-up overloading

Pumping Apparatus Driver/Operator

Lesson 3 — Introduction to Apparatus Inspection and Maintenance

Lesson Quiz Answers

1. D
2. D
3. C
4. C
5. C
6. B
7. A
8. B
9. C
10. A

Pumping Apparatus Driver/Operator

Lesson 3 — Introduction to Apparatus Inspection and Maintenance

Written Test

Name _____ **Date** _____

Note: For each tested objective, you must achieve the specified number of points. For example, in a test item designated *(9/12)*, you must achieve at least 9 of the 12 points possible.

Objective 1:
Define maintenance. *(2 pts., 2/2)*

_____

_____

Objective 2:
Define repair. *(2 pts., 2/2)*

_____

_____

Objective 3:
List reasons for preventive maintenance. *(1 pt. each, 2/3)*

1. _____
2. _____
3. _____

Objective 4:
State the purpose of preventive maintenance. *(4 pts., 4/4)*

_____

_____

_____

Objective 5:
List information that should be included in fire department maintenance SOPs. *(1 pt. each, 4/6)*

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Objective 6:
Identify the functions of apparatus maintenance and inspection records. *(2 pts. each, 4/6)*

1. _____
   _____
2. _____
   _____
3. _____
   _____

Objective 7:
Explain reasons for keeping fire apparatus clean. *(1 pt. each, 2/3)*

1. _____
2. _____
3. _____

Objective 8:
Discuss how over cleaning fire apparatus can have negative effects. *(4 pts., 4/4)*

_____
_____
_____

Objective 9:
Answer questions about proper washing guidelines for fire apparatus. Write the correct letters on the blanks. *(1 pt. each, 3/4)*

_____ 1. During the first six months after an apparatus is received, the vehicle should be washed frequently with ___ to harden the paint and keep it from spotting.

A. cold water
B. warm water
C. soap and water
D. a high pressure washer

_____ 2. Dust or grit should NEVER be removed by:

A. dry rubbing.
B. rinsing with only water.
C. washing with soap and cold water.
D. washing with soap and hot water.

_____ 3. Do NOT wash the vehicle with:

A. cold water.
B. extremely hot water.
C. water and dish soap.
D. a high pressure washer.

_____ 4. Which of the following can be used to remove grease or tar from painted surfaces?

A. Acetone
B. Gasoline
C. Nail polish remover
D. Approved solvents

Objective 10:
Answer questions about glass and interior cleaning of fire apparatus. Write the correct letters on the blanks. *(1 pt. each, 1/2)*

_____ 1. Which of the following should NOT be used to clean glass?

A. Warm soapy water
B. Commercial glass cleaners
C. Dry towels by themselves
D. Warm or hot water alone

_____ 2. Which of the following is acceptable to clean the surfaces of seat upholstery and dashboards?

A. Acetone
B. Nail polish remover
C. Laundry soap and water
D. Commercial cleaning products

Objective 11:
Recall information about waxing fire apparatus. *(2 pts. each, 6/8)*

1. _____

2. _____

3. _____

4. _____

Objective 12:
Clean the interior and wash and wax the exterior of a fire department apparatus.

Objective 12 is measured in Skill Sheet 3-1.

Objective 13:
Select facts about apparatus inspection procedures. Write the correct letters on the blanks. *(1 pt. each, 4/5)*

_____ 1. When should career personnel perform apparatus inspections?

A. Weekly
B. Biweekly
C. Before each run
D. Before each tour of duty

_____ 2. When should volunteer personnel perform apparatus inspections?

A. Weekly
B. Bimonthly
C. Before each run
D. Before each tour of duty

_____ 3. What type of inspection begins at the driver's door on the cab and works around the apparatus in a clockwise pattern?

A. Counter-clockwise method
B. Walk-around method
C. Rectangle method
D. Pretrip method

_____ 4. What is another term for the left side of an apparatus?

A. Curb side
B. Officer side
C. Street side
D. Firefighter side

_____ 5. What is another term for the right side of an apparatus?

A. Street side
B. Officer side
C. Firefighter side

D. Operator side

Objective 14:
Perform a walk-around routine maintenance inspection.

Objective 14 is measured in Skill Sheet 3-2.

Objective 15:
Select facts about maintenance of specific components and systems. Write the correct letters on the blanks. *(1 pt. each, 14/20)*

_____ 1. Which of the following terms is defined as "the distance that the pedal must be pushed before the throw-out bearing actually contacts the clutch release fingers?"

A. Bearing free travel
B. Bearing burnout
C. Clutch free play
D. Clutch tolerance

_____ 2. Which of the following symptoms is NOT a result of insufficient free play?

A. Clutch slippage
B. Clutch overheating
C. Clutch not releasing
D. Shortened life of clutch

_____ 3. Which of the following symptoms is NOT a result of excessive free play?

A. Harsh shifting
B. Gear clashing
C. Warping of bearings
D. Damaged gear teeth

_____ 4. In general, steering wheel play should be no more than about ___ degrees in either direction.

A. 5
B. 10
C. 15
D. 20

_____ 5. What is acceptable play on a steering wheel with a 20-inch (500 mm) diameter?

A. Approximately ½-inch (13 mm) in each direction
B. Approximately 1 inch (25 mm) in each direction
C. Approximately 1½-inch (38 mm) in each direction
D. Approximately 2 inches (50 mm) in each direction

_____ 6. With what type of braking system are most modern fire apparatus equipped?

A. Electric
B. Hydraulic
C. Magnetic
D. Air-operated

_____ 7. With what type of braking system are smaller late-model apparatus and some older large apparatus equipped?

A. Electric
B. Hydraulic
C. Magnetic
D. Air-operated

_____ 8. On apparatus equipped with air brakes, the air pressure should build to a sufficient level to allow vehicle operations within ___ seconds of starting.

A. 10
B. 15
C. 30
D. 60

_____ 9. New apparatus should be able to come to a complete stop from a speed of ___ mph (km/h) in a distance not to exceed ____ feet (m).

A. 10 mph (16 km/h); 15 feet (4.5 m)
B. 15 mph (24 km/h); 20 feet (6 m)
C. 20 mph (32 km/h); 35 feet (10.7 m)
D. 25 mph (40 km/h); 40 feet (12 m)

_____10. The apparatus parking brake should hold the vehicle in place on grades up to ___ percent.

A. 20
B. 25
C. 30
D. 35

_____11. Apparatus with air brakes are to be equipped with an air pressure protection valve that prevents the air horns from being operated when the pressure in the air reservoir drops below ___ psi (kPa).

A. 80 psi (552 kPa)
B. 100 psi (700 kPa)
C. 125 psi (875 kPa)
D. 150 psi (1050 kPa)

_____12. What is the purpose of an apparatus electrical load management system?

A. Notifying the driver/operator when an electrical system is under loaded
B. Preventing an overload of the vehicle's electrical generation system
C. Automatically charging the apparatus battery and keeping it at full charge
D. Allowing the operation of unlimited supplemental apparatus-run electrical systems

_____13. What is the function of a load sequencer?

A. Detecting added electrical loads that threaten to overload the system
B. Shutting down less important electrical equipment to prevent overloading
C. Turning on various lights at specified intervals to prevent start-up overloading
D. Turning off various lights at specified intervals to prevent start-up overloading

_____14. What is the function of the load monitor?

A. Detecting added electrical loads that threaten to overload the system
B. Shutting down less important electrical equipment to prevent overloading

C. Turning on various lights at specified intervals to prevent start-up overloading
D. Turning off various lights at specified intervals to prevent start-up overloading

_____15. What is the purpose of load shedding?

A. Preventing start-up overloading
B. Preventing battery drain by detecting battery charge level
C. Detecting added electrical loads that threaten to overload the system
D. Shutting down less important electrical equipment to prevent overloading

_____16. It is recommended that the windshield washer fluid reservoir be refilled when it becomes:

A. completely empty.
B. less than one-half full.
C. less than one-fourth full.
D. less than three-fourths full.

_____17. Which of the following is NOT a factor that should be considered when selecting the proper chassis lubricant?

A. Characteristics of lubricants
B. Manufacturer's recommendations
C. Length of time between applications
D. Requirements of the unit to be lubricated

_____18. What does the Society of Automotive Engineers (SAE) engine oil number indicate?

A. Viscosity
B. Shelf life
C. Percent of emollient
D. Seasonal application

_____19. Which of the following is NOT an essential characteristic of engine oil?

A. Protection against corrosion
B. Reduction of foaming and sludging
C. Regulation of engine temperature
D. Reduction of carbon accumulation

_____20. Before placing it back in service, what should the driver/operator do any time a fire pump has been operated at draft from a static water supply?

A. Flush the pump and piping.
B. Lubricate the pump and piping.
C. Allow the pump and piping to air dry.
D. Clean the pump and piping with soap and water and air dry.

Objective 16:
Perform an in-cab operational inspection.

Objective 17:
Test new apparatus road and parking brakes.

Objectives 16 and 17 are measured in Skill Sheets.

Objective 18:
Answer questions about an engine compartment inspection. Write the correct letters on the blanks. *(1 pt. each, 1/2)*

_____ 1. What should be done once the exterior of the apparatus has been inspected and the in-cab checks have been completed?

A. Shut down the vehicle and prepare to test the electrical load management system.
B. Shut down the vehicle and prepare to perform an engine compartment inspection.
C. Leave the vehicle running, in the park position, and prepare to perform an engine compartment inspection.
D. Leave the vehicle running, in neutral position, and prepare to perform an engine compartment inspection.

_____ 2. What is the best way to perform an engine compartment inspection?

A. With the engine running
B. Before or after the engine has been run
C. By examining warning lights or gauges
D. No less than 30 minutes after the engine has been run

Objective 19:
Perform engine compartment inspection and routine preventive maintenance.

Objective 20:
Charge an apparatus battery.

Objective 21:
Perform daily and weekly apparatus inspections.

Objective 22:
Lubricate chassis components.

Objectives 19 through 22 are measured in Skill Sheets.

Pumping Apparatus Driver/Operator

Lesson 3 — Introduction to Apparatus Inspection and Maintenance

Written Test Answers

Objective 1
- Keeping apparatus in a state of usefulness or readiness

Objective 2
- To restore or replace that which has become inoperable

Objective 3 *Answers should include any two of the following:*
- Ensures apparatus reliability
- Reduces the frequency and cost of repairs
- Lessens out-of-service time

Objective 4
- To try to eliminate unexpected and catastrophic apparatus failures that could put both firefighters and the public in mortal jeopardy and property at risk

Objective 5 *Answers should include four of the following:*
- Who performs certain maintenance functions
- When maintenance is to be performed
- How detected maintenance problems are corrected or reported
- How the maintenance process is documented
- Which items that driver/operators are responsible for checking and which conditions they are allowed to correct on their own
- How maintenance and inspection results should be documented and transmitted to the proper person in the fire department administrative system

Objective 6 *Answers should include any two of the following:*
- May be needed in a warranty claim to document that the necessary maintenance was performed
- Are likely to be scrutinized by investigators in the event of an accident
- Can assist in deciding whether to purchase new apparatus in lieu of continued repairs

Objective 7 *Answers should include any two of the following:*
- Maintains good public relations
- Permits proper inspection, thus ensuring efficient operations
- Promotes a longer vehicle life

Objective 8
- Over cleaning can lead to the removal of lubrication from chassis, engine, pump, and aerial device components, causing unnecessary wear on the apparatus.

Objective 9

1. A
2. A
3. B
4. D

Objective 10

1. C
2. D

Objective 11 *Answers should include any three of the following:*

- Is no longer necessary on many newer apparatus
- Should not be done until the paint is at least six months old
- Should be done only after washing and drying the apparatus
- Should be applied with a soft cloth and buffed using a soft cloth or mechanical buffer

Objective 12

This objective is measured in Skill Sheet.

Objective 13

1. D
2. A
3. B
4. C
5. B

Objective 14

This objective is measured in Skill Sheet.

Objective 15

1. C
2. C
3. C
4. B
5. D
6. D
7. B
8. D
9. C
10. A
11. A
12. B
13. C
14. A
15. D
16. B
17. C
18. A
19. C

20. A

Objective 16-17
These objectives are measured in Skill Sheets.

Objective 18
1. B
2. B

Objectives 19-22
These objectives are measured in Skill Sheets.

Apparatus Operator Refresher
Lesson 3 — Operating Emergency Vehicles

Lesson Outline

PRESENTATION OUTLINE	VISUALS/NOTES
Objective 1 — List the five most common causes of fire apparatus collisions. **Objective 2 — Answer questions about the common causes of fire apparatus collisions.**	**Slide 13** **Common Causes of Fire Apparatus Collisions**
A. Improper backing of the apparatus 1. Seldom causes serious injury or death, but accounts for significant portion of overall damage costs 2. Occurs in a variety of locations a. On the emergency scene b. In parking lots c. When backing the apparatus into the fire station	**Slide 14** **Improper Backing of the Apparatus**
B. Reckless driving by the public, caused by: 1. Failure to obey posted traffic regulations or directions 2. Failure to yield to emergency vehicles 3. Excessive speed 4. Unpredictable behavior created by a panic reaction to an approaching emergency vehicle 5. Inattentiveness	**Slide 15** **Reckless Driving by the Public**
C. Excessive speed by the fire apparatus driver/operator, resulting in: 1. Loss of control on a curve or adverse road surface, which may cause the vehicle to leave the road surface, roll over, or strike another vehicle or object 2. Inability of driver/operator to stop in time to avoid a collision with another vehicle or object	**Slide 16** **Excessive Speed by the Fire Apparatus Driver/Operator**
D. Lack of driving skill and experience by the fire apparatus driver/operator, including: 1. Overconfidence in one's driving ability 2. Inability to recognize a dangerous situation	**Slide 17** **Lack of Driving Skill and Experience by the Driver/Operator**

3. False sense of security because of a good driving record
4. Misunderstanding of apparatus capabilities
5. Lack of knowledge about how to operate the controls of the apparatus in an emergency

E. Poor apparatus design or maintenance

Slide 18
Poor Apparatus Design or Maintenance

1. Is most often a factor on "homebuilt" vehicles that have been constructed by members of a fire department or by local mechanics
2. Is most often a factor on homebuilt water tenders constructed on surplus military chassis
   a. Are not designed for the weight of the water that will be carried on them
   b. Have not been properly baffled, causing liquid surges that result in the vehicle becoming out of control
3. Can cause vehicle system failures, especially in braking systems

Objective 3 — Name regulatory agencies/laws that govern fire apparatus driver/operators.

Slide 19
Agencies/Laws that Govern Fire Apparatus Driver/Operators

A. Federal laws

B. State or provincial motor vehicle codes

C. City ordinances

D. NFPA standards

E. Departmental policies

Objective 4 — Select facts about driving regulations.

A. Unless specifically exempt, fire apparatus driver/operators are subject to any statute, rule, regulation, or ordinance that governs any vehicle operator.

Slide 19
Driving Regulations

B. In some jurisdictions, statutes may exempt emergency vehicles from driving regulations that apply to the general public concerning the speed, direction of travel, direction of turns, and parking if they are responding to a reported emergency.

Slide 20
Driving Regulations

C. When exempted from statutes, driver/operators must always exercise care for the safety of others and maintain complete control of the vehicle.

Slide 21
Driving Regulations

D. All traffic signals and rules must be obeyed when returning to quarters from an alarm or during any other nonemergency driving.

E. Driving regulations pertain to dry, clear roads during daylight conditions; driver/operators should adjust speeds to compensate for conditions such as wet roads, darkness, fog, or any other condition that makes normal emergency vehicle operation more hazardous.

Slide 22
Driving Regulations

F. Emergency vehicles are generally not exempt from laws that require vehicles to stop for school buses that are flashing signal lights to indicate that children are boarding.

Slide 23
Driving Regulations

G. If a driver/operator does not obey state, local, or departmental driving regulations and is involved in a collision, both the driver/operator and the fire department may be held responsible.

Slide 24
Driving Regulations

Objective 5 — Select facts about starting and driving fire service apparatus.

A. Consult the manufacturer's operator's manual, supplied with each vehicle, for detailed instructions specific to the vehicle.

Slide 26
Starting and Driving Fire Service Apparatus

B. Start the vehicle as soon as possible so that it is warmed up when the rest of the crew is assembled and ready to respond.

C. Let the apparatus idle as long as possible before putting it into road gear.

D. Take time to review the incident location, considering important factors that may affect the response such as road closings and traffic conditions.

Slide 27
Starting and Driving Fire Service Apparatus

E. Do not move the vehicle until all occupants are within the cab, in a seated position, and wearing seat belts.

Objective 6 — Answer questions about driving a manual transmission apparatus.

Note: The information in this section pertains to the typical 4-or 5-speed manual shift transmission with a single-speed rear axle. For information on driving apparatus with 2-speed rear axles or more than a 5-speed transmission, consult the apparatus/transmission manufacturer's operational manual for specific information.

Slide 28
Driving a Manual Transmission Apparatus

A. After releasing the parking brake, place the gear shifter into a low gear that will allow the vehicle to move with a minimum of throttle.

   CAUTION! Never attempt to start the apparatus moving while it is in a high gear.

B. Release the clutch slowly when starting from a standstill, avoiding vehicle rollback before engaging the clutch.

Slide 29
Driving a Manual Transmission Apparatus

C. Keep the apparatus in low gear until the proper speed or revolutions per minute (rpm) is reached for shifting to a higher gear.

D. Disengage the clutch fully when shifting gears.

E. Move the gear shift lever into proper position carefully, without jamming the lever.

Slide 30
Driving a Manual Transmission Apparatus

F. When climbing a hill, shift the transmission to a lower gear.

G. On sharp curves or when turning corners, shift standard transmissions into a lower gear before entering the curve or intersection.

Slide 31
Driving a Manual Transmission Apparatus

H. Use lower gears when fire apparatus must be driven over rough or rugged terrain.

I. If the apparatus becomes stuck, such as in mud or snow, do not race the engine or pop the clutch. Always maintain front wheels in line with the chassis of the vehicle.

Slide 32
Driving a Manual Transmission Apparatus

J. When driving downhill, select a lower gear *before* driving downhill.

K. To prevent engine damage, limit downhill speed to lower than maximum governed rpm.

Objective 7 — Select facts about driving an automatic transmission apparatus.

A. Once the apparatus is ready to move, depress the interlock on the shifter and move it to the appropriate gear selection.

Note: This selection varies depending on the manufacturer of the apparatus or transmission. Consult the manufacturer's operator's manual for recommendations on which gear to select for normal operation.

Slide 33
Driving an Automatic Transmission Apparatus

B. Be aware that the pressure placed upon the accelerator influences automatic shifting.

Examples: When the pedal is fully depressed, the transmission automatically upshifts near the governed speed of the engine. This may result in reduced power and excessive fuel consumption. If the accelerator is partially depressed, the upshift occurs at a lower engine speed.

C. When operating the apparatus at a slow speed for a long period of time or when driving up a steep hill, it may be desirable to manually select a particular gear for operation; simply move the shifter to the lower gear when this change is desired.

Note: Do not attempt to jump more than one gear at a time.

Slide 34
Driving an Automatic Transmission Apparatus

Objective 8 — Recall information about cruising in a fire apparatus.

A. Once the apparatus is moving, accelerate the vehicle gradually.

Slide 35
Cruising in a Fire Apparatus

B. Do not try to reach rated speed in the low gears; going to rated speed in the low gears can be very noisy and increases engine wear.

C. Stay in the highest gear that allows the apparatus to keep up with traffic and still have some power in reserve for acceleration.

D. Attempt to maintain engine rpm control through correct throttling.

Slide 36
Cruising in a Fire Apparatus

E. Avoid over throttling, which results in lugging.

F. Do not allow the engine rpm to drop below peak torque speed if lugging does occur.

Note: Automatic transmissions downshift automatically to prevent lugging. Standard transmissions must be downshifted to avoid stalls and prevent lugging.

Slide 37
Cruising in a Fire Apparatus

G. When ascending a steep grade and momentary unavoidable lugging takes place, select progressively lower gears.

H. Avoid over speeding as the result of improper downshifting or hill descent in an effort to prolong engine life. Choose a gear that allows the engine to operate at 200 or 300 rpm lower than maximum recommended rpm.

Objective 9 — Answer questions about stopping, idling, and shutting down the apparatus.

Slide 38
Stopping the Apparatus

A. Stopping the apparatus
   1. The process of braking fire apparatus to a standstill should be performed smoothly so that the apparatus will come to an even stop.
   2. Before braking, consider the weight of the apparatus and the condition of the brakes, tires, and road surface.

Slide 39
Stopping the Apparatus

   3. Some apparatus employ engine brakes, or retarders, that assist in braking.
      a. Are activated when pressure is released from the accelerator
      b. Allow the driver/operator to limit the use of service brakes to emergency stops and final stops
      c. Save wear on the service brakes and make the apparatus easier to manage on hills and slippery roads

Slide 40
Stopping the Apparatus

   4. If the apparatus has a retarder, become thoroughly familiar with the manufacturer's recommendations regarding its operation prior to use.
   5. Do not disengage the clutch while braking until the last few feet (meters) of travel, particularly on slippery surfaces, because an engaged engine allows more control of the apparatus.

Slide 41
Engine Idling

B. Engine idling
   1. It is SOP in some departments to shut the engine down rather than leave it idling for long periods of time.

Note: This applies to apparatus at an emergency scene that are not being used.

2. When the engine must be left to idle for an extended period of time because of extremely cold weather or during floodlight operations, set it at 900 to 1,100 rpm rather than at lower speeds.
3. Be familiar with departmental SOPs regarding times when the apparatus may be forced to idle for an extended period of time.
4. Some manufacturers offer a high-idle option.
5. If diesel engines are to be left idling, they should be set at high idle.

Slide 42
Engine Idling

C. Engine shutdown

1. Never attempt to shut down the engine while the apparatus is in motion because this cuts off fuel flow from the injectors.
2. Except when in an atmosphere containing flammable gases or vapors (which may cause the engine to accelerate independently of the throttle setting), never shut down immediately after full-load operation. Allow the engine temperature to stabilize before shutdown by idling the engine for 3 to 5 minutes.

Slide 43
Engine Shutdown

CAUTION! Never rev a diesel engine immediately before shutting it down.

Slide 44
Engine Shutdown

Objective 10 — Start, idle, and shut down a fire service pumping apparatus.

Objective 11 — Drive a fire service pumping apparatus.

Objectives 10 and 11 are measured in Skill Sheets.

Objective 12 — Select from a list guidelines for proper driver/operator attitude.

A. Develop a safety-conscious attitude.

B. Remain calm and drive in a safe manner.

C. Do not drive recklessly or aggressively.

Slide 45
Proper Driver/Operator Attitude

D. Do not *demand* the right-of-way although you may legally have it.

Slide 46
Proper Driver/Operator Attitude

E. Be prepared to yield the right-of-way in the interest of safety.

F. Strive to present a positive fire department image at all times.

Objective 13 — Answer questions about apparatus rider safety.

Objective 14 — List the exceptions to the NFPA seated and belted requirement.

Slide 47
Apparatus Rider Safety

A. The driver/operator must assure the safety of all personnel riding on the apparatus.

B. It is most desirable for riders of emergency vehicles to don their protective gear before getting in the apparatus.

C. Because some driver/operators are not comfortable driving the apparatus wearing rubber fire boots or bulky protective coats, protective clothing may be donned after arriving at the scene, if allowed by departmental SOPs.

Slide 48
Apparatus Rider Safety

D. All riders on the apparatus should be seated within the cab or body and wearing their seat belts before the apparatus is put into motion.
   1. *NFPA 1901, Standard for Automotive Fire Apparatus*, requires that a seat and seat belt be provided within the cab or body of the apparatus for every firefighter who is expected to ride the vehicle.
   2. *NFPA 1500, Standard on Fire Department Occupational Safety and Health Program*, also states that all riders must be seated and belted. The standard does, however, provide three exceptions to the requirement:

Slide 49
Apparatus Rider Safety

      a. When providing patient care in the back of an ambulance that makes it impractical to be seated and belted
      b. When loading hose back into a fire apparatus
      c. When performing training for personnel learning to drive the tiller portion of a tractor-drawn aerial apparatus

Slide 50
Apparatus Rider Safety

E. NFPA 1500 prohibits riding the tailboard or running boards of any moving apparatus as well as the practice of attacking wildland fires while riding on the outside of a moving wildland fire apparatus.

Slide 51
Apparatus Rider Safety

F. Some older apparatus are still in service with jump-seat riding positions not totally enclosed. Some of these are equipped with safety bars or gates that are intended to prevent a firefighter from falling out of a jump seat. These devices are not substitutes for safety procedures that require firefighters to ride in safe, enclosed positions wearing their seat belts.

Objective 15 — Answer questions about loading large diameter (4-inch [100 mm] or larger) supply hose onto a moving apparatus.

Slide 52
Loading Large Diameter Supply Hose onto a Moving Apparatus

A. The procedure must be contained in the department's written standard operating procedures (SOPs), and all members must be trained specifically on how to perform the moving hose-load operation.

B. In addition to the driver/operator, at least one member, other than one actually loading the hose, must be assigned as a safety observer to the operation. They must have complete visual contact with the hose-loading operation, as well as visual and voice communications (usually via a portable radio) with the driver/operator.

Slide 53
Loading Large Diameter Supply Hose onto a Moving Apparatus

C. The area in which the hose loading is being performed must be closed to other vehicular traffic.

D. The apparatus must be driven in a forward direction (straddling or to one side of the hose) at a speed no greater than 5 mph (8 km/h).

E. No members are allowed to stand on any portion of the apparatus while the vehicle is in motion.

Slide 54
Loading Large Diameter Supply Hose onto a Moving Apparatus

F. Members in the hose bed must sit or kneel while the apparatus is moving.

WARNING! Firefighters should never ride on the outside of a moving fire apparatus for any reason, other than those exceptions noted in NFPA 1500. Serious injury or death could occur if the apparatus is involved in a collision or rollover or if the rider falls from the moving apparatus.

Objective 16 — Answer questions about backing the apparatus.

Slide 55
Backing the Apparatus

A. Whenever possible, the driver/operator should avoid backing the fire apparatus. It is normally safer and sometimes quicker to drive around the block and start again.

B. When backing is necessary, there should be at least one firefighter — and preferably two — behind the apparatus to act as spotters. One spotter should be equipped with a portable radio and be positioned on the driver side approximately one vehicle length behind, to warn the driver/operator of any obstacles around the apparatus, including overhead.

Slide 56
Backing the Apparatus

C. If two spotters are used, only one should communicate with the driver/operator; the second spotter should assist the first one.

Note: This very simple procedure can prevent a large percentage of the collisions that occur during backing operations.

D. If you are the driver/operator and you do not have or cannot see the spotters behind you, **do not back the apparatus!**

Slide 57
Backing the Apparatus

E. All fire apparatus should be equipped with an alarm system that warns others when the apparatus is backing up. In some departments, when a vehicle is not equipped with a warning device, SOPs require the driver/operator to sound the horn twice before starting to back the vehicle.

Note: A growing number of apparatus are equipped with either a rearview video camera or short-distance radar to alert the driver/operator of objects immediately behind the apparatus.

Slide 58
Backing the Apparatus

Objective 17 — Back apparatus using mirrors.

Objective 17 is measured in Skill Sheet.

Objective 18 — List the basic concepts of defensive driving.

Slide 59
Basic Concepts of Defensive Driving

A. Anticipating other drivers' actions

B. Estimating visual lead time

C. Knowing braking and reaction times

D. Combating skids

E. Knowing evasive tactics

F. Having knowledge of weight transfer

Objective 19 — Select facts about defensive driving techniques.

A. Know the rules that govern the general public when emergency vehicles are responding with warning lights and audible devices operating.

Slide 60
Defensive Driving Techniques

B. When approaching an intersection, slow the apparatus to a speed that allows a stop at the intersection if necessary.

C. Bring the apparatus to a complete stop at the intersection before proceeding slowly (even when faced with a green signal light or no signal at all) if your view of the intersection is obstructed in any way.

Slide 61
Defensive Driving Techniques

D. Proceed through a red traffic signal or stop sign (if motor vehicle statues and departmental SOPs allow) *only* after coming to a ***complete stop*** and assuring that all lanes of traffic are accounted for and yielding to the apparatus.

E. When all lanes of traffic are blocked in the same direction as your responding apparatus, move the apparatus into the opposing lane of traffic (if departmental SOPs allow) and proceed through the intersection at an extremely reduced speed and using full warning devices.

Slide 62
Defensive Driving Techniques

Note: Some departmental SOPs require that the street or road be blocked by law enforcement before fire apparatus are allowed to drive in an opposing traffic lane.

Slide 63
Defensive Driving Techniques

F. Do not drive in the oncoming lane in situations where oncoming traffic is unable to see the apparatus.

Slide 64
Defensive Driving Techniques

G. When forced to drive in the oncoming lane, closely monitor traffic on the crest of a hill, slow-moving traffic, and other emergency apparatus.

H. Be alert for traffic that may enter from access roads and driveways.

Slide 65
Defensive Driving Techniques

I. Realize that warning sirens, lights, and signals may be blanketed by other warning devices and by street noises. Also, some drivers may be distracted by talking on cell phones, manipulating radio controls, or tending to small children.

Objective 20 — Explain techniques for anticipating other drivers' actions.

A. **Aim high in steering:** Find a safe path well ahead.

Slide 66
Anticipating Other Drivers' Actions

B. **Get the big picture:** Stay back and see it all.

C. **Keep your eyes moving:** Scan — do not stare.

D. **Leave yourself an "out":** Do not expect other drivers to leave you an out (escape route). Be prepared by expecting the unexpected.

Slide 67
Anticipating Other Drivers' Actions

E. **Make sure others can see and hear you:** Use lights, horn, and signals in combination.

Objective 21 — Explain the concept of visual lead time.

Slide 68
Visual Lead Time

A. Scanning far enough ahead of the apparatus, for the speed it is being driven, to assure that appropriate action can be taken if it becomes necessary.

Objective 22 — Match to their definitions braking and reaction time terms.

A. Total stopping distance — The sum of the driver/operator reaction distance and the vehicle braking distance

Slide 69
Braking and Reaction Time

B. Driver/Operator reaction distance — The distance a vehicle travels while a driver is transferring the foot from the accelerator to the brake pedal after perceiving the need for stopping

Slide 70
Braking and Reaction Time

C. Braking distance — The distance the vehicle travels from the time the brakes are applied until the apparatus comes to a complete stop

Slide 71
Braking and Reaction Time

D. Refer to Table 4.6a and 4.6b (page 80) for more information.

Objective 23 — List factors that influence the driver/operator's ability to stop the apparatus.

Objective 24 — Answer questions about factors that influence the driver/operator's ability to stop the apparatus.

A. Condition of the driving surface
   1. A flat, dry, paved road provides the optimal stopping ability.
   2. The ability of the apparatus to stop is negatively affected by steep, wet, snowy, icy, or unpaved roads.
   3. Driver/Operators must compensate for poor road conditions by reducing their speed by an appropriate amount to match the condition.

Slide 72
Factors Influencing Driver/Operator Ability to Stop the Apparatus

B. Speed being traveled — It will take a greater distance to stop a vehicle that is going 50 mph (80 km/h) than the same vehicle when it is traveling 30 mph (48 km/h).

Slide 73
Factors Influencing Driver/Operator Ability to Stop the Apparatus

C. Weight of the vehicle — At an equal speed, it will take a greater distance to stop a three-axle water tender (tanker) than a lighter vehicle.

D. Type and condition of the vehicle's braking system — A vehicle that has a properly maintained braking system will stop faster than one that has a system in disrepair.

Slide 74
Factors Influencing Driver/Operator Ability to Stop the Apparatus

Objective 25 — Answer questions about weight transfer.

Slide 75
Weight Transfer

A. Weight transfer occurs as the result of a physical law (inertia) that states that objects in motion tend to remain in motion; objects at rest tend to remain at rest unless acted upon by an outside force.

B. Whenever a vehicle undergoes a change in speed or direction, weight transfer takes place relative to the severity of change.

Slide 76
Weight Transfer

C. The weight carried on most fire apparatus can contribute to skidding or possible rollover due to lateral weight transfer caused by:
   1. Too much speed in turns
   2. Harsh or abrupt steering action
   3. Driving on slopes too steep for a particular apparatus

   Note: Weight transfer is of particular concern with apparatus that have large water tanks improperly baffled and partially filled with liquid.

Slide 77
Weight Transfer

D. Driver/Operators should use only as much steering as needed to keep weight transfer to a minimum.

E. Steering should be smooth and continuous to limit weight transfer.

F. It is advisable to maintain a speed slow enough to prevent severe weight transfer from occurring, particularly on curves.

Objective 26 — List the most common causes of skids.

Slide 78
Common Causes of Skids

A. Driving too fast for road conditions

B. Failing to properly appreciate weight shifts of heavy apparatus

C. Failing to anticipate obstacles (these range from other vehicles to animals)

D. Improper use of auxiliary braking devices

E. Improper maintenance of tire air pressure (overinflated tires)

F. Improper maintenance of tire tread depth (inadequate tread depth)

Objective 27 — Explain the purpose and operation of an antilock braking system (ABS).

Slide 79
Antilock Braking System (ABS)

A. Purpose — Minimizing the chance of skidding when the brakes are applied forcefully

B. Operation — Uses digital technology in an onboard computer that monitors each wheel and controls air pressure to the brakes, maintaining optimal braking ability

Objective 28 — List guidelines for controlling skids.

A. When driving a vehicle equipped with an ABS, maintain a steady pressure on the brake pedal (rather than pumping the pedal) until the apparatus is brought to a complete stop.

Slide 80
Controlling Skids

B. Remember that with air brakes, there is a slight delay (approximately 0.4 seconds) between the time from which the driver/operator pushes down on the brake pedal until sufficient air pressure is sent to the brake to operate.

C. When driving a vehicle not equipped with an ABS, release the brakes, allowing the wheels to rotate freely.

Slide 81
Controlling Skids

D. No matter what braking system, turn the steering wheel so that the front wheels face the direction of the skid.

E. When driving a standard transmission apparatus, do not release the clutch (push in the clutch pedal) until the vehicle is under control and just before stopping the vehicle.

Slide 82
Controlling Skids

F. Once the skid is controllable, gradually apply power to the wheels to further control the vehicle by providing traction.

CAUTION! Using paved parking lots for skid training with heavy fire apparatus may damage the pavement surface and possibly result in rollover accidents. Safety dictates that such training be conducted only at proper facilities and under the supervision of qualified instructors.

Slide 83
Controlling Skids

Objective 29 — Distinguish among characteristics of auxiliary braking systems.

Objective 30 — Explain how an automatic traction control (ATC) system works.

A. Front brake-limiting valve system

Slide 84
Front Brake-Limiting Valve Systems

1. Were commonly installed on apparatus built before the mid-1970s, but improved types are also found on some new apparatus
2. Were more commonly known as the "dry road/slippery road" switches
3. Were intended to help the driver/operator maintain control of the apparatus on slippery surfaces
4. Reduced the air pressure on the front steering axle by 50 percent when the switch was in the slippery-road position, preventing the front wheels from locking up, allowing the driver/operator to steer the vehicle even when the rear wheels were locked into a skid

Slide 85
Front Brake-Limiting Valve Systems

5. Were not overly effective or safe; with the switch in the slippery-road position, the braking capabilities were reduced by 25 percent

Slide 86
Front Brake-Limiting Valve Systems

6. Are almost obsolete; newer systems automatically vary the amount of air delivered to the front brakes, which eliminates the need for the dry road/slippery road switch

B. Electromagnetic braking systems

Slide 87
Electromagnetic Braking Systems

1. Augment and work in conjunction with the vehicle's conventional service brakes
2. Are frictionless braking systems
3. Are connected to either the driver shaft or the rear axle of the vehicle

Slide 88
Electromagnetic Braking Systems

4. Can be programmed to activate when driver/operators remove their foot from the accelerator, step on the brake pedal, or use a manual selector lever mounted on the steering column
5. Do not activate at speeds under 2 mph (3.2 km/h) under normal conditions

C. Automatic traction control (ATC)

Slide 89
Automatic Traction Control (ATC)

1. Turns itself on and off; there is no switch for the operator to select
2. Is engaged when a green light on the dash illuminates
3. Decreases the engine speed as needed until traction is

acquired to move the chassis

4. Helps improve traction on slippery roads by reducing drive wheel over spin
5. Works in two ways:
   a. When a drive wheel starts to spin, the ATC applies air pressure to brake the wheel, transferring engine torque to the wheels with better traction
   b. When all drive wheels begin to spin, the ATC reduces the engine torque to provide improved traction

Slide 90
Automatic Traction Control (ATC)

D. ATC snow-and-mud switch
   1. Increases available traction on extra soft surfaces
   2. Is activated with a switch and is engaged when an indicator light on dash flashes continuously
   3. Should be deactivated when normal traction is regained
   4. Is deactivated by pressing the switch a second time and turning off the vehicle ignition
   5. Can be used to "rock" an apparatus out of a particular spot

Slide 91
ATC Snow-and-Mud Switch

Note: Use caution when activating this switch because axle damage may occur if the apparatus regains traction suddenly.

Slide 92
ATC Snow-and-Mud Switch

Objective 31 — Select facts about safe passing procedures.

A. Avoid passing vehicles that are not pulling over to yield the right-of way; however, the need to pass may occur, and the driver/operator must be prepared to do it in the safest manner possible.

Slide 93
Safe Passing Procedures

B. Always travel in the innermost lane on multilane roads. Wait for vehicles in front of you to move to the right before proceeding.

C. Avoid passing vehicles on their right sides. Most civilian drivers' natural tendency is to move to the right when an emergency vehicle is approaching. Thus, they could turn into your path if you are passing on the right. Some departments have strict SOPs prohibiting this practice.

Slide 94
Safe Passing Procedures

D. Make sure you can see that the opposing lanes of traffic are clear of oncoming traffic if you must cross the center line.

E. Avoid passing other emergency vehicles if at all possible. However, in some cases, it may be desirable for a smaller,

Slide 95
Safe Passing Procedures

faster vehicle (such as a chief's vehicle) to pass a larger, slower vehicle (such as an aerial apparatus). In these cases, the lead vehicle should slow down and move to the right to allow the other vehicle to pass. This maneuver should be coordinated by radio if possible.

Objective 32 — Answer questions about driving in adverse weather.

Objective 33 — Answer questions about using an interaxle differential lock.

A. Decrease speed gradually, slow down while approaching curves, keep off low or soft shoulders, and avoid sudden turns.

Slide 96
Driving in Adverse Weather

B. Recognize areas that become slippery first, such as bridge surfaces, northern slopes of hills, shaded spots, and areas where snow is blowing across the roadway.

Slide 97
Driving in Adverse Weather

C. Test the brakes while in an area free of traffic to find out how slippery the road is and to determine your approximate stopping distance.

Slide 98
Driving in Adverse Weather

D. Use the windshield wipers and defrosters to keep the windshield clean and clear.

E. Know that snow tires or tire chains reduce the stopping distance but increase starting and hill-climbing traction on snow or ice.

F. Increase the safe following distance between vehicles.

Slide 99
Driving in Adverse Weather

G. Remember that it takes 3 to 15 times more distance for a vehicle to come to a complete stop on snow and ice than it does on dry concrete.

H. Know that some fire apparatus are equipped with an auxiliary traction control system called the interaxle differential lock.

Slide 100
Interaxle Differential Lock

1. Is also known as a power divider or third differential
2. Is a switch that may be activated from the cab of an apparatus that has tandem rear axles
3. Allows for a difference in speed between the two rear axles, while providing pulling power from each axle, providing greater traction for each axle

4. Using an interaxle differential lock
   a. Move the switch to the locked position when approaching or anticipating slippery-road conditions to provide improved traction.
   b. Always unlock the switch again when road conditions improve.
   c. Lift your foot from the accelerator when activating the interaxle differential lock.
   d. Do not activate this switch while one or more of the wheels are actually slipping or spinning because damage to the axle could result.
   e. Do not spin the wheels with the interaxle differential locked because damage to the axle could result.

Slide 101
Using an Interaxle Differential Lock

Slide 102
Using an Interaxle Differential Lock

Objective 34 — Explain the operation of automatic tire chains.

Slide 103
Automatic Tire Chains

A. Short lengths of chain are attached to a rotating hub in front of each rear wheel.

B. The hubs swing down into place when a switch on the dashboard is activated.

C. The rotation of the hub throws the chains underneath the rolling tires.

Note: These chains tend to lose their effectiveness in snow that is deeper than 8 inches (200 mm) or when the vehicle is moving at very slow speed or in reverse.

Objectives 35 — Select facts about warning devices and clearing traffic.

A. Know that civilian drivers respond better to sounds that change pitch often, so short bursts with the air horns and the constant up-and-down oscillation of a mechanical or electronic siren are the surest ways to catch a driver's attention.

Slide 104
Warning Devices and Clearing Traffic

B. Be careful not to "outrun" the effective range of the emergency vehicle's audible warning device.

   Example: At 40 mph (64 km/h) the siren can project 300 feet (90 m) in front of the vehicle. At a speed of 60 mph (97 km/h), however, the siren is audible only 12 feet (3.7 m) or

Slide 105
Warning Devices and Clearing Traffic

less in front of the vehicle.

C. Use discretion in the use of sirens when responding to sensitive situations, such as psychiatric emergencies.

Slide 106
Warning Devices and Clearing Traffic

D. Limit the use of warning devices to true emergency response situations.

Note: Each department should have SOPs on what types of calls are considered emergencies and which are not.

E. Turn off all warning devices (if required by departmental SOPs) and proceed with the normal flow of traffic while driving on limited-access highways and turnpikes.

Slide 107
Warning Devices and Clearing Traffic

F. Travel at least 300 to 500 feet (90 m to 150 m) apart from other emergency vehicles responding along the same route.

G. Avoid relying on designated response routes. Use radio reports of location and status, particularly when you are certain you are approaching the same intersection as another emergency vehicle.

Slide 108
Warning Devices and Clearing Traffic

H. Turn headlights on while responding, even during daylight hours.

I. If using a spotlight, move it across the back window of a vehicle to rapidly gain the driver's attention. Do not leave the spotlight shining on the vehicle, however, because this blinds the driver.

Slide 109
Warning Devices and Clearing Traffic

J. Dim headlights and turn off spotlights in situations where they may blind oncoming drivers, including the drivers of other apparatus that are approaching the scene.

K. Though headlight flashers are an inexpensive and effective warning device, check to see if your state (province) allows them.

Slide 110
Warning Devices and Clearing Traffic

L. Turn off some of the apparatus' warning lights once it is parked so as not to overpower the effectiveness of the reflective trim on the firefighters' protective clothing or vests.

Objective 36 — Match traffic control devices to their purpose.

Objective 37 — Match traffic control devices to their activation methods.

Slide 111
Traffic Signal in Front of the Fire Station

A. Traffic signal in front of the fire station
   1. Stops the flow of traffic so that the apparatus can exit safely
   2. May be controlled by a button in the station or by the dispatcher or may be activated when the station is toned out

Slide 112
Multiple Traffic Signal Control

B. Multiple traffic signal control
   1. Controls one or more traffic lights in the normal route of travel for fire apparatus
   2. May be controlled from the fire station, remote controls on the fire apparatus, or from the dispatch center

Slide 113-114
Strobe-Activated System

C. Strobe-activated system
   1. Provides green lights for the direction that the apparatus is traveling and red signals in all other directions
   2. Uses emitters on the fire apparatus and sensors mounted on the traffic lights

Slide 115
Siren-Activated System

D. Siren-activated system
   1. Orders a preemption of the current traffic signal
   2. Is activated by the emergency vehicle's siren as it approaches an intersection

Note: No traffic control device is a substitute for using proper defensive driving techniques.

Objective 38 — Select facts about tests used to certify personnel as driver/operators.

Slide 116
Certification Tests

Slide 117
Written Tests

A. Written Tests
   1. May include questions pertaining to the following areas:
      a. All applicable driving regulations for emergency and nonemergency situations
      b. Departmental regulations
      c. Hydraulic calculations
      d. Specific operational questions regarding pumping
      e. Department standard operating procedures

2. Depending on local preference, may be open or closed book; style will vary according to local preference

B. Practical driving exercises

Slide 118
Practical Driving Exercises

Note: The descriptions for the exercises listed contain minimum dimensions for setting up these exercises. NFPA 1002 notes that these dimensions may not be reasonable for extremely large fire apparatus.

1. NFPA 1002 specifies a number of practical driving exercises (those that follow) that the driver/operator candidate should be able to successfully complete before being certified to drive the apparatus. The standard requires that driver/operators must be able to perform these exercises with each type of apparatus they are expected to drive. Individual jurisdictions may choose to add other exercises that simulate local conditions.
2. Alley Dock

Slide 119
Alley Dock Exercise

   a. Tests the driver/operator's ability to move the vehicle backward within a restricted area and into an alley, dock, or fire station without striking the walls and to bring the vehicle to a smooth stop close to the rear wall
   b. Requirements

Slide 120
Alley Dock Exercise

      1) Boundary lines for the restricted area 40 feet (12.2 m) wide, similar to curb-to-curb distance
      2) Simulated area 12 feet (3.66 m) wide and 20 feet (6.1 m) deep along one side and perpendicular
   c. Alternative: Apparatus station parking maneuver
3. Serpentine Course

Slide 121
Serpentine Course

   a. Simulates maneuvering around parked and stopped vehicles and tight corners
   b. Requirements

Slide 122 – 123
Serpentine Course

      1) Markers between 30 and 38 feet (9 m and 12 m) apart, depending on the size of the apparatus being used
      2) Adequate space on each side of the markers for the apparatus to move freely
   c. Must be completed in each direction in one continuous motion without touching any of the course markers

4. Confined Space Turnaround
   a. Tests the driver/operator's ability to turn the vehicle 180 degrees within a confined space
   b. Requirements — An area that is at least 50 feet (15.25 m) wide and 100 feet (30.5 m) long
   c. Has no limit to the number of direction changes that are required before the apparatus is turned 180 degrees and driven through the same opening it entered
   d. Is completed successfully when the apparatus has been turned 180 degrees and driven through the original entrance point with no course markers being struck or without leaving the defined course
5. Diminishing-Clearance
   a. Measures a driver/operator's ability to steer the apparatus in a straight line, to judge distances from wheel to object, and to stop at a finish line
   b. Requirements — Two rows of stanchions that form a lane 75 feet (23 m) long, narrowing from a width of 9 feet 6 inches (2.9 m) to a diminishing clearance of 8 feet 2 inches (2.5 m)

Slide 124
Confined Space Turnaround

Slide 125 – 126
Confined Space Turnaround

Slide 127 – 128
Diminishing-Clearance

C. Road tests — NFPA 1002 says that any road test that leads to certification should include at least the following elements:
   1. Four left and four right turns
   2. A straight section of urban business street or two-lane rural road at least one mile (1.6 km) in length
   3. One through intersection and two intersections where a stop must be made
   4. A railroad crossing
   5. One curve, either left or right
   6. A section of limited-access highway that includes an on ramp, off-ramp, and a section of road long enough to allow for at least two lane changes
   7. A downgrade that is steep enough and long enough to require downshift and braking
   8. An upgrade that is steep enough and long enough to require gear changing to maintain speed
   9. One underpass or a low-clearance bridge

Slide 129
Road Tests Must Include

Slide 130
Road Tests Must Include

Objective 39 — Perform various driving exercises.
Objective 40 — Perform various road tests in a fire service apparatus.

Objectives 39 and 40 are measured in Skill Sheets.

Objective 41 — Answer questions about safe operation and driving of fire apparatus.

A. Remember that speed is less important than arriving safely at the destination.

Slide 131
Safe Operation and Driving of Fire Apparatus

B. Slow down for intersections and stop when faced with a red light or stop sign. Anticipate the worst possible situation.

C. Drive defensively. Be aware of everything that is happening or likely to happen 360 degrees around the apparatus.

D. Expect that some motorists and pedestrians will neither hear nor see the apparatus warning devices.

Slide 132
Safe Operation and Driving of Fire Apparatus

E. Be aware of the route's general road and traffic conditions. Adjust this expectation with the season, weather, day of the week, and time of day.

F. Remember that icy, wet, or snow-packed roads increase braking distance by as much as fifteen times.

G. Do not grind the gears on manual transmission vehicles.

Slide 133
Safe Operation and Driving of Fire Apparatus

H. Do not use the clutch pedal as a footrest.

I. Do not exceed 10 mph (15 km/h) when leaving the station.

J. Do not race the engine when the apparatus is standing still. It is unnecessary and abuses the engine.

K. Always use low gear when starting from a standstill. Using second or third gear and slipping the clutch damages the clutch and causes unnecessary, rapid wear.

Slide 134
Safe Operation and Driving of Fire Apparatus

L. Keep the apparatus under control at all times.

M. Take ***nothing*** for granted.

Summary

A. A collision or vehicular failure caused by irresponsible or inept driving has many repercussions and is inexcusable.

Slide 135
Summary

B. In order to demonstrate proper driving characteristics and perform competently as the driver/operator of a fire department pumping apparatus, a driver/operator must adopt the proper attitude toward this responsibility.

C. Driver/Operators must familiarize themselves with all departmental SOPs on emergency vehicle operation, and with the capabilities and limitations of the assigned apparatus.

Slide 136
Summary

D. A driver/operator must diligently practice driving and operating the assigned apparatus under controlled conditions until the required level of skill is achieved.

E. Once driver/operators are qualified, they must continue to study and practice to maintain and improve their skills as a pumping apparatus driver/operator.

Slide 137
Summary

Discussion Questions

Slide 138
Discussion Questions

1. What are the most common causes of fire apparatus collisions?
2. What regulatory agencies/laws govern fire apparatus driver/operators?
3. Name a few guidelines for proper driver/operator attitude.
4. What are the exceptions to the NFPA seated and belted requirement?

Slide 139
Discussion Questions

5. What are the basic concepts of defensive driving?
6. Name a few defensive driving techniques.
7. What are a few ways to anticipate other drivers' actions?
8. What is visual lead time?
9. What factors influence the driver/operator's ability to stop the apparatus?

Slide 140
Discussion Questions

10. What are the most common causes of skids?
11. What is the purpose of an antilock braking system?
12. Name a few guidelines for controlling skids.
13. Name a few safe passing procedures.

Apparatus Operator Refresher
Lesson 4— Positioning Apparatus

Lesson Outline

PRESENTATION OUTLINE	VISUALS/NOTES
Objective 1 — Answer questions about guidelines for positioning fire attack pumpers for fire attack. **Objective 2 — Select facts about factors to consider when positioning the apparatus.** **Objective 3 — List indicators of building collapse.**	
A. Size up the incident as quickly as possible in order to determine the proper position for attack.	**Slide 13** **Positioning Fire Attack Pumpers for Fire Attack**
B. If the apparatus arrives at a location where no fire conditions are evident, position near the main entrance to the occupancy. 1. Driver/Operator — Remain with the vehicle and prepare to make connections to the water supply or sprinkler/standpipe fire department connection or pull attack hoselines if the need arises. 2. Fire Company Personnel — Enter the structure and investigate the situation.	
C. When fire conditions are evident upon approaching the scene, look for the best tactical position in which to place the apparatus. Consider the following: 1. Departmental SOPs 2. Rescue situations — Life safety is always the first tactical priority at any fire incident. 3. Water supply 4. Method of attack a. If the incident can be handled with preconnected handlines, the apparatus must be positioned so that the nozzle reaches the area that contains the seat of the fire. b. If portable master streams are going to be used, the apparatus must be positioned close enough for hoselines to effectively supply them. c. If the turret on the apparatus is going to be used, the	**Slide 14** **Factors to Consider when Positioning Apparatus** **Slide 15** **Factors to Consider when Positioning Apparatus**

apparatus must be in a position that allows the fire stream to reach its intended target.

5. Exposures
6. Wind direction — Attempt to position the apparatus upwind (in the "cold" zone) of the incident.
7. Terrain
   a. Choose a paved surface over an unpaved surface.
   b. Position uphill from the incident whenever possible.
8. Relocation potential — Always leave yourself a way out.
9. Building condition and potential for structural collapse
   a. Be aware of indicators of building collapse.
      1) Bulging walls
      2) Large cracks in the exterior
      3) Falling bricks, blocks, or mortar
      4) Interior collapses
      5) Presence of ornamental stars or large bolts with wasters on exterior walls
      6) Buildings that are old and poorly maintained
   b. Position the apparatus far enough away so that the apparatus is not in the collapse zone should a collapse occur.

      Note: The collapse zone is equal to one and one-half times the height of the building.
   c. When possible, position the apparatus at the corners of the building.
10. Fire intensity
    a. Position the apparatus far away from the building for large, hot fires.
    b. If the fire has the potential to grow or spread to other exposures, place the apparatus so that it is not trapped by the advancing fire.
11. Power or other utility lines
12. Falling debris

Slide 16
Factors to Consider when Positioning Apparatus

Slide 17
Factors to Consider when Positioning Apparatus

Slide 18
Factors to Consider when Positioning Apparatus

Slide 19
Factors to Consider when Positioning Apparatus

Slide 20
Indicators of Building Collapse

Objective 4 — Select facts about positioning pumpers to support aerial apparatus.

A. It is best to give the aerial apparatus the optimum operating position and to locate the pumping apparatus a little farther away.

Slide 21
Positioning Pumpers to Support Aerial Operations

B. Many departments use the "inside/outside" method.
   1. If the building is less than five stories tall, engine

Slide 22
Positioning Pumpers to Support Aerial Operations

companies should position on the side of the street closest to the building and aerials position outboard of the engine.

Note: In this case, the building is low enough to be reached by the aerial device even if it has to extend over the closer engines.

2. If the building is higher than five stories, the engines take the outside position and the aerials position next to the building, allowing for maximum reach ability.

Slide 23
Positioning Pumpers to Support Aerial Operations

C. Pumpers providing water for elevated stream operations should position as close to the aerial apparatus as possible.

Slide 24
Positioning Pumpers to Support Aerial Operations

D. Pumpers equipped with their own elevated stream devices should position in the same manner as aerial apparatus providing fire suppression.

E. Pumpers must position to allow side- or rear-loaded ground ladders to be removed from the apparatus.

Objective 5 — Analyze a scenario to determine pumper position to support aerial operations.

Objective 6 — Answer questions about pumper positioning for supporting fire department connections (FDCs).

A. Pumpers will generally position as close as possible to the support sprinkler or standpipe FDC.

Slide 25
Pumper Positioning for Supporting FDCs

B. Most of the time, a fire hydrant is located very close to the FDC, allowing the pumper to connect to both the hydrant and the FDC with ease.

C. When using a draft source, position the pumper at the water supply source.

Slide 26
Pumper Positioning for Supporting FDCs

D. Establish a relay to supply water if there is no water supply near the sprinkler or FDC.

Objective 7 — Supply water to a sprinkler/standpipe system.

Objective 7 is measured in Skill Sheet.

Objective 8 — Analyze a scenario to determine pumper position to support fire department connections.

Objective 9 — Select facts about drafting operations.

A. Drafting operations are required when a pumper is going to be supplied from a static water supply such as a pond, lake, stream, or cistern.

Slide 27
Drafting Operations

B. Drafting pumpers may supply fireground apparatus directly or may serve as source pumpers for relay or water shuttle operations.

C. Attempt to identify all suitable drafting locations in your response district and keep a record of them for future use.

Slide 28
Drafting Operations

D. Give preference to drafting sites that are accessible from a paved surface and require a minimum length of suction hose or lift.

E. Minimize lift distances to provide better discharge abilities. Consult Table 5.1 for a list of maximum lifts.

F. Be aware that bridges, boat ramps, and large docks make for the best drafting locations.

Slide 29
Drafting Operations

G. Be wary of drafting from locations that are off paved surfaces. These surfaces may be unstable and cause the apparatus to sink to the ground.

H. When placing the suction hose directly into the static water source,

Slide 30
Drafting Operations

1. Stop the pumper before reaching the source.
2. Connect the hard suction hose and strainer to the pumper.
3. Drive the pumper into the final draft position.
4. Attach a rope to the end of the strainer before putting it in the water to help position it properly without having to enter the water.

Slide 31
Drafting Operations

I. Be sure that the hard suction hose strainer does not rest on the bottom of the water source during drafting — the rope may be tied off to the apparatus or a nearby object in order to hold the strainer off the bottom.

J. Use a float, such as a spare tire or plastic container, to hold the strainer at an appropriate depth.

Slide 32
Drafting Operations

CAUTION! Apparatus driver/operators working near the edge of bodies of water should be required to wear a personal flotation device (PFD).

Slides 33 – 34
Drafting Operations

K. Many rural jurisdictions identify suitable drafting sites within their jurisdiction and install dry hydrants. A dry hydrant consists of a suction hose connection on the shore and a length of pipe equipped with a strainer that extends into the water supply source.

Objective 10 — Position pumper for drafting from a static water supply.

Objective 10 is measured in Skill Sheet.

Objective 11 — Analyze a scenario to determine pumper position for drafting operations.

Objective 12 — Answer questions about hydrant operations.

Slide 35
Hydrant Operations

A. Historically, hard intake hose has been used to connect a pumper to a fire hydrant. However, hard intake hose is designed to withstand the negative pressures associated with drafting operations, but not to be used under positive-pressure conditions.

Slide 36
Hydrant Operations

CAUTION! Only hard intake hose that has been designed to withstand positive pressure should be connected to a fire hydrant.

Slide 37
Hydrant Operations

B. Many jurisdictions have SOPs that require the driver/operator to place gated valves on the small diameter discharges of the dry-barrel hydrants when making a connection to the large diameter discharge.

C. Large diameter intake hose connections

1. Large diameter intake hose is the preferred type of hose for connection to a fire hydrant, and usually comes in sections of 10 to 50 feet (3 m to 15 m) long.
2. The driver/operator must judge the proper distance from the hydrant through practice.

   Note: The distance is judged from the hydrant rather than the curb because most hydrants are located different distances from the curb.

Slide 38
Large Diameter Intake Hose Connections

Slide 39
Large Diameter Intake Hose Connections

D. Side intake connections

1. The driver/operator must stop the pumper close to the curb and with the pump intake a few feet (meters) short of being in line with the hydrant outlet, allowing the hose to slightly curve, preventing kinks that drastically restrict flow.
2. Kinks can also be minimized by putting two full twists in the hose when making the connection between the hydrant and the pumper.

   Note: Twists should not be put in the hose if either or both ends are equipped with sexless couplings.

   Note: To avoid possible injury to the hydrant operator, some departments train their firefighters to stand behind the hydrant when opening the hydrant valve.

Slide 40
Side Intake Connections

Slides 41 – 42
Side Intake Connections

E. Front and rear intake connections

1. The driver/operator must stop the pumper either a few feet (meters) beyond the hydrant to permit the hose to curve.
2. When using front or rear intake connections, the vehicle should be aimed or angled in the direction of the hydrant; this angle should be 45 degrees or less.

Slide 43
Front and Rear Intake Connections

F. Connection to the 2½-inch (65 mm) hydrant outlets

1. When the maximum flow from a hydrant is not needed or large diameter hose is not available, connection to the hydrant may be made with one or two 2½-inch (65 mm) outlets, by connecting sections of 2½- or 3-inch (65 mm or 77 mm) hose to the pump.
2. Advantages
   a. Is the easiest to set up
   b. Allows maximum flexibility of the hose with regard to the location of the pumper
   c. Can be accomplished by one person due to the light

Slide 44
Connecting to 2½-inch Hydrant Outlets

Slide 45
Advantages of Connecting to 2½-inch Hydrant Outlets

weight of the smaller hose

d. Decreases maneuvering time, allowing the pumper to connect and supply water much more quickly

3. Disadvantage — Limits the amount of water that can be supplied

Note: Maximize possible water flow by using 3-inch (77 mm) hoselines, removing kinks, or putting a gate valve on all outlets before turning the hydrant on.

Slide 46
Disadvantage of Connecting to 2½-inch Hydrant Outlets

Slide 47
Multiple Intake Connections

G. Multiple intake connections — Determine the pumper position by the soft sleeve requirements, because it is the shorter (and greater capacity) hose.

Objective 13 — Analyze a scenario to determine pumper position for hydrant operations.

Objective 14 — Position pumper to make large diameter intake hose connections.

Objective 15 — Position pumper to connect to 2½-inch (65 mm) hydrant outlets.

Objective 16 — Position pumper to make multiple intake connections.

Objectives 14 through 16 are measured in Skill Sheets.

Objective 17 — List advantages of dual pumping operations.

Slide 48
Advantages of Dual Pumping Operations

A. A better use of available water

B. Shorter hose lays

C. Ability to place hoselines in operation more quickly

D. Ability to group apparatus more closely together, allowing easier coordination

Objective 18 — Analyze a scenario to determine pumper position for dual pumping operations.

Objective 19 — Position pumper and make connections for a dual pumping operation.

Objective 19 is measured in Skill Sheet.

Objective 20 — Explain when to use tandem pumping operations.

A. When pressures higher than a single engine is capable of supplying are required

Slide 49
When to Use Tandem Pumping Operations

B. When the attack pumper is only a short distance from a hydrant

CAUTION! Use caution when supplying hoselines with a tandem pumping operation because it is possible to supply greater pressure than the hose can withstand. Pressure supplied to the hose should not exceed the pressure at which the hose is annually tested by the department.

Slide 50
Using Tandem Pumping Operations

Note: Departments that routinely perform high-pressure tandem pumping operations may have hose designated for that function.

Objective 21 — Analyze a scenario to determine pumper position for tandem pumping operations.

Objective 22 — Position pumper and make connections for a tandem pumping operation.

Objective 22 is measured in Skill Sheet.

Objective 23 — Select facts about structural protection at wildland fires.

A. After life safety, the highest priority for most wildland fire fighting operations is the protection of structures that are exposed to the fire.

Slide 51
Structural Protection at Wildland Fires

B. The boundary between the wildland and structural development is often referred to as the wildland/urban interface.

Slide 52
Structural Protection at Wildland Fires

C. Many of the structures threatened by wildland fires are not on wide, paved streets, but at the ends of long, narrow driveways opening from rural lanes.

D. Most structures in the wildland/urban interface are surrounded by dry, flammable vegetation.

Objective 24 — Answer questions about positioning wildland fire apparatus for structural protection.

Slide 53
Positioning Wildland Fire Apparatus for Structural Protection

A. Position the apparatus off the roadway to avoid blocking other fire apparatus or evacuating vehicles.

B. Scrape away fuel, if necessary, to avoid positioning in flammable vegetation.

Slide 54
Positioning Wildland Fire Apparatus for Structural Protection

C. Position the apparatus on the lee side of the structure to minimize exposure to heat and blowing fire embers.

D. Position the apparatus near (but not too close to) the structure so that hoselines can be kept short.

Slide 55
Positioning Wildland Fire Apparatus for Structural Protection

E. Keep cab doors closed and windows rolled up to keep out burning material.

F. Place the engine's air-conditioning system (if equipped) in recirculation mode to avoid drawing in smoke from outside.

Slide 56
Positioning Wildland Fire Apparatus for Structural Protection

G. Do not position the apparatus next to or under hazards such as:
   1. Power lines
   2. Trees or snags
   3. LPG tanks or other pressure vessels
   4. Structures that might burn

Objective 25 — Select facts about a wildland fire attack.

Slide 57
Wildland Fire Attack

A. During a wildland fire, constantly be aware of the fire's current location and direction of spread so that the apparatus and its crew are never placed in a position of danger.

B. To reduce the risk to engine crews as much as possible, begin

attack from an anchor point – a natural or man-made barrier that will prevent the fire from spreading around and encircling the engine and crew. Typical anchor points are roads, lakes, ponds, streams, and previously burned areas.

C. Drive at an appropriately reduced speed when operating the vehicle under conditions of reduced visibility.

Slide 58
Wildland Fire Attack

D. If necessary, have a spotter walk ahead of the vehicle to help locate and avoid obstacles such as logs, stumps, rocks, low-hanging limbs, ditches, and gullies.

E. Make sure that spotters are equipped with reliable handlights, are wearing highly visible clothing, and can stay within the driver's field of view at all times.

Slide 59
Wildland Fire Attack

F. When operating the apparatus in a stationary position, position for maximum protection from heat and flames.

G. Consider potential hazards, such as falling trees, rolling rocks, incoming air drops, and heavy equipment building control lines when selecting a position for the apparatus during times of stationary positioning.

Slide 60
Wildland Fire Attack

H. Deploy and charge a short 1½- or 1¾-inch (38 mm or 45 mm) line for protection of the apparatus.

I. Always chock the wheels when the apparatus is positioned.

J. Position the apparatus facing the exit direction.

Slide 61
Wildland Fire Attack

K. Avoid driving the apparatus on steep hillsides, especially if it has a relatively high center of gravity.

L. Do not stop the apparatus in soft ground, sand, or mud in which it can become mired and vulnerable to being overrun by fire.

M. Do not drive an apparatus across a bridge unless the bridge is known to be strong enough to support the vehicle's weight.

Slide 62
Wildland Fire Attack

N. Do not attempt to ford a stream with an apparatus that is not designed to do so.

O. Avoid driving apparatus on the shoulders of railroad roadbeds.

P. Keep hoselines as short as possible when the apparatus is used in a mobile attack.

Slide 63
Wildland Fire Attack

Q. Always reserve a small portion of water in the vehicle's tank for protection of the apparatus and crew.

R. When progressing along the fire's edge, ensure complete extinguishment by working engines in tandem or working a single engine with a hand crew.

Slide 64
Wildland Fire Attack

S. Position engines in a safety zone and do not leave them unattended.

Slide 65
Wildland Fire Attack

T. Communicate and coordinate effectively with the rest of the fireground organization for safe and effective engine operations.

U. Leave the headlights on whenever the engine is running.

V. Back engines into one-way roads and driveways facing the escape route.

Slide 66
Wildland Fire Attack

W. Keep all windows rolled up to prevent burning embers from entering the cab of the vehicle.

X. Always establish an anchor point prior to attacking a wildland fire.

Y. If the fire is spreading rapidly upslope, draw back to the flanks rather than attempt a frontal attack.

Slide 67
Wildland Fire Attack

Z. Position the engine to maximize protection from heat and fire.

AA. Do not drive apparatus into unburned fuels higher than the bumper or running board without a spotter.

BB. Use areas of burned fuel whenever possible.

Slide 68
Wildland Fire Attack

CC. When attacking from the unburned side, leave sufficient

clearance distances from the fire line to allow for loss of water and mechanical failure.

DD. Be aware of fire conditions at all times.

EE. Consider the location of operating crews when moving the apparatus.

Slide 69
Wildland Fire Attack

FF. Do not drive into smoke where crews may be operating.

Note: If apparatus must drive through smoke, sound the horn or siren intermittently, using warning and headlights, and drive slowly.

Objective 26 — Analyze a scenario to determine position of wildland fire apparatus for wildland fire attack.

Objective 27 — Analyze a scenario to determine wildland fire apparatus position for structural protection.

Objective 28 — Select facts about positioning rescue/squad apparatus.

A. Rescue companies, sometimes referred to as squads, are dispatched to fire incidents as extra manpower on the fire scene or to perform truck company functions in the absence of an aerial apparatus on the scene.

Slide 70
Rescue/Squad Apparatus

B. The positioning of rescue apparatus is not as critical as that of pumping and aerial apparatus.

C. Guidelines

1. Position as close to the scene as possible, without blocking access to other apparatus.
2. Make sure that the rescue/squad apparatus has a clear exit path from the scene in the event that it is needed at a second incident.
3. If using apparatus for scene lighting or SCBA cylinder refilling, locate strategically for those purposes.

Slide 71
Guidelines for Positioning Rescue/Squad Apparatus

Objective 29 — Analyze a scenario to determine rescue/squad apparatus position at a fire scene.

Objective 30 — Answer questions about guidelines for positioning command vehicles.

A. Provide for maximum visibility of the incident (attempt to have a clear view of two sides).

B. Provide for maximum visibility of the area surrounding the incident.

C. Place in a position that is easy to locate for other responders operating on the scene.

D. Position somewhere outside of the immediate danger zone.

E. Avoid blocking the movement of other fire apparatus or interfacing with incident operations.

F. Display some type of light or sign that readily identifies the vehicle as the command post.

Slide 72
Guidelines for Positioning Command Vehicles

Slide 73
Guidelines for Positioning Command Vehicles

Objective 31 — Analyze a scenario to determine position of command vehicle at a fire scene.

Objective 32 — Select facts about mobile breathing air supply systems and apparatus.

A. Cascade systems
   1. Are large breathing air cylinders that are connected together in banks
   2. Range from a bank of 4 to 12 large cylinders
   3. Allow air to be transferred from the large cylinders into the smaller SCBA cylinders
   4. Have a limited duration of use before they themselves must be refilled; this duration depends on the number and size of the cylinders in the system

Slide 75
Cascade Systems

B. Breathing-air compressors

1. Are engine-driven appliances that take in atmospheric air, purify it, and compress it
2. Continue to refill SCBA cylinders as long as their motors are running

Slide 76
Breathing-Air Compressors

C. Mobile breathing air supply apparatus

1. Are used in larger jurisdictions
2. Are dedicated strictly to refilling/replacing SCBA cylinders
3. May carry large quantities of extra SCBA cylinders as well as equipment to refill expended cylinders
4. May be equipped with large cascade systems, breathing air compressors, or both
5. May be equipped with long hose reels that allow cylinders to be refilled at a remote location such as inside a large building or on the upper floors of a high-rise structure

Slide 77
Mobile Breathing Air Supply Apparatus

Slide 78
Mobile Breathing Air Supply Apparatus

Slide 79
Mobile Breathing Air Supply Apparatus

Objective 33 — Answer questions about positioning mobile air supply apparatus.

A. The apparatus should be close enough to the scene so that the firefighters do not have to carry SCBA cylinders an extraordinary distance.

Slide 80
Positioning Mobile Air Supply Apparatus

B. These apparatus should not block scene access for other vehicles.

C. If the hose reel is going to be used for remote filling, the apparatus needs to be positioned so that the hose can be appropriately deployed.

D. Apparatus using breathing air compressors to refill SCBA cylinders need to be positioned upwind of the fire in clear air space.

Note: Breathing air compressors have filter sensors that prevent their use if the incoming air is contaminated.

Slide 81
Positioning Mobile Air Supply Apparatus

E. Driver/Operators need to know the SOPs for their department so that the apparatus is located appropriately.

Objective 34 — Analyze a scenario to determine position of breathing supply apparatus at a fire scene.

Objective 35 — Select facts about emergency medical service (EMS) vehicles and their positioning at a fire scene.

Slide 82
Emergency Medical Services (EMS) Vehicles

A. Commonly respond to fire and hazardous materials incidents to treat and transport injured civilians and to stand by in case an emergency responder needs medical assistance.

Slide 83
Emergency Medical Services (EMS) Vehicles

B. May be one of two types
   1. Paramedic/quick responder units (nontransport) — Utility vehicles that carry emergency medical technicians (EMTs) or paramedics and the equipment they need to treat victims; are not equipped to transport victims to the hospital
   2. Ambulances (transport) — Carry the necessary equipment to both treat and transport victims

Slide 84
Positioning EMS Vehicles at a Fire Scene

C. Should be positioned close to the scene, but not blocking access for other fire and emergency vehicles.

D. Will be located in vicinity of the triage and treatment area for incidents where victims require EMS intervention

E. Will be on standby mode on incidents where there are no immediate EMS situations; will be located in the rehabilitation area

Objective 36 — Analyze a scenario to determine position of an EMS vehicle at a fire scene.

Objective 37 — List the advantages of apparatus staging procedures.

Slide 85
Advantages of Apparatus Staging Procedures

A. Prevents a late-arriving ladder truck from being blocked from a better position by earlier-arriving apparatus

B. Facilitates the orderly positioning of apparatus

C. Allows the Incident Commander to fully utilize the potential of each unit and crew

Objective 38 — Distinguish between Level I and Level II IMS multicompany response staging procedures.

A. Level I

1. Is used on the initial response to a fire or other incident involving more than one responding company
2. Requires the first-due unit to proceed directly to the scene
3. Requires that later-arriving units stop (stage) at least one block away from the scene in their direction of travel and await further orders

Slides 86 – 87
Level I IMS Multicompany Response Staging Procedures

B. Level II

1. Is used when numerous emergency vehicles will be responding to an incident and for incidents that require mutual aid or that result in multiple alarms
2. Includes an apparatus staging area designated by the Operations Section Chief
3. Requires that companies respond directly to the staging area location
4. Generally, the company officer of the first company to arrive at the staging area becomes the staging area manager, although on large-scale incidents, a chief officer may be assigned to the staging officer function.
5. Is the responsibility of the staging area manager to communicate available resources and resource needs to the Planning Section or the IC
6. Requires that company officers report to the staging area manager as they arrive; as the IC requires additional assistance, companies are summoned through the staging area manager and sent to the scene

Slide 88
Level II IMS Multicompany Response Staging Procedures

Slide 89
Level II IMS Multicompany Response Staging Procedures

Slides 90 – 91
Level II IMS Multicompany Response Staging Procedures

Objective 39 — Answer questions about operations on highways.

A. Limited-access highways and turnpikes

1. Apparatus may have to respond over long distances between exits to reach an incident.
2. Apparatus may be required to travel a long distance before there is a turn-around that allows them the ability to get to the opposite side of the median if necessary.
3. Apparatus should not be driven against the normal flow of

Slide 92
Limited-Access Highways and Turnpikes

Slide 93
Limited-Access Highways and Turnpikes

traffic, unless the road has been closed by police units.

4. Incidents occurring on bridges may require the use of aerial apparatus or ground ladders in order to reach the scene from below.

B. Water supply

Slide 94
Water Supply on Highways

1. Long hose lays or water operations may be needed to supply water to the incident scene.
2. Hydrant placement on highways may be infrequent or may not exist.
3. It may be necessary to have one pumper respond to the nearest overpass or underpass in order to assist units on the highway in establishing a water supply if the source is off the highway.

Slide 95
Water Supply on Highways

4. It may be necessary to stretch hoselines or use an aerial device from an overpass or underpass to get water to the level of the highway.
5. Some highway systems are equipped with dry standpipe risers, requiring one pumper off the highway to establish a water supply and pump into the standpipe inlet. Units on the highway can then connect to the standpipe discharge outlet and receive a steady flow of water.

Slide 96
Water Supply on Highways

C. Responding to the scene

Slide 97
Responding to the Scene of a Highway Incident

1. The use of warning lights and sirens may create traffic conditions that actually slow the fire unit's response.
2. The siren should not be used except to clear slow traffic.
3. A minimum of warning lights should be used at the scene to prevent blinding other drivers or distracting them, possibly leading to another accident.

   Note: Departmental SOPs regarding the operation of emergency lights when apparatus are at an emergency scene – either on or off of the roadway – vary. Know and follow the protocols established by your department.

Slide 98
Responding to the Scene of a Highway Incident

D. Oncoming traffic

Slides 99 – 100
Oncoming Traffic

1. Cooperation between police and fire department personnel at highway incidents is essential.
2. At least one lane next to the incident lane should be closed. Additional or all traffic lanes may have to be closed if the extra lane does not provide a safe barrier.

E. Positioning the apparatus

Slide 101
Positioning the Apparatus at Highway Incidents

1. Fire apparatus should be placed between the flow of traffic and the firefighters working on the incident to act

as a shield.

2. The apparatus should be positioned on an angle so that the operator is protected from traffic by the tailboard.
3. Front wheels should be turned away from the firefighters working highway incidents so that the apparatus will not be driven into them if struck from behind.
4. Firefighters should consider positioning additional apparatus 150 to 200 feet (45 m to 60 m) behind the shielding apparatus to act as an additional barrier between firefighters and the flow of traffic.
5. All crew members must use extreme caution when getting off the apparatus so that they are not struck by passing traffic.

Slide 102
Positioning the Apparatus at Highway Incidents

Objective 40 — Analyze a scenario to determine pumper position for operations on a limited access highway.

Objective 41 — Select from a list considerations to keep in mind when responding to a potential hazardous materials emergency.

Slide 103
Responding to a Potential Hazardous Materials Emergency

A. If you are the first-arriving apparatus, never drive directly into the scene without first attempting to identify the material that is involved.

B. Always stop short of the incident scene until the nature of the hazard is understood.

Slide 104
Responding to a Potential Hazardous Materials Emergency

C. Do not stop over manholes. Flammable materials flowing into the underground system could ignite and explode.

D. Try to obtain information on the wind speed and direction while en route to the scene.

E. If at all possible, approach the incident from the upwind and uphill side.

Objective 42 — Distinguish among characteristics of hazardous materials control zones.

A. Control zones prevent sightseers and other unauthorized persons from interfering with first responders, help regulate movement of first responders within the zones, and minimize contamination.

Slide 105 – 106
Hazardous Materials Control Zones

B. Hot zone
   1. Is also called the restricted zone, exclusion zone, or red zone
   2. Is an area surrounding the incident that has been contaminated by the released material
   3. Will be exposed to the gases, vapors, mists, dusts, or runoff of the material
   4. Extends far enough to prevent people outside the zone from suffering ill effects from the released material

Slide 107
Hot Zone

Slide 108
Hot Zone

C. Warm zone
   1. Is also called the contamination reduction zone, limited-access zone, or yellow zone
   2. Is an area abutting the hot zone and extending to the cold zone
   3. Is considered safe for workers to enter briefly without special protective clothing, unless assigned a task requiring increased protection
   4. Is used to support workers in the hot zone and to decontaminate personnel and equipment exiting the hot zone
   5. Is where decontamination usually takes place within a corridor

Slide 109
Warm Zone

Slide 110
Warm Zone

D. Cold zone
   1. Is also called the support zone or green zone
   2. Encompasses the warm zone and is used to carry out all other support functions of the incident
   3. Does not require the use of personal protective clothing because the zone is considered safe
   4. Includes the location of the command post, the staging area, and the triage/treatment area

Slide 111
Cold Zone

Objective 43 — Analyze a scenario to determine apparatus position at a hazardous materials emergency.

Objective 44 — Select from a list facts about operating near railroads.

A. Always treat a railroad track as a potentially active line. It is not always possible to stop the flow of trains on the track during emergency operations.

Slide 112
Operating Near Railroads

B. Never position the apparatus on the railroad tracks.

C. Keep the apparatus far enough away from the tracks so that it will not be struck by a passing train.

D. Position the apparatus on the same side of the tracks as the incident when possible.

Slide 113
Operating Near Railroads

E. If it becomes absolutely necessary to stretch attack or supply lines across a railroad track, attempt to confirm from the rail company that train traffic has been halted on that set of tracks.

F. If it is not possible to confirm the halting of train traffic, attempt to run the hose beneath the rails or use aerial apparatus to run hose over the top of the area.

Slide 114
Operating Near Railroads

G. Use caution when operating aerial apparatus in the vicinity of rail lines that operate from high-voltage, overhead electrical lines.

Slide 115
Operating Near Railroads

Objective 45 — Analyze a scenario to determine apparatus position for operating near a railroad.

Objective 46 — Answer questions about apparatus positioning at emergency medical incidents.

A. Remember that it is important to allow the ambulance the best position for patient loading.

Slide 116
Apparatus Positioning at Emergency Medical Incidents

B. Position the fire apparatus off the street and shut off all emergency lights when possible. Ensure that the positioning surface (driveway, parking lot, etc.) is stable enough to support the weight of the fire apparatus.

C. If it is not possible to locate off the street, use the apparatus as a shield between the work area and oncoming traffic.

Slide 117
Apparatus Positioning at Emergency Medical Incidents

D. Guard the patient-loading area of the ambulance by shielding it with another vehicle.

Slide 118
Apparatus Positioning at Emergency Medical Incidents

E. If possible, place traffic cones to direct oncoming traffic away from the apparatus.

Objective 47 — Analyze a scenario to determine apparatus position at an emergency medical incident.

Summary

A. For maximum safety and efficiency during emergency incidents, especially those on busy streets and highways, emergency response vehicles must be positioned correctly at the scene.

Slide 119
Summary

B. Apparatus must be positioned according to its intended function during the incident.

C. One of the most important roles of the support apparatus is protecting the scene from the hazards associated with oncoming traffic.

Slide 120
Summary

Discussion Questions

1. Where is the apparatus positioned if no fire conditions are evident?
2. Describe the "inside/outside" method of positioning fire apparatus.
3. What are some advantages of dual pumping operations?
4. When should tandem pumping operations be used?
5. What are some guidelines for positioning wildland fire apparatus for structural protection?
6 What are some guidelines for positioning rescue/squad apparatus?
7. What are some guidelines for positioning command vehicles?
8. What are some guidelines for positioning mobile air supply apparatus?

Slide 121
Discussion Questions

Slide 122
Discussion Questions

Slide 123
Discussion Questions

9. What are some guidelines for positioning EMS vehicles at a fire scene? 10. What are the advantages of apparatus staging procedures? 11. Describe the characteristics of Level I IMS procedures. 12. Describe the characteristics of Level II IMS procedures. 13. Name considerations to keep in mind when responding to a potential hazardous materials emergency. 14. Describe the characteristics of a hot zone. 15. Describe the characteristics of a warm zone. 16. Describe the characteristics of a cold zone. 17. What are some guidelines for operating near railroads?	**Slide 124** **Discussion Questions** **Slide 125** **Discussion Questions**

Apparatus Operator Refresher
Lesson 5 — Fireground Hydraulic Calculations

Lesson Outline

PRESENTATION OUTLINE	VISUALS/NOTES
Objective 1 — List methods for determining pressure loss and required pump discharge pressure on the fireground.	**Slide 5** **Methods for Determining Pressure Loss and Required Pump Discharge Pressure**
A. The formulas and calculations presented in Lessons 7 and 8 are useful, but emergency scenes seldom allow the driver/operator to perform these kinds of calculations in the field.	
B. On the fireground, the driver/operator commonly relies on one or more of the following methods for determining pressure loss and required pump discharge pressure: 1. Flowmeters 2. Hydraulic calculators 3. Pump charts 4. Hand method 5. Condensed "Q" formula 6. GPM flowing method	
Objective 2 — Select facts about flowmeters.	
A. Provide the water flow in gallons per minute (liters per minute); the number displayed on the flowmeter requires no further calculation because it reflects how much water is moving through the discharge valve and consequently the nozzle	**Slide 6** **Flowmeters**
B. Are particularly advantageous when supplying hoselines or master stream devices equipped with automatic nozzles	
C. Can make it possible for driver/operators to pump (within the limits of the pump) the correct volume of water to nozzles without having to know the length of hoseline, the amount of friction loss, or whether the nozzles are above or below the	**Slide 7** **Flowmeters**

pump

D. Are allowed (per NPFA 1901, *Standard for Automotive Fire Apparatus*) to be used instead of pressure gauges on all discharges 1½ to 3 inches (38 mm to 77 mm) in diameter

Slide 8
Flowmeters

E. Can be used on discharges that are 3½ inches or larger, but must also have an accompanying pressure gauge

F. Must provide a readout in increments no larger than 10 gpm (38 L/min)

G. Types

Slide 9 – 10
Flowmeters

1. Paddlewheel
   a. Was the first type of flowmeter used on fire apparatus
   b. Is mounted in the top of a straight section of pipe in such a manner that very little of the device extends into the waterway, reducing the problems of impeded flow and damage by debris
   c. Decreases sediment deposit because the paddlewheel is located at the top of the pipe
   d. Works by measuring the speed at which the paddlewheel is spinning and translates that information into a flow measurement

Slide 11 – 12
Flowmeters

2. Spring probe
   a. Is gaining increasing use in the fire service
   b. Uses a stainless steel spring probe to sense water movement in the discharge piping; the greater the flow of water through the piping, the more the spring probe is forced to bend
   c. Has only one moving part (the spring probe itself), so relatively maintenance free

Slide 13
Flowmeters

H. Should be accurate to a tolerance of +/- 3 percent, when properly calibrated and in good working condition; the readout should not be more than 3 gallons (12 L) high or low for every 100 gpm (400 L/min) flowing

I. Have a discharge readout display mounted within 6 inches (150 mm) of the valve control for each discharge equipped

Slide 14
Central Flowmeter Device

J. Some apparatus are equipped with a central flowmeter device that allows the driver/operator a number of options. Some of

the information that the central monitor may provide include:

1. The flow through any particular discharge at that time
2. The total amount of water being flowed through the pump at that time
3. The total amount of water that has been flowed through the pump for the duration of that incident
4. The amount of foam being flowed

Objective 3 — Answer questions about flowmeter applications.

Slide 15
Flowmeter Applications

A. Diagnosing waterflow problems

Slide 16
Diagnosing Waterflow Problems

1. The flowmeter can be used as a diagnostic tool to identify waterflow problems.
2. If the flow does not increase when the driver/operator increases pressure, several problems are likely – kinks, a valve closed, etc.
3. If a firefighter communicates that water volume at the nozzle has suddenly diminished but there is no reduction in the flowmeter reading, it can be assumed that a hose has burst.

B. Relay pumping

Slide 17
Relay Pumping

1. Use of a flowmeter during relay pumping makes it possible to feed a supply line without having to know the number of gallons (liters) flowing from the pumper receiving the water.
2. Steps

Slide 18
Relay Pumping

   a. Monitor the master discharge gauge and the flowmeter as the throttle is increased during the setup stage of the operation; as engine speed (rpm) increases, so does the discharge and the gpm (L/min) reading from the flowmeter.

Slide 19
Relay Pumping

   b. Increase the engine speed until the flowmeter reading no longer increases; this sets the pump at the correct discharge pressure to supply an adequate flow to the receiving pumper.

Slide 20
Relay Pumping

   c. Watch the flowmeter to monitor the water volume being used by the receiving pumper.
   d. Also watch the master intake pressure gauge. Do not allow the incoming pressure to drop too much below 20 psi (140 kPa).

C. Standpipe operations

1. When pumping to standpipes, it is difficult to determine where hoselines and nozzles are being placed in a multistory building.
2. Using a flowmeter can solve this problem by determining the number and type of nozzles connected to the standpipe, adding the maximum rated flow for each nozzle flowing, and then pumping the volume of water that matches this figure.
3. It is important that the driver/operator is in communication with the firefighters on the nozzles to ensure that nozzle pressures and reactions are correct.
4. Driver/Operators must also realize that once the hoseline is charged, there is no flow through the system until a nozzle is opened. Thus, the driver/operator must be able to set the pump for a discharge pressure that is relatively close to that which is required when the nozzle is flowing. Once the nozzle is fully opened and flowing, the driver/operator can adjust the discharge pressure until the appropriate amount of water is flowing.

Slide 21
Standpipe Operations

Slide 22
Standpipe Operations

Slide 23
Standpipe Operations

Objective 4 — Analyze waterflow problems.

Objective 5 — Select facts about hydraulic calculators.

A. Enable the driver/operator to determine the pump discharge pressure required to supply a hose layout without having to perform tedious mental hydraulic calculations

Slide 24
Hydraulic Calculators

B. Types

1. Manual or mechanical — Operate by moving a slide or dial in which the water flow, size of hose, and length of the hose lay are indicated
2. Electronic
   a. Allow the driver/operator to input the known information: the water flow, size of hose, length of hose lay, and any elevation changes
   b. Computes the required pump discharge pressure using preprogrammed formulas from the factory or other available software
   c. May be portable or mounted near the pump panel
   d. Inexpensive electronic programmable calculators can

Slide 25
Hydraulic Calculators

Slide 26
Hydraulic Calculators

be preprogrammed for fireground calculations and carried on apparatus

Objective 6 — Answer questions about pump charts.

A. Are used by some fire departments to reduce the need for calculations on the emergency scene

Slide 27
Pump Charts

B. Contain the required pump discharge pressures for various hose lays and assemblies used within that jurisdiction

C. May be placed on laminated sheets carried on the apparatus or on plates that are affixed to the pump panel

Slide 28
Pump Charts

D. May be developed by fire departments or supplied by fire hose or nozzle manufacturers

E. Columns

1. Nozzle column — Should include only those nozzles and devices used by the department developing the chart; also includes applications such as sprinkler system support or relay pumping operations

Slide 29
Pump Chart Columns

2. GPM (L/min) column — Indicates the flow being provided to that nozzle or layout
3. NP column — Indicates the nozzle pressure being produced

Slide 30
Pump Chart Columns

4. 100, 200, etc. (30, 60, etc.) columns — Indicate the number of feet (meters) of hose being used to supply a given nozzle or layout

F. To use

Slide 31
How to Use Pump Charts

1. Locate the nozzle column and the nozzle or layout being used.
2. Follow that line across to the vertical column headed by the number of feet (meters) of hose in that layout.
3. The figure in the block where the two columns intersect is the required pump discharge pressure.

G. Developing a pump chart

Slide 32
Developing a Pump Chart

1. Identify all nozzles, devices, and layouts used by the department and enter them in the nozzle column.
2. Enter gpm (L/min) flowing and the nozzle pressure desired for each item in the appropriate columns.

3. Calculate the required pump discharge pressures for each of the listed layouts (using the formulas and tables given earlier in this curriculum or derived by field testing). When calculating, remember:
   a. Be certain to include friction loss in master stream appliances flowing in excess of 350 gpm (1 400 L/min).
   b. For wyed hoselines, the length of layout numbers indicates the number of feet (meters) of hose between the pumper and the wye. (If used as a preassembled unit, the attack hose leading from the wye is constant and therefore is not a factor in determining the length of the layout.)
   c. When a master stream nozzle may be supplied by a different number or size of hoselines, indicate these on the chart.
   d. Round pump discharge pressure to the nearest 5 psi (35 kPa).
   e. Do not list pump discharge pressures that exceed the test pressure used for the size of hose concerned or the pump test pressure.
   f. When calculating pump discharge pressures for relay operations, provide established departmental residual pressures at the intake of the pumper being supplied. This residual pressure may be indicated on the chart as a nozzle pressure.

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Calculating Pressures for Pump Charts

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Calculating Pressures for Pump Charts

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Calculating Pressures for Pump Charts

Objective 7 — Interpret a pump chart.
Objective 8 — Create a pump chart.

Objective 9 — Select facts about the hand method.

A. The hand method is used for determining friction loss in 1¾-inch and 2½-inch hose.

B. For 2½-inch hose
   1. Starting with the thumb of the left hand, each finger is numbered at the base in terms of hundreds of gallons per minute.
   2. Returning to the thumb, and again moving from left to right, the tip of each finger is given a successive even number, beginning with two.
   3. Because nozzle capacities vary in gpm, the nearest half-

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Hand Method for 2½-Inch Hose

hundred can be used with slight variations. The numbers 3, 5, 7, and 9 can be used for flows of 150, 250, 350, and 450 gpm, respectively. These half-hundred figures can be assigned to the spaces between the fingers.

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Hand Method for 2½-Inch Hose

4. The friction loss for 100 feet of 2½-inch hose at a desired flow is determined by selecting the finger to which the desired flow has been assigned, and multiplying the number at the tip of the finger by the first digit at the base of the finger.

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Hand Method for 2½-Inch Hose

5. The answers provided by this method give a reasonable estimate of the friction loss that can be expected in that hoseline. If more accurate figures are required, one of the other methods previously discussed in this curriculum needs to be employed.

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Hand Method for 2½-Inch Hose

C. For 1¾-inch hose

1. Calculate the friction loss in 100 feet of 1¾-inch hose by going to the finger that corresponds to the flow you are using and multiplying the number at the tip of the finger by the number at the base of the same finger.

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Hand Method for 1¾-Inch Hose

Note: This method has no conversion for the metric system of measurement.

Objective 10 — Use the hand method to calculate total pressure loss.

Objective 11 — State the equations for determining friction loss using the Condensed "Q" formula.

A. Has been developed for fireground operations in which friction loss can be determined for 2 ½-, 3-, 4-, and 5-inch hose.

B. Equation F (3-inch hose) — Can be used for 3-inch hose with either 2½-inch or 3-inch couplings

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Determining Friction Loss Using the Condensed "Q" Formula

FL per 100 feet = Q^2

FL = Friction loss in 100 feet of 3-inch hose

Q = Number of hundreds of gpm

Note: The amount of friction loss calculated using this formula will be 20 percent greater than if the same situation is calculated using $FL = CQ^2L$.

C. Equation G (4-inch hose)

FL per 100 feet = $\frac{Q^2}{5}$

FL = Friction loss in 100 feet of 4-inch hose

Q = Number of hundreds of gpm

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Determining Friction Loss Using the Condensed "Q" Formula

D. Equation H (5-inch hose)

FL per 100 feet = $\frac{Q^2}{15}$

FL = Friction loss in 100 feet of 5-inch hose

Q = Number of hundreds of gpm

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Determining Friction Loss Using the Condensed "Q" Formula

Note: This method does not work for the metric system of measurement.

Objective 12 — Use the Condensed "Q" formula to calculate total pressure loss.

Objective 13 — Select facts about the GPM flowing method.

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GPM Flowing Method

A. Permits friction loss to be calculated from the gpm flow

B. Is applicable to both solid and fog streams

C. Can be used for hose sizes other than 2½-inch

D. Method (2½-inch hose)

1. Find the flow in gpm from a nozzle at a specified pressure.
2. Subtract 10 from the first two numbers of the gpm flow in order to derive a sufficiently accurate friction loss figure per 100 feet of 2½-inch hose.

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GPM Flowing Method for 2½-Inch Hose

E. Method (1½-inch hose)

1. Find the flow in gpm from a nozzle at a specified pressure.
2. Multiply the flow times four.
3. Subtract 10 from the first two numbers of the gpm flow in

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GPM Flowing Method for 1½-Inch Hose

order to derive a sufficiently accurate friction loss figure per 100 feet of 1½-inch hose.

F. Refer to Tables 9.3 and 9.4 for more information.

Note: This method does not work for the metric system of measurement.

Objective 14 — Use the GPM flowing method to calculate total pressure loss.

Summary

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Summary

A. Fireground situations are often loud and somewhat chaotic scenes that make performing complex mental calculations difficult for driver/operators.

B. Many departments train their driver/operators to use flowmeters, hydraulic calculators, pump charts, and simplified methods of determining pressure loss and required pump discharge pressure during fire incidents.

Discussion Questions

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Discussion Questions

1. What are the two types of flowmeters?
2. What are the two types of hydraulic calculators?
3. How many columns are there on a pump chart? Name each column.
4. Describe the hand method for determining friction loss.
5. State the equations for determining friction loss using the Condensed "Q" formula

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Discussion Questions