INSTRUCTOR GUIDE

January 2011
FIRE APPARATUS
DRIVER/OPERATOR 1A
EMERGENCY VEHICLE OPERATIONS
INSTRUCTOR GUIDE

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January 2011
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State Fire Training

Mission Statement
The mission of State Fire Training is to enable the California fire service to safely protect life and property through education, training, and certification.

California Fire Service Training and Education System
The California Fire Service Training and Education System (CFSTES) was established to provide a single statewide focus for fire service training in California. CFSTES is a composite of all the elements that contribute to the development, delivery, and administration of training for the California fire service. The authority for the central coordination of this effort is vested in the Training Division of the California State Fire Marshal's Office with oversight provided by the State Board of Fire Services.

The role of CFSTES is one of facilitating, coordinating, and assisting in the development and implementation of standards and certification for the California fire service. CFSTES manages the California Fire Academy System by providing standardized curriculum and tests; accredited courses leading to certification; approved standardized training programs for local and regional delivery; administering the certification system; and publishing Certification Training Standards, Instructors Guides, Student Manuals, Student Supplements, and other related support materials.

This system is as successful and effective as the people involved in it are. It is a fire service system developed by the fire service, for the fire service... and we believe it is the best one in the country.

Acknowledgments
State Fire Training coordinated the development of the material contained in this guide. Before its publication, the Statewide Training and Education Advisory Committee (STEAC) and the State Board of Fire Services (SBFS) recommended this guide for adoption by the State Fire Marshal (SFM). This guide is appropriate for fire service personnel and for personnel in related occupations that are pursuing State Fire Training certification.

<table>
<thead>
<tr>
<th>Ken Pimlott</th>
<th>Tonya Hoover</th>
<th>Vacant</th>
<th>Ronny J. Coleman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acting Director of CAL FIRE</td>
<td>Acting State Fire Marshal</td>
<td>Assistant State Fire Marshal</td>
<td>Chair, STEAC</td>
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<tr>
<td>Mike Richwine</td>
<td>Chief, State Fire Training</td>
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January 2011
Special acknowledgement and thanks are extended to the following members of CDF/State Fire Training Curriculum Development Division for their diligent efforts and contributions that made the final publication of this document possible.

Alicia Hamilton  
Fire Service Training Specialist III

The material contained in this document was compiled and organized through the cooperative effort of numerous professionals within, and associated with, the California fire service. We gratefully acknowledge these individuals who served as principal developers for this document.

Special acknowledgement and thanks are extended to Mark Romer, Roseville Fire Department and Darren Hall for this updated 2008 edition.

<table>
<thead>
<tr>
<th>David Anderson</th>
<th>Tom Hostetter</th>
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<tr>
<td>CDF – Riverside Unit</td>
<td>CDF – Nevada/Yuba/Placer Unit</td>
</tr>
<tr>
<td>Gus Bryant</td>
<td>Don Mashburn</td>
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<td>Kern County Fire Department</td>
<td>Sacramento Fire Department</td>
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<tr>
<td>Robert Confer</td>
<td>Tom Murray</td>
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<td>Tiburon And Ben Lomond Fire Districts</td>
<td>San Francisco Fire Department (Retired)</td>
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<td>Tom Davis</td>
<td>Don Ockey</td>
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<td>Modesto Regional Fire Training Center</td>
<td>Fresno City Fire Department</td>
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<tr>
<td>Roy Francis</td>
<td>John Owens</td>
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<td>Pasadena Fire Department</td>
<td>CDF – San Luis Obispo Unit</td>
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<tr>
<td>Thomas D. Gallinatti</td>
<td>Mark Romer, Team Leader</td>
</tr>
<tr>
<td>Oakland Fire Department</td>
<td>Roseville Fire Department (Retired)</td>
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</tbody>
</table>

"We gratefully acknowledge the hard work and accomplishments of those before us who built the solid foundation on which this program continues to grow."
Student Profile

Target Group
Fire service emergency response personnel

Prerequisites
☐ Fire apparatus driving experience on a public way (two options)
  ▪ California Class C driver's license and a signed verification of driving fire apparatus on a public way
    ✦ Section 4.3.1 of the NFPA Standard for Fire Apparatus Driver/Operator Professional Qualifications, 2009 Edition
    ✦ Signed by you and your Fire Chief
  ▪ California driver's license
    ✦ Class A, B, or C with the fire fighter endorsement

☐ Fire Fighter I training recommended

Desired Attendance Time Frame
None
Class Requirements and Space

The characteristics of the classroom and support facilities have a great impact on the learning environment and the instructor's success or failure. For this course, it is advisable for the instructor to adhere as closely as possible to the following guidelines.

**Equipment**
Writing board with markers/erasers
Appropriate audiovisual equipment
Appropriate audiovisual materials

**Driving Grounds And Equipment**
1. Fire apparatus
2. Adequate driving space
3. Tire pressure gauges
4. Wiping rags
5. Creepers
6. 48-inch pillars (minimum of 20)
7. 18-inch cones (minimum of 60)
8. Numbered lane change cards
9. 100-foot tape measure
10. Stopwatch
11. Clipboard

**Materials**
- Unit 1
  - Progress Chart
  - Activity 1-3-1, "Legal Aspects Of Emergency And Nonemergency Driving"
- Unit 2
  - Activity 2-15-1, "Daily Apparatus And Equipment Check"
- Unit 3
  - Activity 3-2-1, "Principles Of Defensive Driving"
Unit 4
- Mandatory Driving Exercise 4-1-1, "Diminishing Clearance Exercise"
- Mandatory Driving Exercise 4-1-2, "Serpentine Exercise"
- Mandatory Driving Exercise 4-1-3, "Three-Point Turnaround Exercise"
- Mandatory Driving Exercise 4-1-4, "Station Apparatus Backing Exercise"
- Mandatory Driving Exercise 4-1-5, "Alley Dock Exercise"

Unit 5
- Optional Driving Exercise 5-1-1, "Lane Change Exercise"
- Optional Driving Exercise 5-1-2, "Offset Alley Exercise"
- Optional Driving Exercise 5-1-3, "Dogleg Exercise"
- Optional Driving Exercise 5-1-4, "Parallel Parking Exercise"

Written Tests
- Test 1
- Test 2
- Certification Exam
Introduction to the Manual

The 2011 Fire Apparatus Driver/Operator 1A Instructor Guide has been updated to reflect the new California fire fighter's licensing law (AB #1648), the current California Vehicle Code (CVC) requirements, and the 2009 NFPA 1002 Standard for Fire Apparatus Driver/Operator Professional Qualifications. This course also requires three corresponding textbooks: the current edition of the California Commercial Driver Handbook published by the Department of Motor Vehicles, the second edition of IFSTA's Pumping Apparatus Driver/Operator Handbook, and the Fire Apparatus Driver/Operator 1A Student Supplement published by State Fire Training. All certification exam questions were developed using any one of the three textbooks.

During the revision process, the developers included the following:

- An increase in group and individual activities
- Endnotes detailing specific code sections as they relate to the lesson plan
- PowerPoint slides for all lesson plans
- Video clips for the driving exercises

This publication is intended to serve as an instructor guide and includes lesson plans, a slide index, student activities, and tests. For each topic identified in the course outline, a lesson plan has been developed that contains: a time frame, level of instruction, behavioral objective, materials needed, references, preparation statement, lesson content, and endnotes. Suggested application methods have been identified throughout the lessons for you to use during your presentation.

- **Time Frame**: The estimated duration required for in-class presentation.
- **Level Of Instruction**: Identifies the instructional level that the material was designed to fulfill. Obviously, you have the latitude to increase the level based on available time, local conditions, and the students' apperceptive base.
- **Behavioral Objective**: The behavioral objective is a statement of the student's performance desired at the end of instruction. You must ensure that enough information is given in the presentation and/or activities to enable the student to perform according to the goal.
- **Materials Needed**: This should be a complete list of everything you will need to present the lesson, including visual aids, tests, and so on.
- **References**: These are the specific references the curriculum development team used when developing the lesson plan. In addition, references may be listed as additional study aids for instructors to enhance the lesson -- books, manuals, bulletins, scripts, visual aid utilization plans, and the like. The corresponding pages in the student supplement are also listed here.
• **Preparation**: The motivational statement connects the student with the lesson plan topic through examples or illustrations relating to their occupation, injury, and even mortality. You will need to develop this statement to fit your target audience.

• **Lesson Content**: Includes information used in the four-step method of instruction.

<table>
<thead>
<tr>
<th>Cognitive Lesson Plans</th>
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<tbody>
<tr>
<td><strong>PRESENTATION</strong></td>
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<tr>
<td>Everything you say or display</td>
</tr>
<tr>
<td>Content Notes</td>
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<table>
<thead>
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<th>Psychomotor Lesson Plan</th>
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<tbody>
<tr>
<td><strong>OPERATIONS</strong></td>
</tr>
<tr>
<td>Specific actions to be performed by the students</td>
</tr>
<tr>
<td>Begin with a verb, followed by a noun</td>
</tr>
</tbody>
</table>

**Appendix A – Glossary**
- Glossary of terms used throughout the course.

**Appendix B – Instructor Tests**
- Course tests with answer keys.

**Appendix C – Student Tests**
- Test masters to copy for your students. Keep these in good condition to use for future classes. Collect these tests after they have been graded and discussed in class.
- **Do not let the students keep them since you will be using the same tests for your next class.**
Course Outline

Course Objectives: To provide the student with…

a) Information on driver responsibilities, recognized standards, and related laws for fire apparatus.

b) Information and techniques on basic inspections, documentation, maintenance, and troubleshooting fire apparatus.

c) Information and techniques on driving and positioning fire apparatus.

d) The opportunity to increase their driving skills during simulated driving conditions.

Course Content.............................................................................................................................................40:00

Unit 1: Responsibilities, Standards, And Laws
1-1 Orientation And Administration .................................................................................................1:00
1-2 Fire Apparatus Driver/Operator Responsibilities ....................................................................0:45
1-3 Legal Aspects Of Emergency And Nonemergency Driving ..............................................1:00

Unit 2: Inspection, Basic Maintenance, Documentation, And Troubleshooting
2-1 Introduction To Inspection, Basic Maintenance, And Troubleshooting .........................0:30
2-2 Inspection And Basic Maintenance Of The Driver And Crew Areas,
Apparatus Body, And Compartmentation ......................................................................................0:15
2-3 Inspection And Basic Maintenance Of The Frame, Axles, Steering And
Suspension Systems, Driveline, Wheels, And Tires ......................................................................0:15
2-4 Troubleshooting The Frame, Axles, Steering And Suspension Systems,
Driveline, Wheels, And Tires .............................................................................................................0:30
2-5 Inspection And Basic Maintenance Of Engine Systems ......................................................0:45
2-6 Troubleshooting Engine Systems .....................................................................................................0:30
2-7 Inspection And Basic Maintenance Of The Transmission And Clutch .........................0:15
2-8 Troubleshooting The Transmission And Clutch .......................................................................0:15
2-9 Inspection And Basic Maintenance Of The Starting, Charging, And Other
Electrical Systems ............................................................................................................................0:30
2-10 Troubleshooting The Starting, Charging, And Other Electrical Systems ......................2:00
2-11 Inspection And Basic Maintenance Of Brake Systems ......................................................1:30
2-12 Troubleshooting Brake Systems ..............................................................................................1:00
2-13 Inspection And Basic Maintenance Of Auxiliary And Accessory Equipment ..............0:15
2-14 Inspection Documentation And Reports ..................................................................................0:15
2-15 Pretrip Inspection Procedures .................................................................................................2:00
### Unit 3: Driving Practices

<table>
<thead>
<tr>
<th>3-1</th>
<th>Accident Statistics And Liability</th>
<th>0:30</th>
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</thead>
<tbody>
<tr>
<td>3-2</td>
<td>Principles Of Defensive Driving</td>
<td>2:00</td>
</tr>
<tr>
<td>3-3</td>
<td>Driving Apparatus To Incidents</td>
<td>1:00</td>
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<tr>
<td>3-4</td>
<td>Principles Of Off-Road Driving</td>
<td>1:00</td>
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<tr>
<td>3-5</td>
<td>Principles Of Braking And Stopping</td>
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<tr>
<td>3-6</td>
<td>Principles Of Steering And Load Control</td>
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<tr>
<td>3-7</td>
<td>Driving During Adverse Weather Conditions</td>
<td>0:15</td>
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<tr>
<td>3-8</td>
<td>Positioning Apparatus</td>
<td>1:00</td>
</tr>
</tbody>
</table>

### Unit 4: Mandatory Driving Exercises

| 4-1 | Introduction To The Mandatory Driving Exercises | 0:30 |

### Unit 5: Optional Driving Exercises

| 5-1 | Introduction To The Optional Driving Exercises | 0:15 |

### Practice And Testing The Driving Exercises

| 14:00 |

### Unit Tests

| 3:00 |

### Certification Exam

| 1:00 |

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**Texts and References**

- Basic Fire Control Module 2A Automotive Battalion Student Supplement, CDF, 1999 Edition, Off Road Vehicle Operations Unit
- California Commercial Driver Handbook, DMV, 2008 Edition
- Chilton technical manuals
- Driver Awareness Instructor Course Manual, California Commission on Peace Officer Standards and Training, 1999 Edition
- http://www.bendix.com/troubleshooting/
- NFPA 1500: Standard on Fire Department Occupational Safety and Health Program, 2007 Edition
• NFPA 1582: Standard on Comprehensive Occupational Medical Program for Fire Departments, 2007 Edition
• NFPA 1911: Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition
• NFPA Journal, July/August 2001 Edition
• NFPA Journal, November/December 2007 Edition
• Off Road and 4-Wheel Driver Operational Procedures Manual, Kern County Fire Department, 1999 Edition
• Sacramento Regional Driver’s Training Authority Student Manual, First Edition
• University of Michigan Transportation Research Study of 1998, University of Michigan
• Webster’s Unabridged Dictionary, Random House, Second Edition
## Calendar of Events

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<thead>
<tr>
<th>DAY</th>
<th>TOPIC</th>
<th>TITLE</th>
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<td>Orientation And Administration</td>
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<td>1-2</td>
<td>Fire Apparatus Driver/Operator Responsibilities</td>
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<td>1-3</td>
<td>Legal Aspects Of Emergency And Nonemergency Driving</td>
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<td>2</td>
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<td>Introduction To Inspection, Basic Maintenance, And Troubleshooting</td>
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<td>2</td>
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<td>Inspection And Basic Maintenance Of The Frame, Axles, Steering And Suspension Systems, Driveline, Wheels, And Tires</td>
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<td>Troubleshooting The Transmission/Clutch</td>
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<td>Inspection And Basic Maintenance Of The Starting, Charging, And Other Electrical Systems</td>
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<td>Principles Of Braking And Stopping</td>
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<td>Principles Of Steering And Load Control</td>
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<td>Driving During Adverse Weather Conditions</td>
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<td>3-8</td>
<td>Positioning Apparatus</td>
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<td>Introduction To The Optional Driving Exercises</td>
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**Day 3 Total** 8:00

**Day 4**

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<td>Three-Point Turnaround Exercise*</td>
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<td>Alley Dock Exercise*</td>
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<td>Offset Alley Exercise</td>
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<tr>
<td>Parallel Parking Exercise</td>
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**Day 4 Total** 8:00

**Day 5**

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**Day 5 Total** 8:00

*Mandatory Driving Exercise*
TOPIC: 1-1: Orientation And Administration

TIME FRAME: 1:00

LEVEL of INSTRUCTION: Level I

AUTHORITY: 2009 NFPA 1002: Chapters 1 and 4

BEHAVIORAL OBJECTIVE:

Condition: Given an oral evaluation

Behavior: The student will confirm knowledge of the course objectives by completing an oral evaluation


MATERIALS NEEDED:
• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials
• Progress chart

REFERENCES:
• NFPA 1002: Standard for Fire Apparatus Driver/Operator Professional Qualifications, 2009 Edition, Chapters 1 and 4 and Appendix A
• NFPA 1500: Standard on Fire Department Occupational Safety and Health Program, 2007 Edition, Sections 5.2.2 and 5.3.1
• NFPA 1911: Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition
PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

- **Attention (attract)**
- **Curiosity (arouse)**
- **Interest (create)**
- **Desire (stimulate)**

**Begin**

**Association**

**Students**

**Experience**

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. INTRODUCTIONS
   A. Introduce self and staff
   B. Cite background
      1. Fire department experience
      2. Education
      3. Training
      4. Teaching history
      5. Instructor phone number(s)

   C. Student Introductions

   NOTE: Announce that if there is a student with any special needs to see the instructor in private.

II. COURSE PREREQUISITES
   A. Fire apparatus driving experience on a public way
      2. Option 1
         a) California Class C driver's license
         b) Signed verification of driving fire apparatus on a public way
            1) Signed by you and your Fire Chief
      3. Option 2
         a) California Class A, B, or C driver's license
            1) With the fire fighter endorsement
   B. Fire Fighter I training recommended

   Have students introduce themselves.

   Verify each student's license or verification form and record this information on your progress chart.
III. FACILITIES ORIENTATION
   A. Classroom location(s)
   B. Restrooms
   C. Food locations
   D. Smoking
   E. Breaks
   F. Telephones
   G. Parking

IV. STUDENT REGISTRATION
   A. Forms
      1. State Fire Training
      2. College

   NOTE: Provide step-by-step directions for completing the forms.

   B. Resolve any tuition issues as needed

V. STUDENT EVALUATION
   A. Activities
      1. Complete all activities
   B. Two written unit tests
      1. Each followed with group discussion
      2. All tests must be completed and passed with a minimum score of 80%

   NOTE: Tests must be returned to the instructor after review.
   C. Driving exercises
      1. Manipulative skills tracking and accountability
      2. Minimum score of 80% required to pass each mandatory manipulative performance test
   D. Progress chart
      1. Use student identification numbers
         a) No names
      2. Federal law prohibits publication of identifiable student grades
E. State certification exam
   1. Not related to final course grade
   2. Must pass the class first before taking the exam
   3. 50 question multiple-choice exam
   4. Minimum 70% required to pass the certification exam

VI. COURSE DESCRIPTION
A. 40-hour class
   1. Classroom information and activities
   2. Reading assignments
   3. Apparatus inspection
   4. Hands-on driving exercises
B. Identify start and end times
   1. Class will begin on time
   2. Student attendance requirements
      a) Must attend the entire course
      b) State Fire Training allows considerations for excused absences up to four hours
C. Proper attire
   1. Classroom
      a) Station wear or equivalent
      b) Station boots or equivalent
   2. Field exercises
      a) Station wear or equivalent
      b) Station boots or equivalent
      c) Helmet
      d) Gloves
D. Required textbooks
3. Student supplement published by State Fire Training

VII. COURSE OBJECTIVES
A. Provide the students with
   1. Information on driver responsibilities, recognized standards, and related laws for fire apparatus
   2. Information and techniques on basic inspections, documentation, maintenance, and troubleshooting fire apparatus
   3. Information and techniques on driving and positioning fire apparatus
   4. The opportunity to increase their driving skills during simulated driving conditions

VIII. HISTORICAL OVERVIEW
A. Course development
   1. First as a career development guide
      a) Titled Driver/Operator I and II
   2. 1988, two courses were developed
      a) Fire Apparatus Driver/Operator 1A
         1) Emergency Vehicle Operations
      b) Fire Apparatus Driver/Operator 1B
         1) Pump Operations
   3. 2003, courses were updated
   4. 2008, courses were updated to meet the Pumping Apparatus Driver/Operator Handbook, IFSTA, Second Edition
   5. 2011, 1A course was updated to meet the new California fire fighter's licensing law (AB #1648)

B. Experience has demonstrated that the following skills and senses are needed to be a successful fire apparatus driver/operator
### PRESENTATION

1. Reading
   a) Able to read and understand the written word

2. Writing
   a) Ability to write clearly and concisely

3. Mathematics
   a) Basic mathematical skills for Fire Apparatus Driver/Operator 1A
   b) Basic algebra skills necessary for hydraulics in Fire Apparatus Driver/Operator 1B

4. Physically fit
   a) Per department standards

5. Vision

**NOTE:** NFPA 1582: Standard on Comprehensive Occupational Medical Program for Fire Departments, 2007 Edition, Section 6.4

   **a)** Category A medical condition
   1) Far visual acuity less than 20/40 binocular, corrected with contact lenses or spectacles, or far visual acuity less than 20/100 binocular for wearers of hard contacts or spectacles, uncorrected
   2) Color perception
      - Monochromatic vision resulting in inability to use imaging devices such as thermal imaging cameras
   3) Monocular vision
   4) Any eye condition that results in the candidate not being able to safely perform one or more of the essential job tasks

   **b)** Category B medical condition
   1) Diseases of the eye such as retinal detachment, progressive retinopathy, or optic neuritis
2) Ophthalmological procedures such as radial keratotomy, Lasik procedure, or repair of retinal detachment.

3) Peripheral vision in the horizontal meridian of less than 110 degrees in the better eye or any condition that significantly affects peripheral vision in both eyes.

6. Ears and hearing

**NOTE:** NFPA 1582: Standard on Comprehensive Occupational Medical Program for Fire Departments, 2007 Edition, Section 6.5

a) Category A medical condition

1) Chronic vertigo or impaired balance as demonstrated by the inability to tandem gait walk.

2) On audiometric testing, average hearing loss in the unaided better ear greater than 40 decibels (dB) at 500 Hz, 1000 Hz, 2000 Hz, and 3000 Hz when the audiometric device is calibrated to ANSI Z24.5, Audiometric Device Testing.

3) Any ear condition (or hearing impairment) that results in the candidate not being able to safely perform one or more of the essential job tasks.

b) Category B medical condition

1) Unequal hearing loss.

2) Average uncorrected hearing deficit at the test frequencies 500 Hz, 1000 Hz, 2000 Hz, and 3000 Hz greater than 40 dB in either ear.

7. Mechanical ability

a) To understand the operation and maintenance of apparatus.

8. Basic supervisory skills.
9. Ability to remain calm
10. Ability to avoid "tunnel vision"
11. Ability to identify safety hazards

IX. APPLICABLE STANDARDS


1. Chapter 5: Training, Education, and Professional Development
   a) Section 5.2.2
      1) Must meet applicable requirements specified in NFPA 1002
   b) Section 5.3.1
      1) Department shall adopt or develop training and education that meet the minimum requirements
      2) Department shall provide training, education, and professional development programs to support the minimum qualifications and certifications expected of its members
      3) Members shall practice assigned skill sets on a regular basis but not less than annually
      4) Department shall provide specific training to members when written policies, practices, procedures, or guidelines are changed and/or updated

2. Chapter 6: Fire Apparatus, Equipment, and Driver/Operators
   a) Department shall consider safety and health as primary concerns in the specification, design, construction, acquisition, operation, maintenance, inspection, and repair of all fire department apparatus
b) Department shall specify restraint devices for fire apparatus, including those restraint devices for emergency medical service (EMS) members operating in the patient compartment of the ambulance

   1. Chapter 5: Fire Fighter I
      a) Section 5.1.1
         1) General knowledge requirements
      b) Section 5.1.2
         1) General skill requirements

   1. Chapter 1: Administration
   2. Chapter 4: General Requirements
   3. Chapter 5: Apparatus Equipped with Fire Pump
   4. Appendix A: Explanatory Material

   1. Chapter 1 Administration
   2. Chapter 4 General Requirements
   3. Chapter 5 Retirement of Fire Apparatus
   4. Chapter 6 Out-of-service Criteria
   5. Chapters 7-15 Inspection and Maintenance
   6. Chapter 16 Road Tests and Annual Weight Verification
   7. Chapters 17-23 Performance Testing

   1. Entire standard applies
F. Other standards
   1. Departmental

X. RELEVANCE OF STANDARDS

A. Legal
   1. Nationally recognized
   2. Upheld in court
      a) Liability
      b) Held personally accountable
   3. Negligence/liability
      a) Possible affects
         1) Driving record
         2) Personal insurance
         3) Career impact
SUMMARY:
The professional fire apparatus driver/operator must recognize his or her role in the fire service and the responsibility that entails. The ability to remain calm, think clearly, decisively, and with intent are just part of the traits which are critical for this position.

EVALUATION:
The student will complete the oral evaluation at a time determined by the instructor.

ASSIGNMENT:
**DRIVER/OPERATOR 1A PROGRESS CHART**

**BEGINNING DATE:**

**ENDING DATE:**

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### DRIVER/OPERATOR 1A PROGRESS CHART

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TOPIC: 1-2: Fire Apparatus Driver/Operator Responsibilities

TIME FRAME: 0:45

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Chapter 1

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of fire apparatus driver/operator responsibilities by completing the written test


MATERIALS NEEDED:
- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)    Begin
Curiosity (arouse)    Association
Interest (create)  Students
Desire (stimulate)  Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. SAFETY

A. Personnel/apparatus riders
   1. Remain seated
   2. Wear seatbelts
   3. Have a spotter
      a) A fire fighter who walks behind a backing apparatus to provide guidance to the driver/operator
      b) Anytime backing up
      c) May be needed front and/or rear

B. Public
   1. Use caution with general public around apparatus
      a) May be located in your "blind spot"
   2. Pedestrians
   3. Cyclists

C. Driving (emergency and nonemergency)
   1. Defensive driving techniques
   2. Obey state, local, and departmental regulations

D. Operating apparatus
   1. Scene considerations
      a) Apparatus positioning
What are two areas of concern when spotting apparatus at an emergency incident?

1) Rescue considerations  
2) Building collapse  
3) Electrical hazards
   - Generators and cords
   - Downed wires
   - Utility poles  
b) Hoselines
   1) Attack
   2) Supply  
c) Weather/topography
   2) Upwind
   3) Uphill
   4) Paved/unpaved roads

2. Equipment
   a) Doors left open
   b) Ladder rack left down
   c) Tools not secured or stored

As a driver/operator, what are some hazards that you should be aware of when departing the station?

E. Station
   1. Apparatus bay doors
   2. Compartment doors open
## III. APPARATUS INSPECTION

A. Regulated by Code of Federal Regulations
   1. Title 49
      a) Part 390: Federal Motor Carrier Safety Regulations
      b) Part 396: Inspection, Repair, and Maintenance
How often does this regulation mandate fire apparatus inspections?

B. Daily
1. Required by law
   a) Title 49 CFR, Part 396
2. Types of inspection
   a) Pretrip
   b) Posttrip (after trip)

C. Weekly/monthly
1. Not required by law
2. Per department SOPs
3. In accordance with the manufacturer's recommendations and specifications

D. Written documentation
1. Completed daily
2. Title 49 CFR, Part 396
3. Per department SOPs

E. Out-of-service criteria
   a) Chapter 6
2. Title 49 CFR, Parts 390 and 396
3. Per department SOPs
4. In accordance with the manufacturer's recommendations and specifications
IV. APPARATUS MAINTENANCE

A. Regulated by Code of Federal Regulations
   1. Title 49
      a) Part 396

B. Daily
   1. Required by law
      a) Title 49 CFR, Part 396
   2. Per department SOPs
   3. In accordance with the manufacturer's recommendations and specifications

C. Weekly/monthly
   1. Per department SOPs
   2. In accordance with the manufacturer's recommendations and specifications

D. Written documentation
   1. Title 49 CFR, Part 396
   2. Per department SOPs

SLIDE: 1-2-13

Who mandates apparatus maintenance?

V. EQUIPMENT MAINTENANCE

A. Daily, weekly, and monthly
   1. Per department SOPs
   2. In accordance with the manufacturer's recommendations and specifications

B. Urgent (immediate) versus nonurgent (delayed)

C. Written documentation
   1. Per department SOPs

SLIDE: 1-2-14
VI. TRAINING

A. On-going

   a) Chapter 5: Training and Education
      1) 5.2.1: On-going training must be provided
      2) 5.2.3: Appropriate training and educations must take place when changes in procedures and/or technology occur

2. Department SOPs

B. Mentoring/instructing

1. Assist interested personnel
SUMMARY:
The importance of accepting the responsibility inherent with the position of fire apparatus driver/operator cannot be understated. Knowing all the elements of one’s apparatus, driving regulations, and response district is part of the overall responsibility of the professional fire apparatus driver/operator.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 1-3: Legal Aspects Of Emergency And Nonemergency Driving

TIME FRAME: 1:00

LEVEL OF INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Sections 4.3.1 and 4.3.6

BEHAVIORAL OBJECTIVE:

Condition: Given an activity and written test

Behavior: The student will confirm a knowledge of California's driving regulations and laws relating to emergency and nonemergency driving by completing the activity and written test


MATERIALS NEEDED:

- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials
- Activity 1-3-1: Legal Aspects Of Emergency And Nonemergency Driving

REFERENCES:

- AB #1648, Chapter 360, January 2011

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.
Attention (attract)  
Curiosity (arouse)  
Interest (create)  
Desire (stimulate)  

Begin  
Association  
Students  
Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
## I. LICENSING REQUIREMENTS

A. Federal Department of Transportation (DOT)

   a) Set basic requirements for states' commercial drivers license programs
   b) Title 49 CFR, Part 383.23
      1) Commercial drivers license standard

B. California

1. Assembly Bill 1648
   a) Effective January 1, 2011
   b) Amends Sections 1808.1, 12804.9, and 15278 and adds Section 12804.11 to the Vehicle Code
   c) Change the provisions regulating the operation of fire-fighting equipment
      1) Permit employed or volunteer fire fighters to operate fire-fighting equipment with a Class A, B, or C license and a **fire fighter endorsement** issued by the DMV
   d) Applying for the fire fighter endorsement
      1) Proof of current employment with a fire department as a fire fighter or registration as a volunteer fire fighter
      2) Evidence of fire equipment operation training
      3) Passing the written fire fighter examination developed by DMV with the cooperation of the OSFM
      4) Submitting a report of medical examination on a DMV-approved form

The basic requirements for individual state commercial driver license programs are found in which document?
e) Repealed three sections of the Vehicle Code that affect fire fighters

1) Section 12954: Driver's license fire fighters emergency exemption
   - Exempted fire fighters from the requirement to have in their immediate possession the appropriate driver's license when operating fire-fighting equipment during an emergency, or when returning from an emergency

2) Section 15250.6: Fire fighter equipment driver's license requirements
3) Section 15250.7: Fire fighter equipment driver's license duplicate fee

2. California Commercial Driver Handbook (CCDH)
   a) Guidelines and standards based upon Title 19 CFR

C. Types of California driver's licenses
   1. Class A

   a) May drive any legal combination of vehicles
      1) Including vehicles under Class B and C

   2. Class B
      a) Limited to drive
         1) Any single vehicle with a GVWR of more than 26,000 pounds
         2) A 3-axle vehicle
         3) Any bus (except trailer bus) with endorsement
         4) Any farm labor vehicle with endorsement
         5) All vehicles under Class C
3. Class C
   a) Limited to drive
      1) Any passenger vehicle with a GVWR under 26,000 pounds

According to DMV, what type of driver’s license must a fire fighter hold?

4. Class A, B, or C with a fire fighter endorsement
   a) Class A limited to drive
      1) Any combination of vehicles
   b) Class B limited to drive
      1) Any single vehicle with a GVWR of more than 26,000 pounds
   c) Class C limited to drive
      1) Fire apparatus
      2) Any passenger vehicle with a GVWR under 26,000 pounds

D. Medical examination requirements
   1. Class A and Class B (with or without a fire fighter endorsement)
      a) By a physician
      b) Two-year renewal
      c) DMV form DL-51

How often is a medical examination required for a Class B license?

   2. Class C with a fire fighter endorsement
      a) By a physician
      b) Four-year renewal
      c) DMV form DL-546A

What is required for a fire fighter endorsed driver's license?
II. CALIFORNIA VEHICLE CODE (CVC)

A. Legally binding and enforceable

B. Code 3 authorization

1. Section 30
   a) Red lights and sirens
   b) Restricted to authorized police, fire, and lifesaving services

2. Section 165.2
   a) Definition of an authorized emergency vehicle

C. Warning systems

1. Section 25252
   a) Emergency vehicles must have at least one burning red warning lamp in front
      b) Visible for 1,000 feet to the front
      c) Minimum allowable by law

2. Section 25252.5(a)
   a) Flashing high beams on authorized emergency vehicles

3. Section 25258
   a) Additional lights on authorized emergency vehicles
      b) Flashing white light
         1) Opticom™

ACTIVITY 1-3-1:
Complete the activity in the student supplement.

What CVC section gives Code 3 authorization?

What is the distance required by law, for a red warning lamp to be visible?
4. Section 25259(a)
   a) Additional warning lights on authorized emergency vehicles
   b) Flashing amber lights

5. Section 25268
   a) Use of flashing warning amber lights
   b) Limits use of flashing amber

6. Section 25269
   a) Limits use of flashing or steady burning red light

7. Section 27000(a)
   a) Horns or warning devices
   b) Identifies who shall be equipped with a horn

8. Section 27001(a)
   a) Use of horns
   b) When reasonably necessary

9. Section 27002
   a) Sirens
   b) Identifies who shall legally use a siren

D. Civil liability

1. Section 17001
   a) Liability of a public entity

2. Section 17002
   a) Extent of liability

3. Section 17004
   a) Liability of public employees operating an authorized emergency vehicle

4. Section 17004.5
   a) Liability of private fire departments

**NOTE:** Section 17001 is discussed in greater depth in Unit 4 – Topic 1.
E. Rules of the road

1. Section 21055
   a) Exemption of authorized emergency vehicles
   b) While sounding siren
   c) Display a lighted red lamp

2. Section 21056
   a) Effect of exemption

NOTE: Sections 21055 and 21056 are also discussed in greater depth in Unit 4 – Topic 1.

3. Section 21706
   a) Following emergency vehicles
   b) No closer than 300 feet

4. Section 21707
   a) Fire areas
   b) No vehicles within the identified fire areas

5. Section 21708
   a) Fire hoses
   b) No driving over or across any fire hose unless provided with jumpers or other appliances to protect the hose

6. Section 22104
   a) No U-turns in front of the driveway entrance or approaches to a fire station
### b) Cannot use the driveway entrance or approaches to a fire station for turning a vehicle to proceed in the opposite direction

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<td>Is there any situation in which an emergency vehicle, while operating Code 3, is not exempt from passing other vehicles?</td>
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7. Section 22454
   a) School bus
      1) Meeting and passing
   b) All vehicles to stop under this law
      1) Emergency vehicles are not exempt from this law

F. Safety
   1. Section 26700(a)
      a) Every fire apparatus shall be equipped with an adequate windshield
   2. Section 27305
      a) Public fire vehicles are required to have seatbelts for all seats

**NOTE:** Individual cities and counties may have laws applicable to their specific region, locality, or department.
SUMMARY:
As a fire apparatus driver/operator, in order to safely and legally perform your job, you must have a clear understanding of all laws and statutes, which are relevant to your position. By understanding and following the laws, your personal liability is greatly reduced.

EVALUATION:
The student will complete the activity and written test at a time determined by the instructor.

ASSIGNMENT:
# ACTIVITY 1-3-1

**TITLE:** Legal Aspects Of Emergency And Nonemergency Driving  

**TIME FRAME:** 0:45  

**MATERIALS NEEDED:**  
- State of California Vehicle Code, DMV, 2007 Edition (one copy for each group)  
- Writing board/pad with markers/erasers  

**INTRODUCTION:** This activity provides the students the opportunity to research the laws and regulations governing emergency and nonemergency driving of fire apparatus using the California Vehicle Code.

**DIRECTIONS:**  
1. Break the class into three groups.  
2. For each topic listed, identify the applicable CVC section.  
3. Using the writing board or pad, write the code section and a brief summary highlighting its important points.  
4. You have 30 minutes to complete this activity.  
5. Be prepared to discuss your answers with the class.

**INSTRUCTOR NOTE:** The section and page numbers listed below apply to the 2007 Edition of the California Vehicle Code. It is imperative that you update these if using a newer edition of the code.
GROUP 1

Code 3 Authorization
1. Red lights and sirens restriction
   Section 30, Page 4

Civil Liability
2. Liability of a public entity
   Section 17001, Page 607

Warning Systems
3. Red warning lamps
   Section 25252, Page 844
4. Additional warning lights
   Section 25259, Page 846
5. Use of flashing warning amber lights
   Section 25268, Page 848
6. Use of horns
   Section 27001, Page 874

Rules Of The Road
7. Exemption of authorized emergency vehicles
   Section 21055, Page 624

GROUP 2

Code 3 Authorization
1. Definition of an authorized emergency vehicle
   Section 165(b)(2), Page 6

Civil Liability
2. Liability of public employees
   Section 17004, Page 607

Warning Systems
3. Flashing upper beams
   Section 25252.5, Page 844

4. Limits use of flashing or steady burning red light
   Section 25269, Page 849

Rules Of The Road

5. Duty of drive with due regard
   Section 21056, Page 624

Safety

7. Windshields
   Section 26700, Page 869

GROUP 3

Civil Liability

1. Liability of private fire departments
   Section 17004.5, Page 607

Warning Systems

2. Controlling traffic signals
   Section 25258, Page 846

3. Horns
   Section 27000, Page 874

4. Sirens
   Section 27002, Page 874

Rules Of The Road

5. Following emergency vehicles
   Section 21706, Page 673

6. Vehicles within the identified fire areas
   Section 21707, Page 673

Safety

7. Seatbelts
   Section 27305, Page 882
TOPIC: 2-1: Introduction To Inspection, Basic Maintenance, And Troubleshooting

TIME FRAME: 0:30

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of basic inspection, maintenance, and troubleshooting procedures by completing the written test


MATERIALS NEEDED: • Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

• NFPA 1911: Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, NFPA, 2007 Edition, Chapters 4 and 6-8

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience

Cite examples or use related illustrations of near-miss
incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. INTRODUCTION

A. All inspections and maintenance shall be conducted in accordance with the manufacturer’s recommendations and specifications

1. Especially important for warranties

B. Troubleshooting

1. Corrective actions beyond the capabilities of the driver/operator must be referred to the department’s fleet manager

C. Department standard operating procedures (SOPs)

1. May exceed manufacturer’s recommendations and specifications

2. Should specify driver/operator’s responsibilities and the conditions he or she is allowed to correct
   a) Should also state those situations that require the service of a qualified mechanic

3. Address the frequency of inspections and maintenance

4. Address how inspection and maintenance is documented and transmitted to the proper person in the administration

5. Requirements for the inspection and maintenance of fire apparatus
## FEDERAL, STATE, LOCAL LAWS, STANDARDS, AND RECOMMENDATIONS

A. These laws, standards, and recommendations are what govern inspections and maintenance

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B. Federal laws

1. 49 CFR
   a) Part 390: Federal Motor Carrier Safety Regulations
   b) Part 396: Inspection, Repair, and Maintenance

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C. California laws

   a) Requires pretrip, en route, and posttrip inspections

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D. Local laws

1. Pertaining to your jurisdiction
   a) Reflect special concerns of any given jurisdiction

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E. NFPA standards


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F. Recommendations


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2. Professional trade publications

III. MAJOR APPARATUS SYSTEMS

A. Can be grouped according to function

B. Driver and crew areas, apparatus body, and compartmentation

C. Vehicle gauges and instrumentation

1. Dash gauges
2. Pump panel gauges
3. Computer monitors

D. Frame, axles, steering and suspension systems, driveline, wheels and tires

E. Engine systems

1. Cooling
2. Fuel
3. Oil
4. Air
5. Exhaust
6. Belts
7. Ignition

F. Transmission and clutch

G. Battery and electrical systems

H. Braking systems

1. Air
2. Hydraulic

Where might gauges be located on fire apparatus?
### III. Auxiliary equipment

1. Power take-off  
   a) Commonly referred to as PTO
2. Auxiliary motors

### J. Accessory equipment

1. Suppression equipment
2. Other equipment

### IV. DOCUMENTATION

A. Inspection and maintenance procedures generate a great deal of paperwork

B. Types of documents
   1. Movement records/logs

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<td>3.</td>
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<td>a) Exhaust</td>
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<td>b) Transmission</td>
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<td>c) Driveline</td>
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When should apparatus inspections be performed?

2. Inspections  
   a) Pretrip  
   b) Periodic  
   c) Posttrip

3. Maintenance and repairs performed

4. Inventories

5. Equipment records

6. Test records

7. Accident/crash records
V. GENERAL CONCERNS

A. A proper inspection and maintenance program includes a thorough pretrip inspection
   1. Includes inspections and functional checks necessary to ensure safe vehicle operation
   2. Should be systematic
   3. Reduces the chance of missing something

B. One method to maintain thoroughness is the circle or walk-around method
   1. Start at the driver's door
   2. Proceed clockwise
   3. Enter the cab
   4. Perform functional checks

C. Road test
   1. Operational tests performed under normal driving conditions
   2. At least annually
   3. Usually done after each scheduled maintenance interval, repairs, adjustments, or modifications to apparatus systems

D. Review previous records
   1. Note problems, reoccurrences, or special concerns

NOTE: Detailed pretrip inspection is discussed in Unit 2 - Topic 15.
VI. INSPECTION VERSUS TROUBLESHOOTING

A. Inspection
   1. Ensure the apparatus, pump, and related components are in a safe operating condition
   2. Inspections typically include checking components for
      a) Operability, position, or status
      b) Fluid levels, leaks
      c) Condition, damage, wear, or corrosion

B. Troubleshooting
   1. Noninvasive activities that do not require the apparatus to be taken out-of-service in order to maintain proper operation
   2. A constant monitoring that detects minor changes in apparatus performance
   3. Identification of what mechanical repair is required to be immediate and which can be scheduled in the future

Does troubleshooting require the apparatus to be put out-of-service?

What does a troubleshooting inspection entail?
SUMMARY:
A proper inspection and maintenance program should reflect the manufacturer's recommendations and specifications, and department policy. A variety of laws and standards dictate minimum requirements for safe operation. The properly prepared driver/operator understands automotive basics and develops a thorough plan of inspection and maintenance to ensure safe operation.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-2: Inspection And Basic Maintenance Of the Driver And Crew Areas, Apparatus Body, And Compartmentation

TIME FRAME: 0:15

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of inspection and basic maintenance procedures for key components of the driver and crew areas, apparatus body, and compartmentation by completing the written test


MATERIALS NEEDED: • Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

• NFPA 1911: Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition, Chapters 4, 6, and 7

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
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Interest (create) Students
Desire (stimulate)  Experience
Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. DRIVER AND CREW AREAS, APPARATUS BODY, AND COMPARTMENTATION COMPONENTS

A. Driver and crew areas

1. Contain components necessary for safe apparatus operation and safe transport of passengers
   a) Seats
   b) Seat belts
   c) Controls
   d) Windows
   e) Doors
   f) Mirrors

   g) Engine gauges
      1) Essential part of the operating system
      2) Indicates normal or abnormal function of the system being monitored
         • Note normal operating ranges
         • May give clues to the cause of any abnormality
         • May indicate malfunction so alternative action may be taken before permanent damage occurs

   3) Individual gauges

      • Oil pressure

      • Temperature (water, oil, transmission)

What are some of the common gauges found on fire apparatus?
### PRESENTATION

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<td>• Air pressure</td>
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<td>• Vacuum</td>
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<td>4) Location of gauges</td>
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<td>• No standard rule</td>
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<td>• Left to the discretion of the apparatus manufacturer</td>
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<td>• Location must be memorized by the driver/operator</td>
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2. May also include items not necessary to apparatus operation
   a) Adjunct items used in functions apart from apparatus operations
   b) Inspections should also include security of these items

### B. Apparatus body

1. Houses and protects the interior operating systems
   a) Much like a person's skin and skeletal system

### C. Compartmentation

1. Houses the equipment carried on the apparatus
2. Secures and protects the equipment in order for it to operate properly when needed

II. INSPECTION

A. Inspections of driver and crew areas, apparatus body, and compartmentation, often occur simultaneously during maintenance

B. Up-close observation is a result of maintenance

1. Defects are uncovered

C. Conditions to look for with the equipment, components, hardware, and systems
   1. Missing
   2. Dirty
   3. Damaged
   4. Loose
   5. Leaking

D. Apparatus damage
   1. Body damage
      a) Dents
      b) Scratches
      c) Missing or loose components
   2. Leaning to one side

What would cause a fire apparatus to lean to one side?

What benefit is gained from close observation?

What conditions should the driver/operator look for?
1) Major
   • Broken suspension

2) Minor
   • Surface not level

NOTE: More information on the suspension is discussed in Unit 2 - Topic 3.

3. Running boards
   a) Dented
   b) Missing or loose

4. Lights and reflectors
   a) Cracked
   b) Missing

5. Doors
   a) Open and close properly

6. Mirrors
   a) Secure
   b) Clean

7. Splash guards or mud flaps
   a) Missing or loose

III. BASIC MAINTENANCE

A. Exterior washing
   1. New apparatus
      a) Paint and protective coating are new and unseasoned
         1) Need to cure about six months
         Should new apparatus be treated differently?
      b) Wash frequently to harden the paint and avoid water spots
2. Use garden hose without a nozzle to apply water
   a) Set water pressure so the stream is no more than 1 foot
      1) Higher pressure can drive debris into the paint
   b) Never remove dust or grit by dry rubbing
   c) Once a new apparatus's finish is properly cured (according to the owner's manual), garden hoses with nozzles may be used
      1) Or pressure washer

3. Wash with a good automotive shampoo
   a) Follow shampoo instructions

4. Do not wash with extremely hot water or while the apparatus surface is hot
   a) Rinse loose dirt before applying shampoo and water
      1) Reduces the chance of scratching the surface when applying shampoo
   b) Try to wash mud, dirt, insects, soot, tar, grease, and road salts off the apparatus before they have a chance to dry
   c) Never use gasoline or other solvents to remove grease or tar from painted surfaces
      1) Use only approved products to remove grease or tar from nonpainted surfaces
   d) Dry with a clean chamois rinsed frequently with clean water
      1) Failure to dry the apparatus completely will also encourage corrosion
      2) Cotton towels are acceptable substitutes for a chamois
      3) Rags or shop towels may scratch painted surfaces

SLIDE: 2-2-17
5. Waxes and polishes  
   a) In accordance with the manufacturer’s recommendations and specifications  
   b) On many newer apparatus, the application of these products is no longer necessary  
      1) May damage clear-coat protective-seal finishes that are applied over paints  
      2) Generally, do not apply waxes or polishes until the paint is at least six months old  
      3) Wash and dry the apparatus before applying polish or wax  
      4) Apply wax or polish with a soft cloth and buff with a soft cloth or mechanical buffer

B. Glass care  
   1. Do not use putty knives, razor blades, steel wool, or other metal objects to remove deposits from the glass  
   2. Use warm soapy water or commercial glass cleaners in conjunction with paper towels or cloth rags  
   3. Do not use dry towels or rags by themselves  
      a) They may allow grit to scratch the surface of the glass  
   4. Windshield washer fluid  
      a) Recommended that reservoir be refilled any time it is less than one-half full  
      b) Commercially available  
      c) Compatibility between brands

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<td>5. Waxes and polishes</td>
<td>When can wax be applied to newly painted surfaces?</td>
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<td>a) In accordance with the manufacturer’s recommendations and specifications</td>
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<td>d) Wash and dry the apparatus before applying polish or wax</td>
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<td>e) Apply wax or polish with a soft cloth and buff with a soft cloth or mechanical buffer</td>
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<td>c) Compatibility between brands</td>
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C. Interior cleaning
   1. Important step
      a) Accumulation of dirt may cause finishes to deteriorate
   2. Sweep or vacuum large, loose dirt particles first

   3. When required, use cleaning agents or protective dressings in accordance with the manufacturer's recommendations and specifications
   4. Otherwise, use warm soapy water or commercial cleaning products to clean
      a) Seat upholstery
      b) Dashboard
      c) Engine compartment coverings
      d) Floor finishes
   5. Do not use volatile cleaning solvents
      a) Acetone
      b) Lacquer thinner
      c) Enamel reducer
      d) Nail polish remover
      e) Laundry detergent
      f) Bleach
      g) Gasoline, naphtha, carbon tetrachloride
   6. Be sure that the apparatus is well ventilated when using any cleaning products inside the cab or crew area

IV. OUT-OF-SERVICE CRITERIA
<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>APPLICATION</th>
</tr>
</thead>
</table>
| 1. Driving and crew areas, the apparatus body, and the compartmentation  
   a) Cracked or broken windshield that obstructs the driver’s/operator’s view  
   b) Missing or broken rearview mirrors that obstruct the driver’s/operator’s view  
   c) Missing or broken windshield wipers  
   d) Missing or broken door latches  
   e) Missing or broken foot throttle  
| 2. Seat belt  
   a) Is torn or has melted webbing, missing or broken buckles, or loose mountings, the following shall apply  
   1) If it is at a seat other than the driver’s seat, that seat shall be taken out of service  
   2) If it is at the driver’s seat, the entire apparatus shall be taken out of service  
| 3. System or components, a qualified technician shall conduct an out-of-service evaluation and make a written report, including recommendations to the AHJ  
   a) Body mounting  
   b) Cab mounting  
   c) Steering wheel  
   d) Required cab instrumentation  
   e) Defrosters  
| B. CCDH criteria  
1. None stated  

SLIDE: 2-2-22
SUMMARY:
Very simple items can indicate or hide a potential major problem. You must determine if the problem is new or if it has existed for some time and if this problem is something that will place the fire apparatus out-of-service.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-3: Inspection And Basic Maintenance Of The Frame, Axles, Steering/Suspension Systems, Driveline, Wheels, And Tires

TIME FRAME: 0:15

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of inspection and basic maintenance of the frame, axles, steering and suspension systems, driveline, wheels, and tires


MATERIALS NEEDED:

- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:

- NFPA 1911: Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition, Chapters 4, 6, and 7

PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

- Attention (attract) Begin
- Curiosity (arouse) Association
- Interest (create) Students
- Desire (stimulate) Experience
Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. COMPONENTS

A. Frame
B. Axles
C. Steering and suspension systems
D. Driveline
E. Wheels and tires

II. INSPECTION AND BASIC MAINTENANCE

A. Frame

1. Cracks in the frame or mountings
2. Broken welds
3. Missing fasteners

B. Axle

1. Leaks
2. Broken axle housings
3. Oil seepage around axle hubs

What could this oil seepage indicate?

   a) Loose axle nuts
   b) Damaged axle seal

C. Steering and suspension

1. Steering wheel play
### Presentaion

<table>
<thead>
<tr>
<th>Fire Apparatus Driver/Operator 1A</th>
</tr>
</thead>
</table>

#### Oct 2008 2-3: Inspection And Basic Maintenance Of The Frame, Axles, Steering/Suspension Systems, Driveline, Wheels, And Tires

<table>
<thead>
<tr>
<th>Frame, Axles, Steering/Suspension Systems, Driveline, Wheels, And Tires</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) No more than 10 degrees</td>
</tr>
<tr>
<td>b) For a 20-inch wheel, this translates to about two inches in either direction</td>
</tr>
<tr>
<td>c) 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</td>
</tr>
</tbody>
</table>

#### SLIDE: 2-3-10

2. Power steering pump and lines
   - Fluid level in reservoir
     1) Must be above refill mark
     2) Use approved power steering fluid
   - Mounting secure
   - Condition of lines
   - Possible damage from nearby components
   - Leaks

How would you find out the proper fluid to use?

- Information on the proper fluid will be included in the manufacturer’s recommendations and specifications

<table>
<thead>
<tr>
<th>SLIDE: 2-3-11</th>
</tr>
</thead>
</table>

3. Steering box
   - Leaks
   - Mounting secure
     1) Missing nuts, bolts, and cotter keys

<table>
<thead>
<tr>
<th>SLIDE: 2-3-12</th>
</tr>
</thead>
</table>

4. Steering linkage
   - Links, arms, or rods
     1) Worn
     2) Cracked
### Springs

| a) Leaf       | 1) Broken or missing leaves
|               | 2) Broken or missing hangers |
| b) Coil       | 1) Broken mounting brackets
|               | 2) Compressed or collapsed
|               | 3) Broken or distorted |

### Shock absorbers

| a) Leaks      | 1) Broken or missing leaves
|               | 2) Broken or missing hangers |
|               | 3) Broken or missing hangers

### Drive shaft

| 1. Damaged U-joints |
| 2. Center support bearings with free play |

- a) Could indicate worn out bearings
- 3. Secure
- 4. Free of foreign objects

What could this indicate?
E. Wheels and tires

1. Lugnuts
   a) Missing
   b) Loose
      1) Check each lugnut by hand
      2) Rust between lugnut and rim
         • Could indicate a loose lugnut

2. Rims
   a) Missing studs
   b) Cracked
   c) Out-of-round

3. Tires
   a) Inflated in accordance with the manufacturer's recommendations and specifications
      1) Found on molded numbers on tire sidewall
      2) Too much or too little pressure
         • Damages the tire
         • Causes poor road handling
   b) Valve stem condition
      1) Damaged
      2) Leaking air
   c) Sidewalls
      1) Not cut or damaged
d) Tire tread condition
   1) Tires that have a tread depth of 4/32 inch (8.2 mm) or less on any steering axle or 2/32 inch (1.6 mm) or less on any nonsteering axle and any two adjacent major tread grooves anywhere on the tire

SLIDE: 2-3-26
SLIDE: 2-3-27

e) Dual tires
   1) Tires same size and type
   2) Nothing locked between them
   3) Tires do not rub together

SLIDE: 2-3-28
SLIDE: 2-3-29

III. OUT-OF-SERVICE CRITERIA
      1. Chassis, axles, steering and suspension systems, driveline, wheels, and tires
         a) Gross axle weight rating (GAWR) is greater than the tire manufacturer’s load rating
         b) Weight on the front axle, weight on the rear axle, or total gross weight exceeds the values shown on the vehicle weight rating label
         c) Tires have cuts in the sidewall that penetrate to the cord
         d) Tread depth of less than 1/8 inch (3.2 mm) on any steering axle or 1/16 inch (1.6 mm) on any nonsteering axle at any two adjacent major tread grooves anywhere on the tire
         e) Suspension components are loose, broken, or missing
2. Wheels or rims  
   a) Bent, broken, cracked, improperly seated, sprung, or mismatched lock or side ring(s)  
   b) Cracked, broken, or elongated bolt holes  
   c) Loose, missing, broken, cracked, stripped, or otherwise ineffective fasteners

3. Weld deficiencies  
   a) Cracks in welds attaching disc wheel disc to rim  
   b) Cracks in welds attaching tubeless demountable rim to adapter  
   c) Welded repair on aluminum wheel(s) on a steering axle  
   d) Welded repair, other than disc to rim attachment, on steel disc wheel(s) mounted on the steering axle

4. Axle flanges have Class 3 leakage
5. An axle has Class 3 leakage
6. Steering components do not meet the requirements of 49 CFR Part 399.211, Appendix G, Minimum Periodic Inspection Standards
7. A steering component has Class 3 leakage
8. Driveline components do not meet the requirements of 49 CFR 399.211, Appendix G
9. A qualified technician shall conduct an out-of-service evaluation of the following tire deficiencies and make a written report, including recommendations to the AHJ
   a) Punctures
   b) Cuts to the cord
c) Bulges, other than bumps or repairs; repair bulges greater than 0.4 inches (10 mm), or bulges or knots associated with tread

d) Sidewall separation

SLIDE: 2-3-33

B. CCDH criteria

1. Leaf springs

   a) \( \frac{1}{4} \) or more of the spring pack is missing, shifted, cracked, or has broken leaves

      1) The suspension system supports the apparatus and its load, and keeps the axles in place

      2) Any broken suspension part can be extremely dangerous

          • Contact your department’s fleet manager for a plan of action

2. Steering wheel having more than 10 degrees of movement in either direction without tire movement
SUMMARY:
There are many components to the suspension, frame, steering, and driveline systems that require your knowledge to be complete and precise. Damaged steering components will not allow you to maintain proper control of the fire apparatus. A damaged drive shaft will not transfer power to the axles. Bad tires will cause you to lose control of the fire apparatus.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-4: Troubleshooting The Frame, Axles, Steering And Suspension Systems, Driveline, Wheels, And Tires

TIME FRAME: 0:30

LEVEL OF INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of troubleshooting the frame, axles, steering and suspension systems, driveline, wheels, and tires by completing the written test

Standard: With a minimum 80% accuracy according to the information contained in Fire Apparatus Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 24-25

MATERIALS NEEDED:

• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

REFERENCES:

• Fire Apparatus Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 24-25

PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)       Begin
Curiosity (arouse)       Association
Interest (create)        Students
Desire (stimulate)       Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. OVERVIEW
   A. Some problems that occur with the apparatus can be a result of one or more component or system failure(s)

II. FRAME
   A. Defects discovered on the frame should be managed according to the manufacturer's recommendations and department SOPs
      1. Contact your department's fleet manager

III. STEERING PROBLEMS
   A. Symptom
      1. Front end pulls right or left
      2. Apparatus drifts right or left
      3. Apparatus is hard to steer

      4. Possible cause
         a) Low tire pressure
         b) Front end out-of-alignment
         c) Axle out-of-alignment
         d) Mixed tires
         e) Mixed rims

      5. Possible corrective action
         a) Check tire pressure
            1) Add air if needed
         b) Visually check components for any obvious defects
         c) If problem persists or defects found, contact your department's fleet manager for a plan of action
IV. NOISES

A. Symptom: Growling or whining coming from the rear axle

1. Possible cause
   a) Bearing failure
   b) Low oil level in rear axle

2. Possible corrective action
   a) Check oil level
      1) Add oil if needed
   b) Do not drive any further than absolutely necessary
      1) Continuous operation could cause irreversible damage to components involved
   c) If problem persists, contact your department’s fleet manager for a plan of action

B. Symptom: Loud clang when placing the apparatus into gear from driveline

1. Possible cause
   a) Pinion bearing out-of-adjustment
   b) Universal joint failure/excessive wear

2. Possible corrective action
   a) Visually inspect the universal joint and driveline for obvious defects
   b) Contact your department’s fleet manager for a plan of action
C. Symptom: Clunking sound in the front end while turning left or right

1. Possible cause
   a) Worn suspension parts
      1) Oftentimes, as bushings wear out, the suspension will begin to shift from side-to-side in corners
      2) This can potentially cause handling problems at inopportune moments

2. Possible corrective action
   a) Contact your department’s fleet manager for a plan of action

V. VIBRATIONS

A. Symptom: Fine (mild) vibration at road speeds

1. Any vibration indicates that something is worn out, out-of-balance, or broken

2. Almost all vibrations will eventually cause some sort of component failure

3. Possible cause
   a) Driveline out-of-balance
   b) Failure of universal joint
   c) Failure of carrier bearing
   d) Failure of input or output shaft bearings

4. Possible corrective action
   a) Catch early
   b) Any one of these conditions is reason to take apparatus out-of-service
   c) Contact your department’s fleet manager for a plan of action
### B. Symptom: Coarse (hard) vibration

1. Possible cause
   a) Probably progressed from a fine vibration
   b) Some kind of catastrophic failure of the drive train
   c) Wheel/tire out-of-balance
   d) Bent wheel
   e) Object between dual tires

### VI. APPARATUS DOES NOT MOVE

A. Symptom: Apparatus in gear, driveline turns but apparatus will not move

1. Possible cause
   a) Pump not shifted from pump to road
   b) Broken axle
   c) Broken ring and pinion gear
   d) Two-speed rear differential stuck between high and low
2. Possible corrective action
   a) Shift pump to road position
   b) Check operator’s manual
      1) May be something as simple as a blown fuse
   c) Take out-of-service
   d) Contact your department’s fleet manager for a plan of action

VII. APPARATUS LEANS

A. Symptom: Apparatus leans to left or right
   1. Fire apparatus spends most of its life sitting in an apparatus bay fully loaded
      a) Spring steel needs to be exercised in order to maintain its tension
   2. Possible cause
      a) Sagging spring or broken spring leaf on front or rear suspension

What is a possible corrective action for this symptom?

3. Possible corrective action
   a) Sagging spring
      1) Contact your department’s fleet manager for a plan of action
   b) Broken spring
      1) Take out-of-service
      2) Contact your department’s fleet manager for a plan of action
SUMMARY:
Driver/operators must use basic apparatus troubleshooting skills to identify and prioritize maintenance problems in axles, steering and suspension systems, driveline, wheels, and tires. Every driver/operator must be familiar with the manufacturer’s operational standards and criteria for maintenance of their department’s apparatus.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
Review your notes and read Fire Apparatus Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 24-25 in order to prepare yourself for the upcoming test. Study for our next session.
TOPIC: 2-5: Inspection And Basic Maintenance Of Engine Systems

TIME FRAME: 0:45

LEVEL OF INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:
Condition: Given a written test
Behavior: The student will confirm a knowledge of inspection and basic maintenance of engine systems by completing the written test

MATERIALS NEEDED:
• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

REFERENCES:
• NFPA 1911: Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, NFPA, 2007 Edition, Chapters 4, 6, and 7

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience

Cite examples or use related illustrations of near-miss
incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. ENGINE SYSTEMS
A. Cooling
B. Fuel
C. Oil
D. Air filtration
E. Exhaust
F. Ignition
G. Drive belt

II. INSPECTION AND BASIC MAINTENANCE
A. It is very important to check these systems with the engine shut-off and the system cool

1. If cooling system is hot, coolant could release under pressure causing a burn injury

B. Cooling systems
   1. Radiator
      a) Leaks
      b) Damage to exterior
      c) Obstructions in the air flow passages
      d) Coolant level and quality
         1) Level to full mark
         2) Fluid clear or translucent
            • Not milky
            • Not dark

   2. Radiator fan
      a) Missing parts
      b) Broken or bent fan blades

   Why does the cooling system need to be cool to inspect?

SLIDE: 2-5-3

SLIDE: 2-5-4
3. Radiator cap
   a) Missing or damaged
   b) Leaking fluid
4. Coolant reservoir
   a) Proper fluid level
5. Hoses
   a) Cracked or spongy
   b) Fluid seepage
   c) Hose clamps tight

6. Auxiliary heat exchanger
   a) Leaks
   b) Secure mounting
   c) Deformation
      1) Could be a sign of stress
      2) Could be a sign of internal rust buildup

7. Basic maintenance
   a) Add water or approved coolant to maintain proper fluid levels in the radiator and coolant reservoir

   a) Cooling system component that has Class 3 leakage
   b) Coolant that contains oil
<table>
<thead>
<tr>
<th>c) Cooling system that exceeds maximum operating temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>d) If there are deficiencies with the following systems or components, a qualified technician shall conduct an out-of-service evaluation and make a written report, including recommendations to the AHJ</td>
</tr>
<tr>
<td>1) Radiator</td>
</tr>
<tr>
<td>2) Water pump bearing</td>
</tr>
<tr>
<td>3) Cooling fan</td>
</tr>
<tr>
<td>4) Coolant system components</td>
</tr>
</tbody>
</table>

C. Fuel system

1. Missing or damaged components
2. Fuel tank secure to frame
3. Fuel level at proper level
4. Caps secure
5. Leaks
   a) From lines or tank
   b) From injector manifold
6. Electronic throttle components and sensors inspected for proper operation

7. Basic maintenance
   a) Proper fuel level in fuel tank
8. Maintained in accordance with manufacturer’s recommendations and specifications
   a) Fuel filters
   b) Fuel-water separators
   c) Carburetor
d) Injection pump

e) Injectors

   a) Any component with a Class 2 leakage
   b) Defective tank, mountings, or straps

D. Oil system
   1. Dipstick level
      a) Safe operating range
      b) Proper parameters
   2. Basic maintenance
      a) Add recommended oil if level is low

   How would you find out the proper oil type to use?
      1) According to department SOPs
      2) In accordance with the manufacturer's recommendations and specifications
      b) Do not overfill

   a) Contaminated with coolant or fuel
   b) Any component that has a Class 3 leakage
### E. Air filtration system

1. **Components**
   - a) Air cleaner element
   - b) Piping
   - c) Turbocharger
   - d) After-cooler
   - e) Intercooler
   - f) Air-to-air cooler
   - g) Blower

2. **Inspect for**
   - a) Missing or damaged components
   - b) Cleanliness

   1) Replace
   - Do not clean a dirty air filter

3. **Basic maintenance**
   - a) Change air filter when dirty or when advised by department SOPs
   - b) In accordance with the manufacturer's recommendations and specifications

   - a) Air filter restriction
F. Exhaust systems

1. Missing or damaged components
2. Leaks
   a) Indicators are dark black soot around leak
   b) Carbon leaks
3. Contact with wires, hoses, etc.
4. Mountings are secure and tight
5. Rain cap operational, if equipped

   a) A flap that keeps rain from entering a vertical exhaust pipe

What is a rain cap?

6. Basic maintenance
   a) All exhaust components shall be maintained in accordance to the engine manufacturer’s recommendations and specifications
   b) Try to tighten nuts and bolts around leaking flange
   c) No other basic maintenance is required

   a) None stated
G. High voltage ignition system for gasoline engines

1. Spark plugs
   a) Proper type and heat range
   b) Proper gap between electrodes
   c) Not fouled or corroded

2. Spark plug wires
   a) Missing
   b) Damaged
      1) Fraying and cracked insulation
      2) Loss of voltage through leaks
      3) Misfires

3. Distributor
   a) Cap
      1) Cracked
      2) Burnt
   b) Rotor
      1) Damaged tip
      2) Cracked body
   c) Electronic ignition
      1) Basically works or not
      2) No basic maintenance needed
   d) Standard ignition
      1) Points
         • Correct gap
         • Burnt conductors
      2) Condenser
### e) Coil

1) Converts low voltage to high voltage
   - High voltage range - 60,000 to 250,000 volts

| SLIDE: 2-5-35 |
| SLIDE: 2-5-36 |

### 4. Basic maintenance

a) All ignition system components shall be maintained in accordance with the manufacturer’s recommendations and specifications

b) There is no basic maintenance for the driver/operator

c) For the most part, any defect that is found needs to be repaired by a qualified mechanic

| SLIDE: 2-5-37 |


a) Any portion of the ignition system that is defective

| SLIDE: 2-5-38 |

### H. Belt system

1. Referred to as engine compartment belts in the California Commercial Drivers Handbook

2. Condition
   a) Snug
   b) Cracked
   c) Frayed
   d) Excessive wear
   e) Missing
3. Proper adjustment
   a) Single belts versus multiple belts
   b) CCDH criteria

   According to the CCDH, what is the maximum amount of play for a belt?

   1) Up to \( \frac{3}{4} \)-inch play at the center of belt

4. Basic maintenance
   a) Set belt tension in accordance with the manufacturer's recommendations and specifications

   a) None stated
SUMMARY:
There are a variety of systems that keep the engine cool, lubricated, and supplied with fuel and clean air. Some of these systems may seem minor, but they all play an important role in how your fire apparatus will perform. A basic knowledge of each of these individual systems and how to perform basic maintenance is necessary in order for you to carry out your role as a fire apparatus driver/operator.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-6: Troubleshooting Engine Systems

TIME FRAME: 0:30

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of troubleshooting engine systems by completing the written test


MATERIALS NEEDED:
- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:

PREPARATION:
Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

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Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
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<thead>
<tr>
<th>PRESENTATION</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. FUEL SYSTEM</strong></td>
<td><strong>SLIDE: 2-6-1</strong></td>
</tr>
<tr>
<td>A. Gasoline engine</td>
<td></td>
</tr>
<tr>
<td>1. Are often linked to the emission systems</td>
<td></td>
</tr>
<tr>
<td>a) Can become very complicated</td>
<td></td>
</tr>
<tr>
<td>b) Contact your department’s fleet manager for assistance</td>
<td></td>
</tr>
<tr>
<td>2. Symptom: Engine will not start</td>
<td><strong>SLIDE: 2-6-2</strong></td>
</tr>
<tr>
<td>a) Possible cause</td>
<td></td>
</tr>
<tr>
<td>1) Flooded, too much fuel in the engine</td>
<td></td>
</tr>
<tr>
<td>b) Possible corrective action</td>
<td></td>
</tr>
<tr>
<td>1) Ensure the choke is off</td>
<td></td>
</tr>
<tr>
<td>a) Slowly push the throttle all the way to the floor</td>
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</tr>
<tr>
<td>b) Do not let off</td>
<td></td>
</tr>
<tr>
<td>c) Crank the engine over until it starts</td>
<td></td>
</tr>
<tr>
<td>d) If the engine still will not start, allow it to set for approximately five minutes and then try again</td>
<td></td>
</tr>
<tr>
<td>2) If problem persists, contact your department’s fleet manager for a plan of action</td>
<td><strong>SLIDE: 2-6-3</strong></td>
</tr>
<tr>
<td>c) Possible cause</td>
<td></td>
</tr>
<tr>
<td>1) No fuel to the engine</td>
<td></td>
</tr>
<tr>
<td>What is a possible corrective action for this symptom?</td>
<td></td>
</tr>
<tr>
<td>What is a possible corrective action?</td>
<td></td>
</tr>
</tbody>
</table>
d) Possible corrective action
   1) Remove the air intake from the carburetor and look down the throat of the carburetor
      - Simultaneously pump the throttle
      - You should see fuel spray inside the carburetor
      - If not, you have no fuel to the engine and your fuel pump is probably out
   2) Take out-of-service

B. Diesel engine
   1. Relies on the fuel system being completely sealed from any contaminants
      a) Very sensitive to dirt and air pockets
      b) Slightest air pocket can cause a drop in fuel pressure
         1) Causing the engine to misfire
      c) Also set up with every close tolerance between components
         1) Slightest bit of dirt can ruin a fuel pump or fuel injector

   2. Symptom: Engine will not start
      a) Possible cause
         1) No fuel to the system
      b) Possible corrective action
         1) Ensure fuel tank is at least one-half full

What is another possible cause for this symptom?
What is your fuel level requirement?
<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2) Ensure fuel is reaching the clean side of the filter</td>
<td></td>
</tr>
<tr>
<td>• Open the pet cock on top of the fuel filter</td>
<td></td>
</tr>
<tr>
<td>• If fuel is not present at the filter, use the fuel primer (if equipped) to pump up the system</td>
<td></td>
</tr>
<tr>
<td>• In accordance with manufacturer’s recommendations and specifications</td>
<td></td>
</tr>
</tbody>
</table>

| 3) Take apparatus out-of-service if engine still will not start |

| What if the engine still will not start? |

SLIDE: 2-6-6
What is another possible cause for this symptom?  
SLIDE: 2-6-7

c) Possible cause  
1) Air leak in the fuel system  
d) Possible corrective action  
1) Check all fuel lines for signs of leaking fuel  
• If fuel comes out, then air will go in  
• Tighten leaking fittings, if possible  
• Bleed the air in accordance with the manufacturer’s recommendations and specification  
2) Contact your department’s fleet manager for a plan of action if the apparatus still will not start

II. COOLANT LEVEL  
A. Leaks  
1. External coolant leaks on fire apparatus are generally easy to see  
a) Shows up on the clean apparatus bay floor
2. An internal leak may not be so obvious
   a) Water in the oil may separate, settle to the bottom of the oil reservoir, and go undetected

B. Symptom: Losing coolant
   1. Possible cause
      a) External leak caused by damage or corrosion
   2. Possible corrective action
      a) Check the entire cooling system for external coolant leaks
         1) May be able to fix the leaks by simply tightening a hose clamp or replacing a radiator cap

3. Possible cause
   a) Internal leaks caused by a failed head gasket, cylinder head, or piston sleeve
   4. Possible corrective action
      a) Check the motor oil
         1) If it has a milky white appearance to it, you have coolant in the oil
      b) Take out-of-service

III. LUBRICATION SYSTEM
   A. Oil leaks on older apparatus are common
      1. Should be watched carefully
   B. Symptom: Loud engine knock accompanied by a dramatic and sudden drop in oil pressure
What is a possible cause for this symptom?

1. Possible cause
   a) External damage to the oil reservoir and loss of oil
   b) Broken connecting rod
   c) Catastrophic (complete) failure of oil pump

What is a possible corrective action for this symptom?

2. Possible corrective action
   a) Shut down immediately
   b) Take out-of-service

C. Symptom: Leaking oil, creating a puddle larger than two inches in diameter on the floor

1. Possible cause
   a) Leaking gaskets
   b) Leaking oil lines
   c) Loose drain plug
   d) Loose oil filter

2. Possible corrective action
   a) If the leak is found, attempt to tighten to stop the leak
   b) If the leak is coming from a source you cannot see or cannot repair, contact your department’s fleet manager for a plan of action

IV. AIR SYSTEM (INTAKE AND EXHAUST)

A. Symptom: Sudden loss of power without increase in engine noise
### What is a possible cause for this symptom?

1. **Possible cause**
   a) Failure of pressure tube from exhaust that drives the turbocharger

2. **Possible corrective action**
   a) Attempt to reattach or repair the hose until you can get to a location where proper repairs can be made

---

### Slide: 2-6-13

**B. Symptom:** Gradual loss of power with heavy black smoke coming from exhaust

1. **Possible cause**
   a) Turbo failure

2. **Possible corrective**
   a) Take out-of-service

---

### What is a possible corrective action for this symptom?

**SLIDE: 2-6-13**

---

### What is the common cause of turbo failure?

**SLIDE: 2-6-14**

3. Most common cause of turbo failure is due to improper shutdown procedures
   a) Turns at 10,000 rpms
   b) Relies on oil from the main engine to keep it lubricated
   c) If the main engine is shutdown before the turbo stops turning, the turbo will not receive sufficient lubrication and may be destroyed
V. EXHAUST SYSTEMS

A. Symptom: Sudden increase in exhaust noise

1. Possible cause
   a) Damaged muffler or pipe
   b) Damaged or worn out exhaust gaskets (donuts)

2. Possible corrective action
   a) None of these problems would take the apparatus immediately out-of-service
   b) Contact your department’s fleet manager for a plan of action

B. Symptom: Gradual increase in exhaust noise starting as a slight ticking noise

1. Possible cause
   a) Failing exhaust manifold gasket at the cylinder head

2. Possible corrective action
   a) Does not require apparatus to be taken out-of-service
      1) As the noise increases, it can become a serious problem
      2) Problem should be addressed
   b) Contact your department’s fleet manager for a plan of action
**SUMMARY:**
A basic troubleshooting review of fuel systems, cooling systems, lubrications systems, and air systems has been discussed. A good knowledge of these individual systems will assist the driver/operator in properly maintaining his or her apparatus.

**EVALUATION:**
The student will complete the written test at a time determined by the instructor.

**ASSIGNMENT:**
TOPIC: 2-7: Inspection And Basic Maintenance Of The Transmission And Clutch

TIME FRAME: 0:15

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of inspection and basic maintenance of the transmission and clutch by completing the written test


MATERIALS NEEDED:

• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

REFERENCES:

• NFPA 1911: Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, NFPA, 2007 Edition, Chapters 4, 6, and 7

PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience
Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. COMPONENTS

A. Transmission

B. Clutch and linkage

C. Lubricants and filters

D. Transmission controls and shift linkage

E. Indicators and gauges

F. Electronic diagnostic system

G. Power take-off units

H. Lock-up systems for pumps or other accessories

I. Transmission braking systems

II. INSPECTION AND BASIC MAINTENANCE

A. All basic maintenance needs to be done in accordance with the manufacturer's recommendations and specifications

B. Basic maintenance for these components is maintaining proper fluid levels with approved fluid or oil

1. Information on approved fluids is listed in the manufacturer's recommendations and specifications

C. Transmission

1. Securely mounted

2. Structurally sound

3. Check for proper fluid level

Where would you find information about this?

SLIDE: 2-7-6
4. Leaking
5. Clean
6. Smooth or hard shifting

D. Clutch and linkage
1. Missing, damaged, or loose components
2. Clutch free play (free travel)
   a) The distance that the pedal must be pushed before the throw-out bearing actually contacts the clutch release fingers
   b) Insufficient free play
      1) Shortens the life of the throw-out bearing
      2) Causes the clutch to slip, overheat, and wear out sooner than necessary
   c) Excessive free play

   1) May result in the clutch not releasing completely
      • Which can cause harsh shifting, gear clash, and damage to gear teeth

E. Lubricants and filters
1. Check level of all fluids
   a) If low, add appropriate fluid to the proper level
   b) Follow department SOPs
   c) In accordance with the manufacturer’s recommendations and specifications
2. No contamination of fluids
3. Burnt smell
4. Fluid leaking from filters

SLIDE: 2-7-7
SLIDE: 2-7-8
<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F. Transmission controls and shift linkage</strong>&lt;br&gt;1. Missing, damaged, or loose components&lt;br&gt;2. In accordance with the manufacturer's recommendations and specifications</td>
<td>SLIDE: 2-7-9</td>
</tr>
<tr>
<td><strong>G. Indicators and gauges</strong>&lt;br&gt;1. Working properly&lt;br&gt;2. In accordance with the manufacturer's recommendations and specifications</td>
<td>SLIDE: 2-7-10</td>
</tr>
<tr>
<td><strong>H. Electronic diagnostic system</strong>&lt;br&gt;1. Check for proper operation in accordance with the manufacturer's recommendations and specifications</td>
<td>SLIDE: 2-7-11</td>
</tr>
<tr>
<td><strong>I. Power take-off units</strong>&lt;br&gt;1. Operational tests&lt;br&gt;2. Mountings secure and not cracked&lt;br&gt;3. Check level of all fluids&lt;br&gt;   a) If low, add appropriate fluid to the proper level&lt;br&gt;   b) Follow department SOPs&lt;br&gt;   c) In accordance with the manufacturer's recommendations and specifications</td>
<td>SLIDE: 2-7-12</td>
</tr>
<tr>
<td><strong>J. Lock-up systems for pumps or other accessories</strong>&lt;br&gt;1. Maintains the transmission in an appropriate gear to operate pumps and other accessories&lt;br&gt;2. Leaking&lt;br&gt;3. Operationally tested</td>
<td>What is the function of a lock-up system?</td>
</tr>
</tbody>
</table>

What is the function of a lock-up system?
K. Transmission braking systems
   1. Missing, damaged, or loose components
   2. In accordance with the manufacturer's recommendations and specifications

III. OUT-OF-SERVICE CRITERIA

   1. Automatic transmission that overheats in any range
   2. Automatic transmission that has a "do not shift" light on
   3. Transmission components that have Class 3 leakage of transmission oil
   4. A qualified technician shall conduct an out-of-service evaluation and make a written report, including recommendations to the AHJ
      a) Clutch components
      b) Transmission components
      c) Shift linkages

B. CCDH criteria
   1. None stated
SUMMARY:
The transmission is fundamentally a gearbox that transmits the clockwise rotation of the engine into the proper gear to perform the movement of the fire apparatus. Regardless of whether the transmission is automatic or manual, each type performs the same operation. The difference being the automatic transmission is a hydraulic pump and the manual transmission is a set of gears and shafts. As with any machine, the various components need to be systematically and regularly checked.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-8: Troubleshooting The Transmission And Clutch

TIME FRAME: 0:15

LEVEL OF INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of troubleshooting the transmission and clutch by completing the written test

Standard: With a minimum 80% accuracy according to the information contained in Fire Apparatus Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 36-37

MATERIALS NEEDED:

- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:


PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)  Begin
Curiosity (arouse)  Association
Interest (create)  Students
Desire (stimulate)  Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. MANUAL TRANSMISSIONS

A. Symptom: Transmission growls under a load
   1. Possible cause
      a) Failure of one of the main bearings in the transmission
         1) May be caused by low oil levels in the transmission

B. Symptom: Transmission growls all of the time
   1. Possible cause
      a) Clutch is out-of-adjustment causing the throw-out bearing to fail
         1) Clutch pedal needs to have some free play in it
         2) Otherwise, the throw-out bearing will be running all of the time and burn out

C. Symptom: Transmission growls when you press on the clutch
   1. Possible cause
      a) Throw-out bearing is failing

D. Possible corrective action
   1. If any of these signs are present, apparatus should be taken out-of-service until repairs can be made
   2. Contact your department’s fleet manager for a plan of action
II. AUTOMATIC TRANSMISSIONS

A. Symptom: Transmission is leaking large amounts of fluid when in gear

1. Possible cause
   a) Too much fluid
      1) Overfilling a transmission with fluid can cause the transmission case to become overpressurized
      2) This can cause the seals to be blown out, allowing fluid to leak

2. Possible corrective action
   a) Shutdown immediately
   b) Take out-of-service
      1) Until the level of fluid has been reduced to normal
      2) Transmission has been inspected and tested by a qualified mechanic

B. Symptom: Engine is running but the transmission will not engage

1. Possible cause
   a) Auxiliary systems that override transmission control may be in use

2. Possible corrective action
   a) Check all auxiliary systems to ensure they are in the lock-down position

3. Possible cause
   a) Most likely low on fluid
1) If the transmission is so low on fluid that the pump cannot pick it up, the vehicle will not move
2) This generally will not damage the components unless it runs for an extended period without fluid
3) If fluid is low but the pump still picks it up, there is risk of overheating the transmission

4. Possible corrective action
   a) Check for leaks
   b) Add fluid if needed
   c) If transmission still will not engage, contact your department’s fleet manager for a plan of action

C. Symptom: Transmission will not shift up or down

1. Possible cause
   a) Low fluid level
2. Possible corrective action
   a) Add fluid

3. Possible cause
   a) Computer failure
4. Possible corrective action
   a) Shutoff engine
      1) Disconnect, then reconnect batteries
         • This reboots the computer
      2) Try it again
   b) Contact your department’s fleet manager for a plan of action if transmission still will not engage
SUMMARY:
The transmission system is a vital component of the drive train. This lesson has given you a few tools to assist you in recognizing the symptoms of a failure in the transmission that may or may not put your apparatus out-of-service. Early recognition may avoid potentially costly repairs.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
Review your notes and read Fire Apparatus Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 36-37 in order to prepare yourself for the upcoming test. Study for our next session.
TOPIC: 2-9: Inspection And Basic Maintenance Of The Starting, Charging, And Other Electrical Systems

TIME FRAME: 0:30

LEVEL OF INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of inspection and basic maintenance of the charging, starting, and other electrical systems by completing the written test


MATERIALS NEEDED:

• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

REFERENCES:

• NFPA 1911: Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition, Chapters 4, 6, and 8

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience
Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
# Components

## Starting System

1. Batteries
2. Cables and connections
3. Cranking motor
4. Solenoid, relays, and switches
5. Interlock systems

## Charging System

1. Alternator
2. Regulator
3. Associated wiring and cables
4. Rectifiers
5. Isolators
6. Alternator drive belts
7. Solenoids, relays, switches, instrumentation, and lighting
C. Ignition system
   1. Associated wiring and cables
   2. Solenoid, relays, switches, instrumentation, and lighting
   3. Glow plugs

D. Electrical load management system (ELMS)
   1. Electronic hardware
   2. Associated wiring and cables
   3. Solenoid, relays, switches, instrumentation, and lighting
   4. Low-voltage warning devices

5. Purpose
   a) To prevent an overload of the electrical generation system
   b) 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
   c) Monitors the system for added electrical loads that threaten to overload the system
      1) When an overload condition occurs, the ELMS load monitor shuts down less important electrical equipment to prevent overloading
      2) This process is called "load shedding"

E. Miscellaneous electrical components
   1. Battery conditioners and chargers
   2. Shoreline receptacles
What is the definition of a "shoreline receptacle?"

a) A 120v electrical cord that attaches to fire apparatus to maintain voltage of various systems

3. Radios and intercoms
4. Converters and inverters
5. Fast idle system
6. Interlock system(s)
7. Operator alert devices

F. Apparatus lighting
   1. Headlights
   2. Marker lights
   3. Clearance lights
   4. Turn signals and hazard lights
   5. Brake lights
   6. Backup lights and alarms
   7. Dash lights

G. Work lighting
   1. Ground lights
   2. Step lights
   3. Flood, spot and scene lights
   4. Cab interior lights
   5. Compartment lights
      a) Open compartment door
      b) Activate switch by hand
SLIDE: 2-9-16
How do you check compartment lights and switches?

1) Light should turn off when switch depressed
2) Light should turn on when switch is released

SLIDE: 2-9-17
H. Electrical accessories
1. Heater and defroster
2. Air conditioning system
3. Windshield wipers and washers
4. Instrumentation

SLIDE: 2-9-18
I. Warning devices
1. Emergency warning lights
2. Electric and electronic sirens
3. Automotive traffic horn
4. Air horns
5. Backup alarm
6. Traffic preemption

SLIDE: 2-9-19
SLIDE: 2-9-20
II. INSPECTION AND BASIC MAINTENANCE
A. General guidelines
1. All components of the electrical system shall be maintained in a clean condition and free of corrosion
2. All components shall be inspected for secure mounting, deformation and shall be operationally tested
3. Components shall be tested to ensure proper operation

B. Starting system
   1. Batteries
      a) Tested for storage and performance capabilities
         1) In accordance with the manufacturer's recommendations and specifications
      b) Clean
         1) Use baking soda and water to clean

C. Charging system
   1. Alternator
      a) Operationally tested for the output performance
   2. Condition of drive belts
      a) Inspect for
         1) Missing
         2) Fraying
         3) Cracks
         4) Excessive wear
   3. Maintain in accordance with the manufacturer's recommendations and specifications

D. ELMS
   1. Tested for activation
   2. Operation of low voltage warning devices
   3. Maintain in accordance with the manufacturer's recommendations and specifications
III. OUT-OF-SERVICE CRITERIA

   1. Legally required lighting (DOT lighting) or horn that is not operational
   2. Ignition system that is not operational
   3. Charging system that is not operational
   4. Any failure of the warning light system that creates any position around the apparatus from which no warning light is visible
   5. If there are deficiencies in the grounding and bonding system or an inoperative siren, a qualified technician shall conduct an out-of-service evaluation and make a written report, including recommendations to the AHJ

B. CCDH criteria
   1. None stated
SUMMARY:
The importance of complete and accurate inspection and maintenance procedures for the electrical systems should be apparent. As fire apparatus become more electronically sophisticated, the need to keep pace increases. You cannot afford to lag behind the changes that seem to occur daily. The delicate nature of the starting, charging, and other electrical systems need professional, up-to-date attention by a proficient fire apparatus driver/operator.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-10: Troubleshooting The Starting, Charging, And Other Electrical Systems

TIME FRAME: 2:00

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of troubleshooting the starting, charging, and other electrical systems on fire apparatus by completing the written test


MATERIALS NEEDED:
• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

REFERENCES:

PREPARATION:
Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

| Attention (attract) | Begin |
| Curiosity (arouse) | Association |
| Interest (create) | Students |
| Desire (stimulate) | Experience |

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
## I. BASIC THEORIES

### A. Electricity
1. The movement of electrons from atom to atom
2. Random movement of electrons is not electric current; the electrons must move in the same direction

### B. Voltage (V)
1. Defined as electrical pressure
2. The electromagnetic force that causes the movement of electrons in a conductor

**NOTE:** Attempt to relate electricity to the hydraulics of water.

### C. Current (I)
1. Defined as the rate of electron flow
2. Measured in amperes
   a) The rate at which electrons pass any given point in the circuit in one second
3. Will increase as voltage (pressure) is increased

**What is "resistance?"**

### D. Resistance (R)
1. Defined as opposition to current flow
2. The size, type, length, and temperature of the material used as a conductor will determine the resistance of the conductor

### E. Ohm's Law (Ω)
1. The resistance of a conductor such that a constant current of 1 ampere in it produces a voltage of 1 volt between its ends
2. Defines the relationship between current, voltage, and resistance
   a) If any two or these three electrical values are known, the third can be found

3. Mathematical formula that shows how current, voltage, and resistance work together to produce electricity

F. Series circuit
   1. Provides a single path for current flow from the electrical source through all the circuit’s components and back to the source

G. Parallel circuit
   1. Provides two or more paths for electricity to flow

II. TEST EQUIPMENT

   NOTE: Remind students that all test equipment is different and that they need to follow manufacturer’s recommendations for proper use.

A. Jumper wires (not the same as jumper cables)
   1. Simply a wire with an alligator clip on each end
   2. **Warning!** Never connect a jumper wire across the terminals of the battery
      a) Battery could explode causing serious injury

   3. Connecting one end of the jumper wire to positive battery post will provide an excellent 12-volt power supply for testing components
   4. Can be used to check the load of components by bypassing switches, conductors, and connections in the circuit
   5. Can also be used to provide the ground to test that portion of the circuit
B. Test lights

1. Used when you need to “look” for electrical power in the circuit
2. Handle is transparent and contains a light bulb
   a) A sharp probe extends from one end of the handle
   b) A ground wire with a clamp extends from the other end
3. The lamp should light after clamping the lead of the test light to ground and probing a live circuit
4. **Warning!** It is not recommended that a test light be used to probe for power in a computer-controlled circuit
   a) The increased draw of the test light may damage the system components

C. Self-powered continuity tester

1. Used to test circuits without power
2. Looks similar to a test light
3. Tester has a battery and lights when the circuit is complete between the probe and the lead
4. **Warning!** Do not connect a self-powered test light to a circuit that is powered
   a) Doing so will damage the test light
### D. Voltmeter

1. One of the most used meters in the shop
2. Used to read the pressure behind the flow of electrons
3. Connected in parallel with a circuit
   a) Reads directly in volts

### E. Ammeter

1. Used to measure current draw
2. Many styles require being connected in series with the current load to read the amount of current draw
3. To make the series connection, disconnect the load and reconnect it with all of the current going through the ammeter
   a) Polarity must be followed
4. **Warning!** Do not connect the meter in parallel with the circuit
   a) This can cause damage to the test meter

### III. CIRCUIT DEFECTS

#### A. Open

1. A circuit in which there is a break in continuity
2. Similar to turning off the switch, resulting in the system not operating

#### B. Short

1. A circuit that allows current to bypass part of the normal path
a) Example: Insulation breaks down allowing two wires to come in contact with each other, copper to copper

C. Ground
1. A condition that allows current to return to ground before it has reached the intended load component
2. Can be checked by removing the fuse and connecting a test lamp in series across the fuse connections
   a) If the lamp lights, the circuit is grounded

D. Excessive voltage drop
1. When considered as a defect, defines the portion of applied voltage that is used up in other points of the circuit rather than that used by the load component
   a) A resistance in the circuit that reduces the amount of electrical pressure available beyond the resistance

IV. CHARGING AND STARTING SYSTEMS
A. Batteries, starter, and alternator

B. Batteries
1. Reservoirs that hold energy
2. First components in the electrical system, and the first place that should be checked when a problem occurs
   a) Is the battery switch on?
   b) Are battery terminals clean and serviced?
      1) A corroded battery terminal can be the only problem in 80% of electrical problems
   c) Perform a voltage test
      1) Check the voltmeter on the apparatus or use a hand-held voltmeter
2) If the voltage is below 11.5 volts, try charging the batteries
   - After charging the battery completely, perform a load test using a load tester
   - Now you have eliminated the batteries as the problem

C. Starter
   1. Engaging the starter is a two-step process
      a) Step 1
         1) Activates a solenoid
      b) Step 2
         1) Solenoid activates the starter motor

   2. Symptom
      a) Engine will not start

   3. Possible cause
      a) Most common problem is that the solenoid hangs up or it has a loose connection to the battery

   4. Possible corrective action
      a) Check the battery
      b) Check the connections at the starter
         1) Both the solenoid and the starter motor hook up
2) Make sure that the battery cables are disconnected before tightening

c) Contact your department’s fleet manager for a plan of action

D. Alternator

1. Maintains voltage (pressure) in the electrical system

2. Symptom

   a) Low voltage (low pressure)

      1) Voltmeter is dropping below 12 volts and staying there

      2) May place your apparatus out-of-service when electronic systems begin to shut down if the voltage (pressure) drops below 11.5 volts

   b) Possible cause

      1) This problem can be caused by a variety of system failures

   c) Possible corrective action

      1) Contact your department’s fleet manager for a plan of action

3. Symptom

   a) High voltage (over pressure)

      1) Modern day fire apparatus systems are becoming increasingly sensitive to high voltage problems
b) Possible cause
   1) Voltmeter is raising above 16 volts and staying there
      • May cause the battery to overheat causing acid to boil, exploding the battery, and damaging sensitive components

c) Possible corrective action
   1) Contact your department’s fleet manager for a plan of action

4. Symptom
   a) Growling sound coming from the alternator or squealing sound from the belts

b) Possible cause
   1) Alternator may have bearing failure

c) Possible corrective action
   1) Take out-of-service
   2) Contact your department’s fleet manager for a plan of action

V. LIGHTING CIRCUITS

A. Symptom
   1. Head lights, tail lights, or marker lights do not light
   2. Possible cause
      a) Light bulb failure
      b) Broken wire
      c) Corroded connection
3. Possible corrective action
   a) Change the bulb
   b) Check the circuit using a test light
   c) Clean the corroded connection
   d) Contact your department’s fleet manager for a plan of action

B. Symptom
   1. Turn signals or hazard flashers do not flash

   What might cause this symptom?

   2. Possible cause
      a) Bad light bulb
      b) Bad flasher unit
      c) Failure in the lighting circuit
   3. Possible corrective action
      a) Replace light bulb
      b) Change flasher unit
      c) Test the circuit with a test light
      d) Contact your department’s fleet manager for a plan of action

C. Symptom
   1. Brake lights do not light
   2. Possible cause
      a) Light bulb failure
      b) Switch failure
      c) Circuit failure
   3. Possible corrective action
      a) Change light bulb
b) Test brake light switch using a test light

c) Test circuit using a test light

d) Contact your department’s fleet manager for a plan of action

D. Symptom

1. Auxiliary systems and/or Code 3 systems not functioning properly

2. Possible cause

   a) Can be caused by a variety of system failures
   b) Load manager operating
   c) Opticom™ installed with door or brake termination switch

3. Possible corrective action

   a) Check the load manager
   b) Close doors and/or release brake
   c) Contact your department’s fleet manager for a plan of action
SUMMARY:
Electrical systems on fire apparatus can be vast and complicated. Knowing the basics of troubleshoot electrical systems will get you out of most jams and allow you to complete your mission and get back to the station in a safe manner.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-11: Inspection And Basic Maintenance Of Brake Systems

TIME FRAME: 1:30

LEVEL OF INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge the inspection and basic maintenance of brake systems by completing the written test


MATERIALS NEEDED:

• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

REFERENCES:

• NFPA 1911: Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition, Chapters 4, 6, and 7

PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience

Cite examples or use related illustrations of near-miss
incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. TYPES
   A. Air
   B. Hydraulic
   C. Secondary

II. AIR BRAKE SYSTEM
   A. Most large, modern fire apparatus are equipped with air-operated braking systems

   B. Three braking systems combined
      1. Service brake system applies and releases the brakes when using the brake pedal during normal driving
      2. Parking brake system applies and releases the parking brakes when using the parking brake control
      3. Emergency brake system uses parts of the service and parking brake systems to stop the apparatus in the event of a brake system failure

   C. Shall be inspected and maintained in accordance with the manufacturer's recommendations and specifications

   D. Components
      1. Air compressor and governor
         a) Air compressor
            1) Pumps air into the air storage tanks (reservoirs)
         b) Governor
            1) Controls when the air compressor will pump air into the air storage tanks

How many air brake systems can be found on a fire apparatus?
c) On apparatus equipped with air brakes, the air pressure should build to a sufficient level to allow apparatus operations within 60 seconds of starting

d) Need to be operationally tested daily
   1) DMV brake tests
   2) Department SOPs
   3) In accordance with the manufacturer's recommendations and specifications

2. Air storage tanks
   a) Used to hold compressed air
      1) Hold enough air to allow the brakes to be used several times, even if the compressor stops working
   b) Must be checked daily for condensation
   c) Number and size varies among apparatus

3. Air dryer
   a) Collects and removes air system contaminants in solid, liquid, and vapor form
   b) Provides clean, dry air to air reservoirs and air brake components
   c) Normally in line between the air compressor and first air storage tank

4. Alcohol evaporator
   a) Some air brake systems have an alcohol evaporator to put alcohol into the air system
b) Helps to reduce the risk of ice in air brake storage tanks, valves, and other parts during cold weather
   1) Ice inside the system can cause brake failure

5. Treadle valve or master control valve
   a) Located at the brake pedal
   b) Controls entire brake system
   c) Overrides other components

6. Safety relief valve
   a) Installed in the first tank the air compressor pumps air into
   b) Protects the tank and the rest of the system from too much air pressure
   c) Usually set to open at 150 psi

7. Brake pedal
   a) Apply the brakes by pushing down on the brake pedal
      1) Also called the foot valve or treadle valve
   b) The harder the pedal is pushed down, the more air pressure is applied from the storage tanks into the brake chambers

8. Brake chamber
   a) Converts the energy of compressed air into mechanical force and motion
      1) Actuates the brake camshaft, which in turn operates the foundation brake mechanism
      2) Forces the brake shoes/pads against the drum/disc
9. Slack adjuster
   a) The link between the brake chamber and the foundation brake camshaft
      1) Transforms and multiplies the force developed by the chamber into a torque
      2) Applies the brake via the camshaft
      3) Equipped with an adjusting mechanism, providing a means of adjusting for brake lining wear
         • Can be manual or automatic

10. Brakes
   a) Brake drums and shoes
      1) Friction between the drums and shoes is what causes the wheel to stop
   b) Brake discs and pads
      1) Friction between the discs and pads is what causes the wheel to stop
      2) Discs are normally used for front brakes because they can absorb more heat than drums
   c) Types
      1) S-cam brakes
      2) Wedge brakes
      3) Disc brakes

11. One-way check valve
   a) Allows air to flow in one direction only
b) All air tanks on air-braked vehicles must have a check valve located between the air compressor and the first reservoir

12. Air supply pressure gauge
   a) All air-braked vehicles have an air supply pressure gauge connected to the air tank
   b) If the apparatus has a dual air brake system, there will be a gauge for each half of the system
      1) Sometimes a single gauge with two needles
   c) Indicate how much pressure is in the air tanks
      1) Must be above 90 psi to operate the brakes safely

13. Application pressure gauge
   a) Indicates how much air pressure you are applying to the brakes
      1) Some apparatus do not have this gauge

14. Low air pressure warning
   a) Required with air brakes
      1) A visible and audible warning device that must come on when the air supply pressure drops below 60 psi, or
      2) When it reaches one-half of the compressor governor's cut-out pressure (older apparatus)
      3) Usually a red light and buzzer
15. Air pressure protection valve  
   a) This valve prevents air horns from operating when the pressure in the air reservoir drops below 80 psi (552 kPa)

16. Stop light switch  
   a) Turns on the brake lights when applying the air brakes  
      1) Drivers behind apparatus must be warned when driver/operator applies the brakes  
   b) Air brake system does this with an electric switch that works by air pressure

SLIDE: 2-11-22

17. Front brake limiting valve  
   a) Some apparatus made before 1975 have a front brake limiting valve and a control in the cab  
   b) Control is usually marked "normal" and "slippery"  
      1) Normal position  
         • Normal brake operation is unaltered  
      2) Slippery position  
         • The limiting valve cuts the normal air pressure to the front brakes by half  
      3) Limiting valves are used to reduce the chance of the front wheels skidding on slippery surfaces  
      4) They also reduce the stopping power of the apparatus

SLIDE: 2-11-23

18. Spring brakes  
   a) Usually used to meet the emergency and parking brake requirements for all apparatus using air pressure to apply the service brakes

Do spring brakes serve more than one purpose?
b) When driving, powerful springs are held back by air pressure

1) If the air pressure is removed, the springs put on the brakes
   • Actuated by a parking brake control in the cab

2) A significant leak in the air brake system could cause the springs to put on the brakes

At what pressure do the spring brakes apply?

3) Spring brakes will come fully on when air pressure drops to a range of 20-45 psi

4) The braking power of spring brakes depends on the brakes being properly adjustment

c) Parking brake must be held on by mechanical force

1) Because the air pressure can eventually leak away

2) Always use a chock block with parking brake to secure apparatus

19. Dual air brake systems

a) Most new heavy-duty apparatus use dual air brake systems for safety

b) A dual air brake system has two separate air brake systems that use a single set of brake controls

1) Each system has its own air tanks, hoselines, etc.

c) The first system is the primary system

1) Typically operates the regular brakes on the rear axle(s)
d) Other system is the secondary system
   1) Operates the regular brakes on the front axle and possibly one rear axle

20. Antilocking brake systems (ABS)
   a) Most newer apparatus, regardless of the brake system, are equipped with antilock braking systems
   b) Antilock brake systems reduce the possibility of the apparatus being thrown into a skid when the brakes are fully applied

   1) A skidding wheel has less traction than a nonskidding wheel
   c) Components
      1) Speed sensors
         • Senses when the wheel is about to lock up
         • Located at each wheel or, in some cases, in the differential (one controlling valve for more than one wheel)
      2) Valves
         • In the brake line of each brake controlled by the ABS
         • On some systems, the valve has three positions
         • 1. Open – pressure passes through the brake
         • 2. Blocks – prevents pressure from rising further in that brake
         • 3. Release – releases pressure from the brake
### 3) Pump
- Restores pressure to the brakes once released by the valves

### 4) Controller
- A computer in the car that watches the speed sensors and controls the valves

### III. HYDRAULIC BRAKE SYSTEMS

#### A. Smaller late-model apparatus and some older large apparatus are equipped with hydraulic braking systems

#### B. Master cylinder
1. Acts as the holding tank for brake fluid
2. When the brake pedal is depressed, the master cylinder forces fluid to each of the wheels
3. Can be power assisted
   a) Using vacuum from the engine
   b) Multiplies the force applied by the brake pedal to the master cylinder
   c) Contains a one-way check valve to allow limited power-assisted stopping in the event of a vacuum leak or loss of engine power

#### C. Combination valves
1. Ensures that the front and rear brake systems are working together
2. Regulates the pressure of each wheel
   a) Ensures that pressure is applied to the front and rear brakes at the same time

3. Consists of a
   a) Metering valve
   b) Proportioning valve
   c) Brake warning light

D. Brake pedal
E. Brake lines
F. Wheel cylinders

1. Contains fluid-activated pistons that push the brake shoes/pads against the drums/discs
2. Contains an air bleeding screw used to remove air from the system

G. Emergency brakes
   1. Manually operated
      a) By a cable
   2. Not dependent on the hydraulic system

H. Brakes
   1. The operational principles of drum brakes/shoes, and the disc brakes/pads are the same as with air brakes

How do hydraulic brakes activate?

SLIDE: 2-11-33
SLIDE: 2-11-34
SLIDE: 2-11-35
SLIDE: 2-11-36
SLIDE: 2-11-37
SLIDE: 2-11-38
SLIDE: 2-11-39
IV. SECONDARY BRAKE SYSTEMS

A. Saves wear on the primary brakes

B. Retarders are an integral part of some modern fire apparatus
   1. Reduces apparatus speed
      a) Increases control faster when slowing
      b) Extends service brake life

C. Retarders employ many existing apparatus components
   1. Optimized control through the use of rotating engine and drive train forces
      a) Affect drive axle(s) only
      b) Provides continuously renewed tire contact area (maximum traction)

D. Retarders are operated by the apparatus driver
   1. Most retarders allow variable application
   2. Under no circumstances should retarding devices be used during pump operations

E. Several types of retarders are in use today
   1. Engine retarders
      a) Compression brake

      1) Uses the engine to provide braking power
      2) Turns the engine into an energy absorbing air compressor
      3) Modifies the timing on the exhaust valves
4) When braking is desired, the exhaust valves open right as the piston reaches the top of the compression stroke.

5) The energy gathered in the compressed air is released.
   • Compression stroke actually provides braking power.

b) Exhaust brake
   1) Uses exhaust from engine
      • To provide braking power
   2) Works opposite of compression brake
      • Holds compression in engine instead of releasing it
      • Accomplished by butterfly valve in exhaust system
      • Most favorable location to mount exhaust brake - to outlet side of turbo charger.

2. Automatic transmission retarder
   a) Works in conjunction with gear selection
      1) To slow vehicle
   b) Empty chamber usually mounted
      1) On rear of transmission
      2) Stationary vanes
         • AKA stators
         • Built into walls of chamber
      3) Vanes or paddles
         • On rotating driveline
   c) Transmission pump forces liquid into the chamber
      1) Rotating paddles on driveline
         • Forces fluid against stator vanes
2) Chamber automatically empties
   • When not in use
d) Types
   1) Input shaft
   2) Output shaft
      • 50% more efficient than input shaft
3. Driveline
   a) Magnetic field that uses battery voltage to create the braking effect

V. INSPECTION AND BASIC MAINTENANCE

A. Air brakes
   1. Air brake tests – DMV

NOTE: Review DMV brake tests if necessary.

2. Air compressor and governor
   a) On apparatus equipped with air brakes, the air pressure should build to a sufficient level to allow apparatus operations within 60 seconds of starting
   b) Need to be operationally tested daily
      1) DMV brake tests
      2) Department SOPs
      3) In accordance with the manufacturer's recommendations and specifications

3. Air storage and drain tanks
   a) Proper mounting
   b) Loose
   c) Clean
   d) Check daily
4. Air dryer
   a) Securely mounted
   b) Connections intact

5. Alcohol evaporator
   a) Securely mounted
   b) Connections intact

6. Safety valve
   a) If the safety valve releases air, something is wrong with the brake system

7. Slack adjusters
   a) Look for
      1) Broken, loose, or missing parts
      2) Proper angle between push rod and adjuster arm
         • A little over 90 degrees when brakes released and,
         • Not less than 90 degrees when applied

8. Brake pedal
   a) Pedal should be firm when applied
   b) Pedal should not continue to travel to the floor when pressure is applied
   c) Securely mounted
   d) Operating properly

9. Brake drums and shoes
   a) Excessive or uneven wear
   b) Missing components
   c) Cracks
<table>
<thead>
<tr>
<th><strong>PRESENTATION</strong></th>
<th><strong>APPLICATION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>d) Out of shape</td>
<td></td>
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<tr>
<td>e) Operational failure</td>
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<tr>
<td>f) Falls below required standards</td>
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<tr>
<td>10. Brake discs and pads</td>
<td></td>
</tr>
<tr>
<td>a) Same as drums and shoes</td>
<td>SLIDE: 2-11-51</td>
</tr>
<tr>
<td>11. One-way check valve</td>
<td></td>
</tr>
<tr>
<td>a) Check for leaks</td>
<td></td>
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<tr>
<td>b) Securely mounted</td>
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<tr>
<td>12. Air supply pressure gauge</td>
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<tr>
<td>a) Must be above 90 psi to operate the brakes safely</td>
<td>What is the minimum pressure required to operate safely?</td>
</tr>
<tr>
<td>13. Application pressure gauge</td>
<td></td>
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<tr>
<td>a) Proper operation</td>
<td>SLIDE: 2-11-52</td>
</tr>
<tr>
<td>14. Low air pressure warning</td>
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<tr>
<td>a) A warning device that you can see must come on when the air supply pressure drops below 60 psi, or</td>
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<tr>
<td>b) One half the compressor governor cut-out pressure on older apparatus</td>
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<tr>
<td>15. Stop light switch</td>
<td></td>
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<tr>
<td>a) Ensure that it operates the brake warning lights</td>
<td>SLIDE: 2-11-53</td>
</tr>
<tr>
<td>16. Front brake limiting valve</td>
<td></td>
</tr>
<tr>
<td>a) Leaks</td>
<td></td>
</tr>
<tr>
<td>b) Mounting</td>
<td></td>
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</tbody>
</table>
17. Spring brakes  
   a) Missing components  
   b) Leaks  
      1) Leaks in the air brake system will generally cause the springs to apply the brakes

Are inspections for dual systems the same as for single systems?  
**SLIDE: 2-11-54**

18. Dual air brake systems  
   a) All inspections same as single

**SLIDE: 2-11-55**

19. Maintenance of the air brake system should be completed by a qualified technician  
   a) This is due to the complexity of the system and safety issues

**SLIDE: 2-11-56**

B. Hydraulic brakes  

1. Hydraulic brake test  
   a) Pump brake pedal three times and hold for five seconds  
   b) Pedal should not move  
   c) If it does, there is a leak

**SLIDE: 2-11-57**

2. Master cylinder  
   a) Check fluid level  
      1) Fill with proper fluid in accordance with the manufacturer's recommendations and specifications  
   b) Cover should not be leaking fluid  
   c) Inspect for leaks  
      1) Wear may cause cylinder to leak  
      2) May result in brake failure
d) Loss of the vacuum power assist will cause a reduction of efficiency

What can cause a reduction of efficiency?

1) Caused by
   • Vacuum leak
   • Loss of engine power

3. Brake pedal
   a) Pedal should be firm when applied
   b) Pedal should not continue to travel to the floor when pressure is applied
   c) Securely mounted
   d) Operating properly

4. Brake drums and shoes
   a) Excessive or uneven wear
   b) Missing components
   c) Cracks
   d) Out of shape
   e) Operational failure
   f) Falls below required standards

5. Brake discs and pads
   a) Same as drums and shoes

6. Brake lines
   a) Physical damage
   b) Leaking fluid

7. Wheel cylinders
   a) Leaking fluid
   1) Leaks or malfunctions can cause brake to partially or completely fail
b) A sticking wheel cylinder can cause brake to drag

8. Brake linings
   a) Same principles as linings for air brake systems

9. Maintenance of the hydraulic brakes should be completed by a qualified technician
   a) This is due to the complexity of the system and safety issues

C. Secondary brakes
   1. Inspections of the various secondary braking systems should include
      a) Proper mounting
      b) Loose or missing components
      c) Physical damage
      d) Leaks (if applicable)

   2. Most failures of secondary brake systems are discovered during operational tests

   3. Maintenance of the secondary braking system should be completed by a qualified technician
      a) This is due to the complexity of the system and safety issues

VI. OUT-OF-SERVICE CRITERIA
1. Air brakes
   a) Service brakes that have an air pressure drop of more than 2 psi (13.8 kPa) in 1 minute for straight chassis or more than 3 psi (20.7 kPa) in 1 minute for combination chassis, with the engine stopped and the service brakes released

   b) Leak-down rate (time) of the applied side of the air brake that is more than 3 psi (20.7 kPa) in 1 minute for straight chassis or more than 4 psi (27.6 kPa) in 1 minute for combination chassis, with the engine stopped and the service brakes applied

   c) Brakes that are out of adjustment

   d) Braking system components that are not operational

   e) Service brake that does not meet test or DOT requirements

   f) Parking (spring) brake operation that does not meet parking brake tests or standards

   g) Air compressor that fails to build air pressure from 85 psi to 100 psi (586 kPa to 690 kPa) in 45 seconds, with engine at full RPM

   h) Air compressor that fails to maintain 80 psi to 90 psi (552 kPa to 621 kPa) pressure in the system, with the service brakes applied and the engine at idle, or air compressor that fails to fill the air system to the air compressor governor cutout pressure with the service and parking brakes released

   i) Friction surfaces, brake shoes, or disc brake pads that have grease or oil on them

What are the out-of-service criteria for air loss in the applied brake test?
j) Brake linings or pads that are worn beyond the brake system manufacturer’s minimum specifications

k) Rotors and drums that are worn beyond the brake system manufacturer’s minimum specifications

l) Air gauge or audio low-air warning device that has failed

m) If the antilock braking system (ABS) warning indicator indicates a problem, a qualified technician shall conduct an out-of-service evaluation and make a written report, including recommendations to the AHJ

n) Service brakes that have a drop of more than 2 psi in one minute, with the engine stopped and the service brake released

2. Hydraulic brakes

   a) Brake system components that have Class 2 leakage of brake fluid

   b) Friction surfaces, brake shoes, or disc brake pads that have grease or oil on them

   c) Braking system components that are not operational

   d) Braking operation that does not meet braking tests or standards

   e) Parking (service) brake operation that does not meet parking brake tests or standards

   f) Brake warning light that is activated or brake pedal that falls away or drifts toward the floor when brake pressure is applied

   g) Brake linings or pads that are worn beyond the brake system manufacturer’s minimum specifications
h) Rotors and drums that are worn beyond the brake system manufacturer’s minimum specifications

i) If the ABS warning indicator indicates a problem, a qualified technician shall conduct an out-of-service evaluation and make a written report including recommendations to the AHJ

3. Air-over-hydraulic brake systems
   a) Same as hydraulic and air brakes

4. Wheel chocks
   a) If the apparatus is not equipped with two wheel chocks, mounted in readily accessible locations, the condition shall be reported to the AHJ

B. CCDH criteria
   1. Air brakes
      a) Only indicates driving test failure and not out-of-service criteria

   2. Hydraulic brakes
      a) Place out-of-service if it fails DMV hydraulic brake test

   3. Secondary brakes
      a) None stated

Does the CCDH have out-of-service criteria for air brakes?

SLIDE: 2-11-70
SUMMARY:
Making sure that apparatus brakes are in proper operating order is an extremely important part of the apparatus inspection process. Modern air, hydraulic, and secondary braking systems are complicated and each component has a specific, important function. You must know each type of braking system so that the apparatus may be tested, maintained, and driven in the appropriate manner.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-12: Troubleshooting Brake Systems

TIME FRAME: 1:00

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of troubleshooting the air brake system by completing the written test

Standard: With a minimum 80% accuracy according to the information contained in Fire Apparatus Driver Operator 1A Student Supplement, SFT, 2008 Edition, Pages 53-56

MATERIALS NEEDED:

- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:

- Chilton technical manuals
- http://www.bendix.com/troubleshooting/

PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. INTRODUCTION
   A. All repairs to brake components should be conducted by a qualified technician
   B. Troubleshooting a problem with the air supply/service systems can be difficult at times
      1. More than one component can be the cause
      2. One component can effect more than one operation
      3. Problems can occur internally
         a) The source of the problem may not be readily apparent
         b) The only indication may be a malfunction

II. SUPPLY SIDE PROBLEMS
   A. Symptoms can appear during the pretrip brake test or normal driving conditions
   B. Air compressor with governor

      1. Symptom: Excessive governor cut-in/cut-out
         a) Air compressor cycles too often or not often enough to keep up with the system
         b) Possible cause
            1) Defective compressor and/or governor
         c) Possible corrective action
            1) Contact your department's fleet manager for a plan of action

         d) Possible cause
            1) Excessive system leakage
         e) Possible corrective action
            1) Have the leak repaired
2) Contact your department's fleet manager for a plan of action

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Possible corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>f) Reservoir volume reduced</td>
<td>1) Drain water from system</td>
</tr>
<tr>
<td>• System is partially filled with water, oil, or both</td>
<td></td>
</tr>
</tbody>
</table>

What may reduce the volume in the air reservoir?

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Possible corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>h) Brakes out of adjustment</td>
<td>i) Contact your department's fleet manager for a plan of action</td>
</tr>
</tbody>
</table>

2. Symptom: Passing excessive oil while draining tanks

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Possible corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Poorly filtered air</td>
<td>1) Check for defective intake components</td>
</tr>
<tr>
<td>b) No air dryers in system</td>
<td>1) Drain reservoirs daily</td>
</tr>
</tbody>
</table>

SLIDE: 2-12-6

SLIDE: 2-12-7

SLIDE: 2-12-8

SLIDE: 2-12-9
3. Symptom: Slow air buildup
   a) Possible cause
      1) Poorly filtered air
      2) Excessive governor cut-in/cut-out
      3) Restricted air discharge
      4) Loose pulley
   b) Possible corrective action
      1) Contact your department's fleet manager for a plan of action

   c) Possible cause
      1) Air dryer purge valve stuck open
   d) Possible corrective action
      1) Have air dryer purge valve repaired
      2) Contact your department's fleet manager for a plan of action

   e) Possible cause
      1) Braided discharge line heat fatigued
   f) Possible corrective action
      1) Check using a soap solution
      2) Contact your department's fleet manager for a plan of action

III. SERVICE SIDE PROBLEMS
    A. Symptoms can appear during the pretrip brake test or normal driving conditions
    B. General brake symptoms

   1. Symptom: Sensitive brakes
      a) Possible cause
         1) Brakes improperly adjusted
2) Defective/improperly installed component
3) Chamber/slack alignment binding momentarily
4) Foot valve/pedal sticking
5) Lubrication
   • Too much damages the rubber spring and/or boot
   • Too little causes the plunger to stick
6) Installation
   • Body or mounting plate distortion due to uneven floor board or firewall mounting surface

   b) Possible corrective action
      1) Contact your department's fleet manager for a plan of action

2. Symptom: Brakes will not apply completely
   a) Possible cause
      1) Brakes improperly adjusted
      2) Automatic slack adjuster malfunction
         • Under adjusting
      3) Air line or component freeze-up
      4) Faulty brake components
      5) Foot valve/pedal sticking or movement restricted by floor board obstruction
         • Tools
         • Cans
         • Gravel
         • Debris
      6) Improper chamber/slack adjuster alignment
      7) No air pressure in one brake circuit
b) Possible corrective action
   1) Contact your department's fleet manager for a plan of action

3. Symptom: Brakes will not release completely
   a) Possible cause
      1) Parking brakes on; will not release
      2) Brakes improperly adjusted
      3) Condition of brake components
      4) Air lines pinched, improperly assembled into fittings, or misconnected
      5) System contamination
      6) Chamber/slack adjuster binding
      7) Automatic slack adjuster malfunction
         • Over-adjusting
   b) Possible corrective action
      1) Contact your department's fleet manager for a plan of action

C. Manual slack adjusters

   1. Symptom: Adjustment backs off
      a) Possible cause
         1) Component malfunction
      b) Possible corrective action
         1) Contact your department's fleet manager for a plan of action

D. Automatic slack adjusters

   1. Automatic slack adjusters should only be looked at by a qualified technician
E. Air system leaks

1. Symptom: Air leak greater than 2 psi in one minute
   a) Possible cause
      1) Air leak in system when brakes are not applied
   b) Possible corrective action
      1) Mix up a bottle of soapy water using dish soap and water
         • Tip: Warm water works better than cold
      2) Chock the apparatus to prevent movement
      3) Turn off the engine
         • So you can hear possible air leaks
      4) Starting at the compressor
         • Spray every fitting from the compressor to the foot control valve
         • Leaks will show up as bubbles at the location of the leak
      5) Once you have located the leak, contact your department's fleet manager for plan of action

2. Symptom: Air leak greater than 3 psi in one minute
   a) Possible cause
      1) Air leak in system when brakes are applied
   b) Possible corrective action
      1) Same as with 2 psi air leak
      2) Have someone assist you
         • Hold pressure on the foot valve while you check for leaks
IV. HYDRAULIC BRAKE SYSTEMS

A. Troubleshooting

1. The majority of problems occur with hydraulic brake systems are caused by
   a) Defects or improper adjustments that allow hydraulic fluid to leak from the system
   b) Defects or improper adjustments that allow air to enter the system
      1) Air can also be introduced during repair and replacement of brake components

   SLIDE: 2-12-23

B. Symptom: Brake pedal feels soft and spongy

1. Possible cause
   a) Low amount of fluid in the system

2. Possible corrective action
   a) Add fluid to the reservoir

3. Possible cause
   a) Air in the system

4. Possible corrective action
   a) Have the air removed from the system by a qualified technician

   SLIDE: 2-12-24

C. Symptom: Pedal drifts toward or falls to the floorboard

1. Possible cause
   a) Low amount of fluid in the system

2. Possible corrective action
   a) Add fluid to the reservoir

   SLIDE: 2-12-25
3. Possible cause
   a) Fluid leak in the system

4. Possible corrective action
   a) Have a qualified technician repair or replace the source of the leak and restore the system to a proper working condition

SLIDE: 2-12-26

D. Symptom: Lack of response of a powered or vacuum assisted brake augmentation system

1. Possible cause
   a) Failure of the augmentation system or its ability to transfer energy to the brake system

2. Possible corrective action
   a) Have a qualified technician restore the powered assist system

SLIDE: 2-12-27

V. SECONDARY BRAKING SYSTEMS

A. Symptom: Secondary brake system fails to activate as designed

1. Possible cause
   a) System is manually turned off

2. Possible corrective action
   a) Ensure that the system is activated and is at the proper setting

SLIDE: 2-12-28

3. Possible cause
   a) System is activated but has failed

4. Possible corrective action
   a) Take out-of-service
   b) Have it repaired by a qualified technician

SLIDE: 2-12-29
SUMMARY:
You have been given some basic information on how to troubleshoot possible problems with the air brake system since it is important for you to know how to identify a potential problem. However, it is imperative that a qualified technician should conduct all repairs. Before any action is taken, contact your department's fleet manager to determine a plan of action.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
Review your notes and read Fire Apparatus Driver Operator 1A Student Supplement, SFT, 2008 Edition, Pages 53-56 in order to prepare yourself for the upcoming test. Study for our next session.
2-13: Inspection And Basic Maintenance Of Auxiliary And Accessory Equipment

TIME FRAME: 0:15
LEVEL of INSTRUCTION: Level II
AUTHORITY: 2009 NFPA 1002: Section 4.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of inspection and basic maintenance of auxiliary and accessory equipment by completing the written test


MATERIALS NEEDED:
- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:

PREPARATION:
Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
## I. OVERVIEW

A. Fire apparatus are designed to perform work

B. All equipment assigned to or attached to a vehicle are to be considered part of the apparatus

1. Driver/operator responsibilities extend to auxiliary and accessory equipment

## II. AUXILIARY EQUIPMENT

A. Permanently attached equipment, engines, etc that are not essential to the driving of commercial apparatus

B. May include, but not be limited to

1. Generators
2. Pumps
3. Power units

4. Hydraulic or pneumatic equipment

C. Auxiliary equipment inspections should be conducted with the same thoroughness as all other vehicle inspections
1. In accordance with the manufacturer's specifications and recommendations

2. Inspection should include
   a) Security of mounting
   b) All necessary fluids
   c) Proper components
   d) Cleanliness

3. Can be incorporated into apparatus inspections

4. Basic maintenance of all auxiliary equipment should be conducted in accordance with the manufacturer's specifications and recommendations

III. ACCESSORY EQUIPMENT

A. Equipment assigned to and/or carried on apparatus

B. Not permanently attached

C. May include, but not be limited to
   1. Portable power equipment
   2. Forcible entry tools
   3. Apparatus portable equipment
      a) Jacks
      b) Spare tire(s)

D. Accessory equipment inspections should be conducted with the same thoroughness as all other vehicle inspections
1. In accordance with the manufacturer’s specifications and recommendations

2. Inspection should include
   a) Security of mounting
   b) All necessary fluids
   c) Proper components
   d) Operational tests
   e) Cleanliness

3. Can be incorporated into apparatus inspections

4. Basic maintenance of all accessory equipment should be conducted in accordance with the manufacturer’s specifications and recommendations
SUMMARY:
A properly designed apparatus inspection and basic maintenance program includes all associated equipment. Inspection and maintenance procedures should be based on the manufacturer’s specifications and recommendations, all applicable laws, recommendations, and SOPs. The emergency scene is not the place to discover deficiencies.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-14: Inspection Documentation And Reports

TIME FRAME: 0:15

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2003 NFPA 1002: Sections 4.2.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of the inspection documentation and reports by completing the written test


MATERIALS NEEDED:
- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:
- dictionary.com

PREPARATION:
Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. DEFINITIONS

A. Document (dictionary.com)
   1. A written or printed paper furnishing information or evidence, as a passport, deed, bill of sale, or bill of lading; a legal or official paper

B. Report (dictionary.com)
   1. An account or statement describing in detail an event, situation, or the like, usually as the result of observation, inquiry, etc.

II. OVERVIEW

A. Apparatus inspection and maintenance records serve many functions

   1. Warranty claims
      a) These records may be needed to document that the necessary maintenance was performed
   2. Events of an accident/crash
      a) Maintenance records are likely to be scrutinized by the accident investigators
   3. Proper documentation of recurrent repairs
      a) Assists in deciding whether to purchase new apparatus in lieu of continued repairs on an older unit

Why is it important to keep apparatus inspections and maintenance records?
B. Abide by the department's SOP on how maintenance and inspection results are documented and submitted to the proper person

1. All driver/operators must be trained to use their department's recordkeeping system

2. Written forms or computer programs may be used to record the information

C. Fire departments should maintain an effective filing system that allows the information from these reports to be reviewed, stored, and retrieved when required

III. TYPES OF DOCUMENTATION

A. Apparatus documents

1. Movement records/logs

2. Inspections
   a) Pretrip
   b) Periodic
      1) Daily, weekly, monthly, quarterly, semiannual, annual
   c) Posttrip

1) Ensuring the apparatus and equipment is ready for the next response

3. Maintenance and repairs performed

4. Inventories

5. Equipment records
   a) Inspections
   b) Inventories

6. Test records

7. Accident records

What is the reason for a posttrip inspection?
B. Manufacturer’s operation manuals
   1. References for inspection practices
   2. Often manufacturer or equipment specific
C. Training manuals
   1. Procedures and practices for the driver/operator
D. Department maintenance SOPs
   1. Should address
      a) Who should perform certain maintenance functions
      b) When maintenance and inspection should be performed
      c) How detected problems should be corrected or reported
      d) What items driver/operators are responsible for checking and which conditions they are allowed to correct on their own
      e) How the process should be documented and submitted to the proper person
E. Government or private industry publications
   1. Laws and ordinances
   2. Standards and common practices
SUMMARY:
Documentation of fire apparatus and equipment maintenance is a key component for the driver/operator. It is mandatory that all equipment be fully operational for every response. If records are not accurately maintained, then equipment and job performances will suffer. Moreover, as far as the law is concerned, if it is not written down then it did not happen.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 2-15: Pretrip Inspection Procedures

TIME FRAME: 2:00

LEVEL of INSTRUCTION: Level II

AUTHORITY: 49 CFR Part 390 and the State Fire Marshal

BEHAVIORAL OBJECTIVE:

Condition: Given an activity

Behavior: The student will confirm a knowledge of pretrip inspection procedures by completing the activity


MATERIALS NEEDED:

- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials
- Activity 2-15-1: Daily Apparatus And Equipment Check

REFERENCES:


PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
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Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
### I. VISUAL WALK AROUND

A. Cleanliness of apparatus
B. Apparatus leaning to one side

C. Body damage
D. Puddles or leaks under apparatus

### II. BRAKE/TIRES/UNDERCARRIAGE

A. Brakes
   1. Linings and pads
   2. Drums and rotors
   3. Brake chambers
   4. Air lines/hoses/fittings
   5. Slack adjusters

B. Tires
   1. Air pressure
   2. Tread condition
   3. Rims
   4. Lugnuts
   5. Axle seals

C. Undercarriage
   1. Frame
      a) Missing, broken, or loose components

Review: What are the possible conditions that could cause the apparatus to lean to one side?

Review: What are indicators of a leaking axle seal?
PRESENTATION

2. Exhaust system
   a) Missing, broken, or loose components

3. Drive shaft
   a) Missing, broken, or loose components

4. Mud flaps

5. Fuel system
   a) Tank and straps
   b) Hoses and lines
   c) Leaks

6. Springs

7. Shocks

8. Air ride system
   a) Missing, broken, or loose components

9. Steering
   a) Steering box
   b) Steering pump
   c) Hoses and lines
   d) Linkage

III. BRAKES

A. The following tests need to be completed with apparatus on level ground with the wheels chocked

1. Test air leakage rate
   a) With a fully charged air system (typically 125 psi), turn off the engine, release the service brake and let the system settle (air gauge needle stops moving)
      1) Time the air pressure drop

Review: How would you find out what type of fluid is used in the power steering reservoir?
According to the CCDH, when testing the air leakage rate the air loss rate should be no greater than what?

2) The loss rate should not be greater than
   - 2 psi or less in one minute for single vehicles
   - 3 psi or less in one minute for a combination of two vehicles

b) With roughly a fully charged air system (typically 125 psi), turn off the engine, release all brakes and allow the system to settle (air gauge needle stops moving)
   1) Then apply full steady pressure to the brake pedal (brake on) and hold
   2) After the system settles again, the air loss should not be more than
      - 3 psi or less in one minute for single vehicles
      - 4 psi or less in one minute for a combination of two vehicles

B. Check air compressor governor cut-out pressure
   1. Run the engine at a fast idle
   2. Pumping should start at about 100 psi and stop at about 125-130 psi minimum
   3. The air pressure shown by the gauge(s) will stop rising

According to the CCDH, the governor should start and stop at what pressures?

4. For testing purposes, identify when the compressor cuts out
C. Check air compressor governor cut-in pressure
   1. Start with the air pressure above the governor cut-in level (no lower than 85 psi)
   2. With the engine idling, slowly pump the brake pedal to reduce the air tank pressure
   3. Watch the air gauge between pumps to identify when the compressor cuts in (needle starts to rise)

D. Test low pressure warning signal
   1. May be performed with engine on or off
   2. To perform the test with the engine off, turn the electrical power on so there is enough air pressure to keep the low air pressure warning signal from coming on
   3. Slowly pump the brake pedal to reduce air tank pressure

   According to the CCDH, when should the low air pressure warning signal sound?

   4. The low air pressure warning signal will must come on before the pressure drops to less than 60 psi in the air tank (or tank with the lowest air pressure, in dual air systems)

E. Check rate of air pressure buildup
   1. With the engine at operating rpms, the pressure should build from 85 to 100 psi within 45 seconds in dual air systems
   2. If the vehicle has larger than minimum air tanks, the buildup time can be longer and still be safe
      a) Check the manufacturer's specifications and recommendations

F. Test service brakes
   1. Remove chock blocks
   2. Wait for normal air pressure, release the parking brake, move the vehicle forward slowly (about 5 mph), apply the brakes firmly using the brake pedal
3. Any pulling to one side, unusual feel, or delayed stopping action should be checked

G. Test parking brake
1. Fasten seat belt
2. Set the parking brake and try to move the vehicle or allow the vehicle to move forward slowly and apply the brake
3. The parking brake should not allow any movement

IV. ENGINE COMPARTMENT
A. Visible signs of a problem
   1. Leaks
   2. Damage
   3. Missing
B. Check fluid levels
   1. Engine oil level
   2. Coolant level
   3. Power steering fluid level
   4. Transmission fluid level
   5. Windshield washer fluid
C. Drive belts
   1. Condition
      a) Cracks
      b) Frays
      c) Excessive wear
   2. Missing
   3. Adjustment

What is the maximum amount of movement in a belt as per the CCDH?

a) Up to ¾-inch play at center
D. Hoses and lines
   1. Radiator
   2. Air
   3. Fuel
   4. Oil

E. Air filter
   1. Air filter restriction gauge

F. Battery
   1. Electrolyte level
   2. Clean
   3. Terminals tight

G. Other/miscellaneous

V. CAB AREA - PRESTART
A. Battery switch
B. Key/ignition switch
C. Seats
D. Seatbelts
E. Windshield wipers and blades
F. Mirrors
G. Glass
H. Gauges
I. Load manager
J. Floor area clean
K. Maps and books
L. Fuel tank level
M. Dome and map lights

VI. CAB AREA - POSTSTART
A. Gauges
B. Heater and defroster
C. Horn
D. Emergency lights and sirens
E. Emergency radios
F. Computer (mobile data terminal)
G. Headlights
H. Flashers and turn signals

VII. FIRE EQUIPMENT AND ACCESSORIES

A. This course does not cover how to check fire equipment that is carried on an apparatus

1. This is determined by each piece of equipment's manufacturer's specifications and recommendations or departments SOPs

ACTIVITY 2-15-1:
Complete the activity in the student supplement.
**SUMMARY:**

By law, standardized daily departmental pretrip inspections are necessary to ensure all fire apparatus are ready to respond. This standardized daily checkout procedure helps reinforce apparatus readiness and your knowledge. Apparatus logbooks must be kept up-to-date and accurate so you can take the appropriate actions if deficiencies are found.

**EVALUATION:**

The student will complete the activity at a time determined by the instructor.

**ASSIGNMENT:**

ACTIVITY 2-15-1

| Title: | Daily Apparatus And Equipment Check |
| TIME FRAME: | 1:00 |
| MATERIALS NEEDED: | • Fire apparatus  
• Daily apparatus and equipment checklist  
• Tire pressure gauge  
• Wiping rags  
• Creeper  
• Clipboard  
• Pen or pencil |

**introduction:**
This activity provides the students the opportunity to complete a required daily inspection that complies with all applicable laws and standards.

**DIRECTIONS:**
1. Divide the class into manageable groups.
2. Have each group perform a complete inspection on the apparatus.
3. Document the inspection on the check sheet.
4. Each team has 30 minutes to complete this activity.
5. Be prepared to discuss the inspection results with the class.

**Instructor note:**
The instructor must demonstrate a complete inspection in detail before the students perform this activity.

The attached forms are sample checklists that may be used. You can substitute your department's checklist or the students may use their department's checklist.
### DAILY APPARATUS AND EQUIPMENT CHECK

<table>
<thead>
<tr>
<th>Group:</th>
<th>Apparatus:</th>
<th>Date:</th>
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#### VISUAL CHECK

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<tr>
<td>Leaning to One Side</td>
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<td>Body Damage</td>
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<tr>
<td>Puddles or Leaks</td>
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#### BRAKES, TIRES, AND UNDERCARRIAGE

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<td>Brake Drums and Rotors</td>
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<td>Brake Chambers</td>
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<td>Air Lines, Hose, Fittings</td>
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<td>Slack Adjusters</td>
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<td>Rims</td>
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<td>Lug Nuts</td>
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<td>Exhaust System</td>
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<td>Mud Flaps</td>
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<td>Fuel Tanks</td>
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<td>Steering Linkage</td>
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#### BRAKE CHECK

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<td>Air Leakage Rate Test</td>
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<tr>
<td>Air Compressor Governor</td>
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<td>Cut-Out Pressure</td>
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<td>Cut-In Pressure</td>
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<td>Parking Brake Test</td>
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<td>Low Air Pressure Warning</td>
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<td>Air Pressure Buildup Rate</td>
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<td>Service Brake Test</td>
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#### ENGINE COMPARTMENT

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<td>Missing Components</td>
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<td>Engine Oil Level</td>
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<td>Coolant Level</td>
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<td>Power Steering Level</td>
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<td>Transmission Fluid Level</td>
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<td>Windshield Washer Level</td>
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<td>Drive Belts</td>
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<td>Radiator Hoses</td>
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<tr>
<td>Battery Terminals</td>
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#### CAB AREA – PRESTART

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<td>Battery Switch</td>
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<tr>
<td>Windshield Wipers/Blades</td>
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<tr>
<td>Mirrors</td>
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<tr>
<td>Glass</td>
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<tr>
<td>Gauges</td>
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<tr>
<td>Load Manager</td>
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<tr>
<td>Floor Area Clean</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Maps and Books</td>
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<tr>
<td>Fuel Tank Level</td>
<td></td>
<td></td>
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<tr>
<td>Dome and Map Lights</td>
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</table>

#### CAB AREA - POSTSTART

<table>
<thead>
<tr>
<th>Item</th>
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<th>REPAIRS MADE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Gauges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heater and Defroster</td>
<td></td>
<td></td>
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<tr>
<td>Horn</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Emergency Lights, Sirens</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Radio, Portable Radio</td>
<td></td>
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<td></td>
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<tr>
<td>Computer/MDT</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Headlights</td>
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<td></td>
<td></td>
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<tr>
<td>Parking Lights</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Backup Lights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backup Alarm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flashers/Turn Signals</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPARATUS OPERATORS DAILY CHECKLIST

Check off each item as completed and indicate any fluids that are added. Log and record all fluids added and all maintenance problems in apparatus logbook with date, mileage, and your initials. Follow proper channels for needed repairs. Send all completed forms to the shop on the last day of every month. Also, complete a form after all significant class and daily when on a strike team.

I FLUID LEVELS  QUANTITY ADDED

- Radiator
- Engine Oil
- Transmission Fluid
- Hot and running in neutral
- Water Tank
- Assigned Equipment
- Generators, Blowers, etc.
- Priming Oil
- Power Steering Fluid

II ELECTRICAL SYSTEMS

- Warning Lights
- Head and Parking Lights
- Turn Signals and Brake Lights
- Portable Radio Chargers
- Siren and Public Addresses
- Horns and Warning Buzzers (air and electric)
- Gauges (cab and panel)
- Cab and Compartment Lights

III AIR SYSTEMS

- Air Pressure
- Parking Brakes (set and release)
- Air Leaks in Brake System
- Full pressure, engine off, foot brakes applied
- Air Line and Hose

IV EQUIPMENT

- Knox Box Key
- Portable Radios

V BODY AND RUNNING GEAR

- Any New Body Damage Not Logged
- Tires (nails, glass, air, etc.)
- Belts and Hoses (condition and tension)
- Undercarriage (location of leaks and fluid color)
- Valve Operation (open and close) lube as necessary
- After Steam Cleaning, Lube All Effected Moving Parts

VI REMARKS

- Battery Readings
- Brake Piston Travel
- Amount of Water Discharge from Air Tanks
- Operation of Relief and Change Over Valves
- Oil Needed, Lubrication, etc.
- Engine Miles
- Road Miles
- Tire Pressure
- Other

WEEKLY

Monday  Check batteries. Inspect cables. Dip fuel tanks and check for water.
Tuesday  Check brake piston travel, tire pressure, lug nuts, and axle nuts.
Wednesday  Clean and inspect undercarriage. Clean engine compartment. Tighten all loose screws, nuts, and bolts.
Thursday  Check batteries. Clean compartments. Bleed air tanks.
Friday  Clean, flush, and operate relief and change over valves. Wax and touch up.
Saturday  Run and clean all mechanical equipment, electrical equipment, and ground ladders. Lube and discharge rods and valves.
Sunday  Make-up day. Bleed air tanks. Operate aerial ladders. Check ground jacks

MONTHLY

1st Monday  Remove and clean battery cables. Check hydraulic fluids.
1st Tuesday  Inventory first aid kit. Date and record findings. Check intake valves and all screens.
1st Wednesday  Pressure check all spare oxygen cylinders. Date sign tag.
1st Thursday  Clean communicator rings. Grease fifth wheel. Grease locks.
1st Friday  Inventory toolbox. Date and sign record.
1st Saturday  Check and clean any special equipment. Rotate all ground ladders.
1st Sunday  Inspect extinguisher. Date and sign both tags/records. Tighten driveline bolts.
# DAILY VEHICLE INSPECTION REPORT

## ENGINE COMPARTMENT

<table>
<thead>
<tr>
<th>OK</th>
<th>DEF</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>Fluid Leaks Under Vehicle*</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Oil Fluid Level</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Transmission Fluid Level</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Power Steering Fluid</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Coolant Level/Filter</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Battery Condition</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Exhaust System</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Belts and Hoses</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Other</td>
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</tbody>
</table>

## BRAKE SYSTEM TESTS

<table>
<thead>
<tr>
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<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>Low Air Warning Signal (Test 1)</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Air Compressor Governor (Test 2)</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Cut In &gt;85 psi</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Cut Out &gt; 110-120 psi</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Static Air Pressure Loss (Test 3)</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Single – Maximum Loss 2 psi/min.</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Applied Air Pressure Loss (Test 4)</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Maximum Loss 3 psi/min.</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Service Brake (Test 5)</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Parking Brake (Test 6)</td>
</tr>
</tbody>
</table>

**Tuesday**
- ☐ Battery Water Level
- ☐ Rotate Portable Radio Batteries
- ☐ Check/Discharge Mag-lites

**Saturday**
- ☐ Battery Water Level
- ☐ Bleeder Valves
- ☐ Decontaminate Equipment

## OUTSIDE APPARATUS

<table>
<thead>
<tr>
<th>OK</th>
<th>DEF</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>Tire Pressure Front _____ Rear _____</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Wheels, Rims, and Lug Nuts</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Steering Mechanism</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Springs and Shock Absorbers</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Tilt Cab Pump Reservoir</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Operator Panel Lights</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Primer Tank Oil</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Activate Priming Pump</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Fuel Tank Mounting and Filters</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Head Lamps High/Low</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Running Lights/Reflectors</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Turn Signals</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Brake Lights/Backup Lights</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Emergency Lighting</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Door/Compartment Latches</td>
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<tr>
<td>☐</td>
<td>☐</td>
<td>Covers</td>
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<td>☐</td>
<td>☐</td>
<td>Equipment Secure</td>
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<td>☐</td>
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<td>Body Damage*</td>
</tr>
<tr>
<td>☐</td>
<td>☐</td>
<td>Fifth Wheel Assembly</td>
</tr>
</tbody>
</table>

*Remarks

___________________________________________
___________________________________________
___________________________________________

**Overall Condition of Apparatus**
- ☐ Satisfactory
- ☐ Unsatisfactory

F-G 2s Made

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October 2008 2-15: Pretrip Inspection Procedures Page 13
**AIR SYSTEM TEST**

**TEST 1: Low Air Warning Signal and Emergency Brake Test**
1) With engine OFF, ignition ON
2) Chock wheels
3) Release all brakes
4) Pump brake pedal to activate low pressure warning signal at 60 psi**
5) Confirm parking brakes are still released
6) Continue pumping brake pedal until parking brake control knob pops out (approximately 30 psi)

**When performing Step 4, applying the brake pedal will be accompanied by the sound of air escaping from the spring brake relay valve. This is due to the operation of the spring brake control valve being operated by the treadle valve.**

**TEST 2: Air Compressor Governor Test**
1) With engine running, build pressure to 110-125 psi (should hear air dryer release air, indicating compressor has shut-off)
2) Pump brake pedal to reduce pressure to 85 psi (air compressor should build pressure to 100 psi within 45 seconds)
3) Build pressure to 110-125 psi

**TEST 3: Static Air Pressure Loss Test**
1) Chock wheels
2) Release all brakes
3) Shut-off engine with air pressure at 110-125 psi
4) Time air pressure reading for one minute (maximum drop 2 psi for single vehicle)

**TEST 4: Applied Air Pressure Test**
1) With engine off, chock wheels
2) Release parking brake
3) Apply steady pressure to brake pedal for one minute (after initial drop, maximum drop 3 psi)

**TEST 5: Service Brake Test**
1) Start apparatus
2) Place in gear and move apparatus
3) Apply brake pedal (apparatus should stop)

**TEST 6: Parking Brake Test**
1) Set parking brake
2) Place in gear
3) Try to move apparatus (should not move)
### Daily Apparatus Checkout Sheet

<table>
<thead>
<tr>
<th>S</th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>T</th>
<th>F</th>
<th>S</th>
<th>Comments</th>
</tr>
</thead>
</table>

**Engine Compartment**
- Fluid levels
  - radiator
  - engine oil
  - power steering
  - automatic transmission
  - priming oil
- Belts and hoses
  - radiator hoses
  - all belts

**Electrical Systems**
- Warning lights, four-way lights
- Headlights (low and high beam)
- Turn signal indicators
- Gauges (all)
- Brake lights
- Backup lights
- Code 3 lights (light bar, strobes)
- Pump panel
- Miscellaneous lights

**Air Systems**
- Brakes
  - air pressure (static and applied)
  - low pressure warning light
  - air governor (cut-out and cut-in)
  - air lines and hoses

**Pump Checkout**
- Valve operation (open and closed)
- Transfer valve (pressure and volume)
- Relief valve
- Water level gauge
- Water tank (leaks)

**Equipment**
- All assigned equipment

**Body**
- Tires (including rims)
- Exterior paint and gold leaf

### Weekly

- **Monday**: Start and run all equipment
- **Tuesday**: Check tires, lug nuts, and axle nuts
- **Wednesday**: Check all batteries
- **Thursday**: Bleed air tanks
- **Friday**: Flush, clean, and operate relief and change-over valves
- **Saturday**: Wash, clean, and inspect apparatus
- **Sunday**: Check and weight all extinguishers

### Monthly

- **1st Saturday**: Check undercarriage and transmission for grease
- **1st Sunday**: Check radio batteries
- **1st Monday**: Clean and inspect all ground ladders
- **1st Tuesday**: Perform any missed or needed maintenance
- **25th**: Complete apparatus reports
TOPIC: 3-1: Accident Statistics And Liability

TIME FRAME: 0:30

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section

BEHAVIORAL OBJECTIVE:

Condition: Given a written test
Behavior: The student will confirm a knowledge of accident statistics and liability by completing the written test

MATERIALS NEEDED:
- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:
- National Fire Data Center, FEMA/USFA

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.

I. STATISTICS

A. Fire fighter deaths and injuries from apparatus accidents

1. 16,202 apparatus accidents in 2006
2. 1,250 apparatus occupants of apparatus injured each year
   a) 15 killed
3. Rollovers were the leading cause

NOTE: Data from the National Fire Data Center, FEMA/USFA.

B. Civilian deaths

1. 21 civilians are killed each year from collisions with apparatus
2. 642 civilians are injured each year

NOTE: Statistics for civilian deaths and collisions are included in the University of Michigan Transportation Research Study of 1998.

C. Collisions

1. 20% of apparatus collisions result in rollovers
2. 47% of apparatus collisions occur at intersections
II. 2001 CVC - LIABILITY OF ACCIDENTS

A. Section 17001 - Liability of a public entity
   1. A public entity is liable for death and injury to person or property proximately caused by a negligent or wrongful act or omission in the operation of any motor vehicle by an employee of the public entity acting within the scope of his employment

B. Section 17302 - Damage from weight or size
   1. The driver, or the owner and driver, jointly, as the case may be, are also liable for all damages that any highway or bridge sustains as the result of any operation, driving, or moving of any vehicle that exceeds any of the limitations imposed by Division 15 (commencing with Section 35000), Chapter 1 (commencing with Section 29000) of Division 13, Section 21461 with respect to a sign erected under Section 35655, and Sections 21712 and 23114 even though the vehicle is exempted from the limitations by Section 35001, 35104, 35105, 35106, 35108, 35250, 35400, 35414, or 36615

C. Section 21056 - Effect of exemption
   1. Section 21055 does not relieve the driver of a vehicle from the duty to drive with due regard for the safety of all persons using the highway, nor protect him from the consequences of an arbitrary exercise of the privileges granted in that section

What does the CVC state as to liability when apparatus are being operated?

SLIDE: 3-1-6
### III. COST OF ACCIDENTS

A. Judgment is based upon the injured person’s loss of ability to make a living

1. Example
   a) If killed at the age of 35 and the average person works until 65 years of age, he or she could have worked an additional 30 years
   b) If the job paid $35,000 a year, that is multiplied times the 30 years totaling $1,050,000 (plus inflation factor, medical bills, anguish, etc.)
      1) This could easily surpass $5.7 million

2. "Deep pocket" syndrome
   a) The courts have held that government or big business have deep pockets and are capable of paying large sums for judgments
SUMMARY:

The responsibility and liability extends not only to the agency, but also to the driver/operator. All driver/operators must realize their responsibility while operating fire apparatus. There is a level of trust and expectation on the part of the agency and the public for the driver/operator to act with "due regard" for all others using the roadway.

EVALUATION:

The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:

TOPIC: 3-2: Principles Of Defensive Driving

TIME FRAME: 2:00

LEVEL OF INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.3.6

BEHAVIORAL OBJECTIVE:

Condition: Given an activity and written test

Behavior: The student will confirm a knowledge of the principles of defensive driving by completing the activity and written test


MATERIALS NEEDED:

• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials
• Activity Sheet 3-2-1: Principles Of Defensive Driving

REFERENCES:


PREPARATION: As a defensive driver/operator, you drive to prevent accidents despite the conditions around you. Be prepared by expecting the unexpected; anticipate the unpredictable reactions of other drivers and pedestrians. Operate apparatus at a speed that allows you to safely maneuver under any situation that may occur.
I. DEFENSIVE DRIVING
   A. Be familiar with the basic concepts that ensure safety in all situations while driving
      1. Must allow for factors over which the driver has no control
   B. OR.. Includes a constant awareness of operating vehicles in a safe manner to avoid accidents
   C. Take nothing for granted

   D. Key to defensive driving
      1. Anticipating other drivers' action

II. FACTORS OF DEFENSIVE DRIVING
   A. Knowledge
   B. Understanding
   C. Actions taken
      1. Visual lead time
      2. Braking and reaction time
      3. Combating skids
      4. Weight transfer
      5. Evasive tactics

III. THE DEFENSIVE DRIVER
   A. One who makes allowances for his or her own deficiencies and for the lack of skill and knowledge on the part of the other driver
B. Recognizes that he or she has no control over the unpredictable actions of other drivers or pedestrians, nor over weather or road conditions

C. Will give up the right-of-way and will make whatever concessions to avoid a collision

IV. FACTORS CONTRIBUTING TO ACCIDENTS

What is the most preventable accident?

SLIDE: 3-2-6

A. Improper backing
1. Most preventable accident
2. Significant portion of overall damage costs
3. At scene of incidents
   a) When positioning apparatus
   b) When leaving scene
   c) Consider driving around the block
4. Parking lots
5. Into fire stations

SLIDE: 3-2-7

B. Reckless driving by the public
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 emergency vehicles
5. Inattentiveness

SLIDE: 3-2-8

C. Excessive speed by apparatus driver/operator
1. Urgency of incident often leads to speeds faster than should reasonably be used
2. May lead to the following types of collisions
   a) Loss of control on curves or adverse road conditions
      1) Apparatus leaves road surface
      2) Rollovers
      3) Apparatus strikes other vehicle or object
   b) Unable to stop apparatus prior to collision

3. Apparatus do not handle or respond like an automobile
   a) Braking systems different
   b) Apparatus are top heavy

D. Lack of driving skills and experience
   1. May be attributed to several factors
      a) Insufficient training
      b) Unfamiliarity with apparatus
      c) Overconfidence in driving ability
      d) Inability to recognize dangerous situations
      e) False sense of security because of good driving record
      f) Misunderstanding apparatus capabilities

E. Poor apparatus design or maintenance
   1. Typically more serious with "home built" than with manufactured apparatus
      a) "Home built" apparatus can be
         1) Overweight/underbraked
         2) Have high center of gravity
3) Built on worn out chassis
4) Lacking proper baffling

2. Maintenance problems can result in system failures

F. Intersections
1. Location for most apparatus collisions
2. Most serious in damage, injury, and cost
3. Causes
   a) Failure to yield the right-of-way
   b) Speed

V. SAFE DRIVING TECHNIQUES
A. Driver/operator still key to driving safely
   1. Even with the improved technologies of apparatus design and safety
B. Requirements for an effective driver/operator

1. Attitude
   a) Think safety
   b) Remain calm
   c) Respect for public
      1) Agency image
2. Personnel safety
   a) All apparatus personnel must be properly seated and wearing seat belts
3. Skills
   a) Reading
      1) Maps

What do you think is the number one requirement to be an effective driver/operator?
2) Manufacturer's operations instructions
3) Prefire plans
4) Educational materials
   • Training evaluations
   • Policy and procedure changes
5) Writing
6) Mathematics
   • Simple addition, subtraction, multiplication, and division
   • Hydraulics

4. Physical fitness
   a) General physical condition
      1) Minimum physical requirements
         • DMV standards
         • Department policies and procedures
   b) Strenuous activities
      1) Connecting hose
      2) Laying hose by hand
      3) Deploying portable water tanks
   c) Bending and lifting of heavy, awkward equipment
      1) Proper lifting techniques

5. Visual acuity
   a) Keep your eyes moving
   b) Visual lead time

   1) Scanning far enough ahead for speed being driven, to assure appropriate and safe action if needed

   How would you define visual lead time?
2) Match speed you are traveling with distance ahead of vehicle you are surveying
   • If a vehicle is 100 feet in front of an apparatus, based on the speed of the apparatus, it would take 200 feet to stop or perform an evasive maneuver or a collision will likely occur.

6. Hearing
   a) Must be able to distinguish between your siren and sirens of other vehicles
   b) Must be able to focus on particular sounds
      1) Radio instructions for placing apparatus
         • Failure to do so could result in less effective or unsafe positioning

7. Techniques
   a) Never assume
   b) Expect the unexpected
   c) Anticipation
   d) Aim high in steering
   e) Get the big picture

   How far ahead should you look while driving?

   1) In town
      • Look 1 block ahead
   2) Open road/highway speeds
      • Look ¼ mile ahead
   f) Leave yourself an "out"
   g) Make sure others can "see" and "hear" you
   h) Manage your space
      1) Maintain safety cushion around apparatus
8. Other
   a) Mechanical
   b) Supervisory
   c) Safe following distances
      1) ≤40 mph
         • At least 1 second for each 10 feet of vehicle length
      2) >40 mph
         • Add 1 second for safety
   3) Example
      • 40-foot vehicle = 4 seconds between you and the vehicle ahead
   4) Some departments use one vehicle length per 10 mph
      • Chief's car = 20 feet
      • Pumper = 30 feet
      • Ladder truck = 50 feet

9. Make sure they see you
   a) Eye-to-eye contact is a good rule
   b) No guarantee they will stop

C. Transmission gear usage
   1. Downshift prior to
      a) Entering a turn
      b) Descending a hill
         1) Select lower gear
      c) Entering an intersection
         1) Well ahead of the intersection

SLIDE: 3-2-13

SLIDE: 3-2-14
D. Other factors
   1. Correct hand placement
      a) 9-3 o'clock position
         1) Greatest turning control
      b) Thumbs not around the steering wheel
   2. Use mirrors
   3. Use reference points on apparatus
   4. Right-of-way
      a) School bus with red lights flashing
      b) Vehicle facing downhill must backup for vehicle going uphill
   5. If backing is needed, consider driving around the block

What is the proper hand placement?

INDIVIDUAL ACTIVITY
Complete Activity 3-2-1.
SUMMARY:
Safe operation of your apparatus will allow you to anticipate and avoid situations that might result in a serious accident or injuries to you, your crew, and the public. By developing good driving skills, proper attitude, and understanding "due regard" when driving, you will become the efficient and effective driver/operator that is expected of you.

EVALUATION:
The student will complete the activity and written test at a time determined by the instructor.

ASSIGNMENT:
INDIVIDUAL ACTIVITY 3-2-1

**TITLE:** Principles Of Defensive Driving

**TIME FRAME:** 0:15

**MATERIALS NEEDED:**
- Notes
- Pen or pencil

**INTRODUCTION:** This activity provides the students the opportunity to review the material covered in the principles of defensive driving.

**DIRECTIONS:**
1. Using information from your notes, answer the following questions.
2. You have 5 minutes to complete this activity.
3. Be prepared to discuss your answers with the class.
PRINCIPLES OF DEFENSIVE DRIVING

1. What are the most important aspects of safe driving?

   Defensive driving skills


2. List four of the six components of defensive driving?

   (1) *Anticipating other drivers’ actions*

   (2) *Estimating visual lead time*

   (3) *Knowing braking and reaction times*

   (4) *Combating skids*

   (5) *Knowing evasive tactics*

   (6) *Knowledge of weight transfer*


3. Where do most collisions involving an emergency vehicle occur?

   *Intersection*


4. List two of the five control factors.

   (1) *Aim high in steering*

   (2) *Get the big picture*

   (3) *Keep you eyes moving*

   (4) *Leave yourself an “out”*

   (5) *Make sure others can see and hear you*


5. To get the "big picture" in town at lower speeds you should be seeing ahead _____ block and at highway speeds about _____ mile.

   (a) *one*

   (b) *1/4*

6. If you must stop on or by a one-way or divided highway, what three locations should you place your warning devices?

   (1) **10 feet**
   
   (2) **100 feet**
   
   (3) **200 feet toward the approaching traffic**


7. What is the first thing to consider when passing a vehicle, pedestrian, or cyclist?

   **Assume they don’t see you**


8. Which is greater, total stopping distance or total braking distance?

   **Stopping distance**


9. What four special situations require more than regular mirror checks?

   (1) **Lane changes**
   
   (2) **Turns**
   
   (3) **Merges**
   
   (4) **Right maneuvers**


10. Define the "Law of Inertia."

    **Objects in motion tend to remain in motion**
    
    **Objects at rest tend to remain at rest unless acted upon by an outside force**

TOPIC: 3-3: Driving Apparatus To Incidents

TIME FRAME: 1:00

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.3

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of driving apparatus to incidents by completing the written test


MATERIALS NEEDED:
- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. PRINCIPLES OF CODE 3 RESPONSE

A. Use of warning devices
   1. Lights, siren, and air horn

B. Driving at a safe speed
   1. Maintain constant rate of travel
   2. Keep complete control of apparatus

C. Driving Code 3
   1. Right-of-way
      a) Fire apparatus driver/operator requests the right-of-way
         1) You cannot just take it
      b) Request it by using warning lights and siren
   2. Do not rely on the public obeying the CVC
      a) CVC Section 21806 requires all drivers to immediately pull to the right and stop for emergency vehicles
      b) CVC Section 21806(c) also requires all pedestrians to immediately proceed to the nearest curb or place of safety
      c) This code section shall not relieve the driver of emergency vehicles to drive with "due regard"

D. Factors to consider (anticipation)
   1. Expect the unexpected
   2. Expect the worst
   3. Take nothing for granted
   4. Drive defensively
II. PROCEDURES

A. Personnel safety
   1. Crew's safety is part of the driver/operator's responsibility
   2. Reduce stress and anxiety
      a) Walk, don't run, to the apparatus
      b) Resist the "fight or flight" syndrome
      c) Is crew ready?
   3. Seat belts
      a) All personnel must wear
      b) Required by CVC, Section 27315

B. Prior to responding
   1. Do not become victims while en route to the incident
   2. Consult a map for response route and possible alternatives
   3. Determine hydrant locations and driveway accesses

C. Make yourself noticed and visible
   1. Headlights on
      a) New apparatus are equipped with daytime running lights
   2. Red warning lights
      a) At least one steady burning red warning lamp to the front of apparatus
         1) Visible to 1,000 feet (CVC Section 25252)
b) Over reliance on lights leads to accidents
   1) Studies have shown that lights mounted low are more effective than roof-mounted

3. Sirens
   a) Operate through a wide spectrum
   b) Sound waves produced by a siren are directional
      1) Apparatus moving at 40 mph can project 300 feet in front
      2) Apparatus moving at 60 mph can project 12 feet
   c) Mechanical siren
      1) Full up, then down
   d) Electrical siren
      1) May use different tones to gain attention of others
   e) CVC Section 21055 requires the driver/operator to sound the siren as may be reasonably necessary

4. Air horns
   a) Very good "attention getters"
   b) Cannot drowned out the sound of the siren
   c) Is not a legal emergency vehicle warning device

5. You are not considered as a responding emergency vehicle if you are not using red lights and siren
   a) Do not come up from behind someone and sound an air horn
   b) Due regard implies a level of responsibility not to scare other drivers

Is an air horn a legal emergency warning device?

SLIDE: 3-3-8
III. ROADWAY OPERATIONS

A. When entering the street, do so carefully
   1. Sudden appearance scares/confuses motorists and pedestrians
   2. Drive with the window down so you can hear other vehicles

B. Use main response routes designated by the department
   1. Use wider streets
      a) Safer than narrower streets
   2. Avoid residential streets
      a) Too narrow
      b) Children darting out between cars
      c) Disturbs residents

C. Intersections
   1. Fire service accidents at intersections are the worst location for death and injuries
   2. Use your turn signal 100 feet before the turn
   3. Scan all directions
      a) Blind spots, people, other motorists
      b) Clear lane-by-lane
      c) Make eye-to-eye contact with other drivers and pedestrians
   4. Approach and enter with caution being prepared to stop
      a) Foot off accelerator and over brake pedal
   5. Enter toward center of roadway
      a) Be prepared to avoid other vehicles

What are some of your department's designated response routes?
6. Proceed after it is safe

7. Green signal light
   a) Be alert for stale green signal
   b) Enter with caution
   c) Watch for vehicles running their red signal
   d) Watch for pedestrians

8. Red signal light
   a) Stop
   b) Clear intersection
   c) Proceed with caution when safe to do so
   d) Watch for other vehicles and pedestrians

9. Stop sign, flashing red light
   a) Stop, proceed only when safe

If an intersection is blocked, what would you consider doing?

10. Congested or blocked
    a) Be patient; wait for traffic to clear
        1) Do not lay on the horn and siren
        2) This will only confuse the drivers
        3) They will not know what you want them to do and may enter the intersection and be struck by another vehicle
    b) If traffic cannot be cleared, move to opposing lane and proceed
        1) Use caution
        2) Clear lane-by-lane
        3) Use eye-to-eye contact
        4) Do not pass in the opposing lane if opposing traffic cannot see the apparatus
c) If traffic cannot be cleared, and the opposing lane cannot be used
   1) Do not "force" vehicles into the intersection
   2) Forcing vehicles into the intersection is extremely dangerous

   3) If you force a vehicle into the intersection and it gets hit, you are responsible
   4) Consider shutting down the lights and siren and wait for the signal light to change to green
   5) Response time lost by using due caution is very small

What are some possible results if you "force" another vehicle into an intersection?

SLIDE: 3-3-13

d) Right turn procedure with traffic, against a red signal light
   1) Move to the left lane
      • Clear lane-by-lane
      • Make eye-to-eye contact
      • Proceed through intersection
   2) Right turn alternative
      • Shut down the lights and siren
      • Move to the right turn lane
      • Proceed as a normal right turn

SLIDE: 3-3-14

e) Left turn procedure with traffic, against a red signal light
   1) Move to the left lane
   2) Stop
   3) Proceed when safe
4) Clear lane-by-lane
5) Make eye-to-eye contact
f) Cancelled or reduced to Code 2
   1) If already committed to the intersection, consider continuing Code 3 through the intersection
   2) Shutting down while already committed may confuse other drivers

D. Use of left lane or center of roadway
   1. Pass on the left
   2. Divided roads
      a) Travel next to divider

E. Freeway driving
   1. Entering
      a) Turn off red lights and sirens
   2. Move to left lane or #1 lane
   3. Proceed with flow of traffic
   4. Do not scare other drivers
   5. Exiting
      a) Move to exit lane
      b) Turn on lights and siren
      c) Do not scare other drivers

F. Apparatus blind spots
   1. Mirrors
   2. A-post
   3. Use other personnel on apparatus as spotters

G. Speed
   1. Maintain control of the apparatus at all times

What areas are deemed to be blind spots?
2. Excessive speed is reason for most response accidents
   a) Use basic speed law

   1) Never drive faster than is safe for the present conditions

H. Citizens' reaction
   1. Predictable
      a) They will pull to the right and stop
      b) You cannot pass on the right
   2. Unpredictable
      a) You should avoid sudden moves
         1) Your sudden moves can confuse and cause panic to others
      b) Try to get eye-to-eye contact
   3. Warning devices may be blanketed
      a) Driver/operator assumes all motorists are
         1) Partially deaf
         2) Inattentive to their driving
         3) Have their windows up and radio on
         4) Driving newer cars with sound proofing
      b) Weather conditions
         1) Rain
         2) Hail

I. When responding from same location (2 or more units) tandem or caravan
   1. Maintain 300-500 feet separation
   2. Do not pass other emergency vehicles unless signaled to do so and it is safe

What does the basic speed law say?

SLIDE: 3-3-16

SLIDE: 3-3-17
J. When responding from other locations (2 or more units)
   1. Let other units know when you are approaching an intersection that they might be using at the same time

K. Traffic control devices
   1. Proper direction selected
   2. Apparatus responding from opposing direction

What should you do if several apparatus are responding to the same location?

SLIDE: 3-3-18
SUMMARY:
A fire apparatus driver/operator has the responsibility to safely drive the apparatus to an incident. You have the responsibility of driving with due regard to ensure that your crew and the public are safe by responding with the proper warning devices, roadway operations, speed, and attention to other drivers.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 3-4: Principles Of Off-road Driving

TIME FRAME: 1:00

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 1.4.13

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of the principles of off-road driving by completing the written test


MATERIALS NEEDED:
- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:
- Basic Fire Control Module 2A Automotive Battalion Student Supplement, CDF, 1999 Edition, Off Road Vehicle Operations Unit
- Off Road and 4-Wheel Driver Operational Procedures Manual, Kern County Fire Department, 1999 Edition, Off Road Section

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

- Attention (attract) Begin
- Curiosity (arouse) Association
- Interest (create) Students
- Desire (stimulate) Experience
Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. OFF-ROAD DEFINED
   A. Unpaved or unimproved roads, trails, paths, or dozer breaks
   B. Maintained or not
   C. Even and uneven terrain
   D. Flat and high-angle elevations

II. INDICATIONS THAT LEAD TO OFF-ROAD OPERATIONS
   A. Wildland fires
      1. Apparatus required at fire scene
      2. Remote locations
      3. Best or only access
   B. Structure fires
      1. Undeveloped locations
      2. Exposure protection
   C. Rescue
      1. Remote locations
      2. Undeveloped locations
   D. Public service
      1. Assisting public in nonemergency situations
   E. Area familiarization
      1. Topographical layout of area
   F. General indicators
      1. Advantages realized must justify risks taken
III. RISKS OF OFF-ROAD OPERATIONS

A. Known or unknown obstacles
   1. Vegetation
      a) Do not cut corners
      b) Hidden objects
      c) Do not cross country unless you must
   2. Fences
   3. Rocks
      a) Know which side the differential is on
      b) Go slow
      c) Go easy
   4. Holes
   5. Ruts
   6. Washouts or gullies
   7. Rivers, streams, creeks, and irrigation ditches
   8. Topography
   9. Retardant drops

B. Surface conditions
   1. Soft dirt
   2. Sand
   3. Mud
   4. Water
   5. Bridges
      a) Capacity to support apparatus
      b) Use alternate route if necessary

C. Slower response times
What could cause a slower response time?

1. Limited access
2. Limited maneuverability
3. Must drive slower

SLIDE: 3-4-8

D. Safety hazards
1. Escape routes
2. Visibility
   a) Dust
   b) Smoke
   c) Terrain
   d) Trees, foliage, rocks, berms
3. Proximity to fire
4. Retardant drops
5. Old bridges

SLIDE: 3-4-9

E. Apparatus limitations

1. Type I engine
   a) Designed for paved roads
   b) May be used on dirt roads
   c) Weight
   d) Low ground clearance
     1) Angle of approach
        • Angle between the ground and line running from the two front tires to lowest hanging component directly ahead, usually front bumper

SLIDE: 3-4-10
- Allows the driver/operator to judge the ability of the apparatus to negotiate obstacles

**SLIDE: 3-4-11**

2) Breakover angle
- Ability of apparatus to maneuver over objects without making contact with underside of apparatus

**SLIDE: 3-4-12**

3) Angle of departure
- Angle between the ground and line running from the two rear tires to the lowest hanging component directly behind it, usually the rear bumper or tail board
  
e) Inability to pump and roll

**SLIDE: 3-4-13**

2. Type II engine
  a) Similar to Type I
  b) Some designs allow for better clearance
  c) Some designs can pump and roll
  d) Ground clearance
    1) Angle of approach
    2) Breakover angle
    3) Angle of departure

**SLIDE: 3-4-14**

3. Type III engine
  a) Designed for off-road
  b) Some are four-wheel drive
  c) Can pump and roll
  d) Consider center of gravity
    1) Some are higher than normal
<table>
<thead>
<tr>
<th>PRESENTATION</th>
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<tbody>
<tr>
<td>e) Less water than Types I and II</td>
</tr>
<tr>
<td>f) Ground clearance</td>
</tr>
<tr>
<td>1) Angle of approach</td>
</tr>
<tr>
<td>2) Breakover angle</td>
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<tr>
<td>3) Angle of departure</td>
</tr>
</tbody>
</table>

4. Type IV engine
   a) Similar to Type III
   b) Less water and hose
   c) Increased mobility
   d) Ground clearance
      1) Angle of approach
      2) Breakover angle
      3) Angle of departure

   What components can experience excessive wear?

5. Excessive wear on components
   a) Brakes
   b) Tires
   c) Shocks and springs
   d) Transmission
   e) Cooling system
      1) Moving slowly
      2) Debris
      3) Dirt
      4) Long idle times
IV. DRIVING ON DIRT ROADS

A. Safety considerations
   1. Slow down
      a) Decreased traction
      b) Increased braking distances
   2. Visibility
      a) Dust
      b) Terrain
         1) Winding roads
            • Unable to see around corners
         2) Hills
         3) Overhanging vegetation
   3. Rules of the road
      a) Principles of defensive driving and vehicle code apply

      1) Vehicles face-to-face on single lane
         • Vehicle going uphill has the right-of-way

B. Apparatus familiarization prior to driving (pretrip)
   1. General cosmetic condition
   2. Tank water and foam levels
   3. Under the hood
      a) Fluid levels
         1) Oil
         2) Coolant
         3) Brakes

Which vehicle has the right-of-way when driving on sloped roads?
<table>
<thead>
<tr>
<th>PRESENTATION</th>
</tr>
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<tbody>
<tr>
<td>4) Power steering</td>
</tr>
<tr>
<td>5) Transmission</td>
</tr>
<tr>
<td>b) Belt or belts condition</td>
</tr>
<tr>
<td>c) Loose or leaking items</td>
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<tr>
<td>d) Radiator obstructions</td>
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<tr>
<td>e) Overall engine condition</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>APPLICATION</th>
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</thead>
<tbody>
<tr>
<td>4. Tires and lug nuts</td>
</tr>
<tr>
<td>a) Tires</td>
</tr>
<tr>
<td>1) Thump tires for proper inflation</td>
</tr>
<tr>
<td>2) Tire wear</td>
</tr>
<tr>
<td>3) Sidewalls for cuts or damage</td>
</tr>
<tr>
<td>4) Rocks between rear duals</td>
</tr>
<tr>
<td>b) Lug nuts</td>
</tr>
<tr>
<td>1) Damage</td>
</tr>
<tr>
<td>2) Missing</td>
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<tr>
<td>3) Loose</td>
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<tr>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>5. Undercarriage</td>
</tr>
<tr>
<td>a) Muffler and exhaust pipes</td>
</tr>
<tr>
<td>b) Shock absorbers</td>
</tr>
<tr>
<td>c) Steering linkage</td>
</tr>
<tr>
<td>d) Springs</td>
</tr>
<tr>
<td>e) Spring hangers</td>
</tr>
<tr>
<td>f) Drivelines</td>
</tr>
<tr>
<td>g) Skid plates</td>
</tr>
<tr>
<td>h) Frame</td>
</tr>
</tbody>
</table>

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<tr>
<th>APPLICATION</th>
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<tbody>
<tr>
<td>6. Lights and safety devices</td>
</tr>
<tr>
<td>a) Headlights</td>
</tr>
<tr>
<td>b) Taillights</td>
</tr>
<tr>
<td>c) Clearance lights</td>
</tr>
<tr>
<td>d) Turn signals</td>
</tr>
</tbody>
</table>
C. Route selection

1. Know where you are going
2. Plan your route ahead of time
   a) Longer route may be safer route
3. Constantly evaluate road conditions
4. Avoid side-hilling whenever possible
5. Pick flat areas to turn around
6. Avoid steep slopes that are covered with green grass
7. Always leave gates the way you found them
   a) If open, leave open
   b) If closed, then close them after going through
8. Have an escape route

D. Return to pavement

1. Set chock blocks
2. Check undercarriage
   a) Tie rods and steering linkage
   b) Mufflers
c) Drive line
d) Shocks
e) Skid plates
f) Brake system
g) Fuel system

3. Check tires
   a) Damage
   b) Rocks in duals
   c) Lug nuts

4. Check body damage

5. Check radiator
   a) Brush
   b) Debris

6. Check for fluid leaks
   a) Oil
   b) Water
   c) Coolant
d) Fuel

7. Check windshield
   a) Cracks
   b) Stars
      1) Impact marks left by rocks or debris
   c) Dust

8. Disengage 4-wheel drive

9. Make necessary repairs if possible

V. DRIVING WITHOUT ROADS

   SLIDE: 3-4-21

   A. Surface conditions
What type of surface conditions might a driver/operator find when driving without a road?

<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hard surface with loose materials</td>
<td>What type of surface conditions might a driver/operator find when driving without a road?</td>
</tr>
<tr>
<td>a) Maintain smooth and steady speed</td>
<td></td>
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<tr>
<td>b) Increased braking distances</td>
<td></td>
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<tr>
<td>2. Soft sand, mud, or loose dirt</td>
<td></td>
</tr>
<tr>
<td>a) Small area</td>
<td></td>
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<tr>
<td>1) Travel through quickly</td>
<td></td>
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<tr>
<td>b) Large area</td>
<td></td>
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<tr>
<td>1) Maintain steady speed</td>
<td></td>
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<tr>
<td>2) Avoid tire spinning</td>
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<tr>
<td>3) Avoid stopping</td>
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<tr>
<td>4) Avoid chattering with tires</td>
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<tr>
<td>5) Accelerate and decelerate slowly</td>
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<tr>
<td>6) Use some water if needed</td>
<td></td>
</tr>
<tr>
<td>3. Gullies and ruts</td>
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<tr>
<td>a) Go at an angle</td>
<td></td>
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<tr>
<td>b) Slow speed</td>
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<tr>
<td>c) Clearance of bumpers</td>
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<tr>
<td>d) Could take control of steering</td>
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<tr>
<td>4. Crossing water</td>
<td></td>
</tr>
<tr>
<td>a) Scout</td>
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<tr>
<td>1) Water depth</td>
<td></td>
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<tr>
<td>2) Soil condition</td>
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<tr>
<td>3) Approach and departure angles</td>
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<tr>
<td>b) Condition before crossing</td>
<td></td>
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<tr>
<td>c) Maintain slight pressure on brake</td>
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</tbody>
</table>
**Why would you apply slight pressure on the brakes while crossing water?**

1) Keeps water from entering in between brake pad and drum
2) Check brakes after crossing

**B. Slopes**

1. **Determine angle of slope**
   a) Topographic maps
   b) Estimation by eye
   c) Other apparatus
   d) Safe maximum limit is 40%
      1) If exceeded, should drive straight up or down incline

   **SLIDE: 3-4-22**

2. **Driving on a slope**
   a) Downhill
      1) Use proper gear
         - Normally a lower gear
      2) Avoid locking brakes
      3) Attempt to drive straight down
         - Avoid side-hilling
      4) Use spotter, if needed
      5) Sound horn where needed
      6) Use engine compression
      7) Be in four-wheel drive before descending

   **SLIDE: 3-4-23**
   **SLIDE: 3-4-24**
   **SLIDE: 3-4-25**
### Uphill

1. Keep rpms in safe range
   - Maintain around 2,000 rpm
   - Refer to owner's manual
2. Use proper gear
3. Attempt to drive straight up

**What are some conditions that you should evaluate when driving on a slope?**

4. Evaluate condition of slope for
   - Rocks
   - Ruts
   - Wet areas
   - Air drops
   - Green grass
5. Use caution at top of hills
   - Poor visibility
   - Use spotter
   - Sound horn

### Sidehill

1. Avoid driving on sidehill, if possible
2. Travel slowly
3. If apparatus begins to slide, steer downhill

### Stopping or parking on slopes

**SLIDE: 3-4-26**

**SLIDE: 3-4-27**

a) Temporary stopping
1. Automatic transmission
   - Hold brake with left foot
2) Standard transmission
   • Set parking brake
   • Release clutch pedal as you accelerate slowly while releasing the parking brake
   • Do not slip clutch or stall engine

b) Stopping when engine dies
   1) Brake with left foot
   2) Set parking brake
   3) Start engine
   4) After engine starts
      • Continue as indicated above
   5) If engine will not start
      • Remain behind steering wheel unless you are alone
      • Other personnel disembarks apparatus to safe area
      • Apply parking brake
      • Place transmission in park or first gear
      • Set chock blocks
      • Call for assistance

What steps would you take if the engine dies while on a slope?

SLIDE: 3-4-28
c) Parking on a slope
   1) Avoid if possible
   2) Use natural barriers
      - Trees
      - Rocks
      - Berms
   3) Set all brakes
   4) Set chock blocks
   5) Leave standard transmission in first or reverse gear
   6) In extreme situations, keep someone behind the steering wheel

VI. FOUR-WHEEL DRIVE
   A. Engaging/disengaging
      1. Refer to manufacturer's recommendations and specifications
      2. Refer to department SOPs
   B. Where to use
      1. Steep slopes
      2. Unpaved and poorly conditioned roads
      3. Soft surfaced roads

VII. OPERATIONS NEAR OTHER EQUIPMENT

What are some considerations for parking on slopes?

SLIDE: 3-4-29

What are some hazards that you should consider when operating near other equipment?
### A. Hazards
1. Flying or falling debris
2. Limited mobility
3. Other equipment nearby
4. Limited visibility

### B. Communications
1. Use radios
2. Use hand signals
3. Face-to-face

### C. Aircraft
1. Keep equipment and personnel not assigned to the aircraft away
2. Never approach the aircraft until the pilot signals you to do so
   a) Always make eye contact with the pilot
   b) Approach from the front of the aircraft
3. Close apparatus windows to avoid flying debris
4. Secure all equipment and gear

### D. Dozers and earthmovers
1. Watch for falling or rolling material
2. Use caution when driving on new trails cut by dozers
   a) Soft ground
   b) May end suddenly
   c) Slope of trail may be unsafe
      1) Too steep
      2) No escape route
3) Natural barriers for anchor points
   • Rocks
   • Rivers, streams, creeks
d) Watch for personnel working with dozers
e) Stay close to uphill side of break
f) Stay at least 100 feet behind the dozer
g) Use radio to communicate with operator or walker
h) Watch for stobs

VIII. SAFETY PRECAUTIONS

A. Keep clear of fire line construction
B. Watch for low hanging limbs
C. Use extreme caution when driving in smoke where personnel may be in the way
   1. Use spotter if necessary
D. Spot apparatus for protection from heat, fire, and falling or rolling debris
   1. Roads
   2. Orchards
   3. Downhill from heavy equipment operation
E. Use caution in tall vegetation
   1. Use spotter
   2. Watch for logs, holes, etc.
F. Watch for embers
G. Always use spotters when backing, if available
H. Spot apparatus facing escape route

Name some safety precautions during off-road driving?

SLIDE: 3-4-35

SLIDE: 3-4-36
<table>
<thead>
<tr>
<th>PRESENTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Keep roads clear if possible</td>
</tr>
<tr>
<td>J. Drive with headlights on</td>
</tr>
<tr>
<td>K. Wear seatbelts</td>
</tr>
<tr>
<td>L. Use chock blocks when needed</td>
</tr>
<tr>
<td>M. Awareness of apparatus fuel, oil pressure, and coolant temperature at all times</td>
</tr>
<tr>
<td>N. Think safety at all times</td>
</tr>
</tbody>
</table>

| APPLICATION |
SUMMARY:
Operating an apparatus off-road, and/or in 4-wheel drive, you must be aware of the conditions you might encounter. The ability to operate on various and hazardous road conditions, changing environmental conditions, and equipment limitations will assist you in a safe and effective operation.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 3-5: Principles Of Braking And Stopping

TIME FRAME: 0:30

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.3

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of the principles of braking and stopping by completing the written test


MATERIALS NEEDED:
- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:

PREPARATION:
Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract)  Begin
Curiosity (arouse)  Association
Interest (create)  Students
Desire (stimulate)  Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. BRAKING

A. Should be planned
   1. Before a curve or turn
      a) Approach zone
      b) Straight line braking
   2. Before driving downhill
      a) Using correct gear before starting down the grade
   3. Before the need to stop
      a) Intersection
      b) Incident
   4. Secondary braking devices should also be used in conjunction with primary braking systems
      a) Engine or exhaust brake
      b) Transmission retarder

B. Antilock brake system
   1. Allows driver/operator to steer while braking
      a) Even aggressive (panic) braking
   2. Prevents wheels from skidding on wet or slippery roads while braking

C. No antilock brake system
   1. Does not allow the driver/operator to steer during emergency braking
      a) Apparatus will skid during emergency braking
      b) Stab brake the brakes during emergency braking to prevent skidding

What is "brake fade?"
D. Brake fade
   1. Brakes can fade or fail when they overheat
      a) Excessive use at high speeds
      b) Improper slack adjustment
         1) Too much slack
         2) Brakes are not sharing the work
            • Some of the pads or shoes are not contacting the linings or disks
            • Brakes with more contact overheat

II. FOUR FACTORS DETERMINE STOPPING DISTANCE

A. Apparatus total stopping distance
   1. Perception
   2. Reaction
   3. Braking lag
   4. Braking distance

B. Perception distance (mental evaluations)
   1. The distance your apparatus moves from the time your eyes see a hazard until your brain knows it
      a) Perception time for an alert driver is about ¾ second
      b) At 55 mph, you will travel 60 feet in ¾ second
   2. Identify
      a) Do you see?
         1) Looking ahead?
   3. Analyze
      a) What do you see?
         1) Conditions?
4. Decide
   a) What must I do?
      1) Brake?
      2) Steer?

C. Reaction distance (physical action)
1. The distance traveled from the time your brain tells your foot to move from the accelerator until your foot is actually pushing the brake pedal
   a) Reaction time for the average driver is \( \frac{3}{4} \) second
   b) This accounts for an additional 60 feet traveled at 55 mph
2. Execute
   a) Do it - action taken by driver/operator

3. Apparatus traveling at 30 mph
   a) Perception distance takes 33 feet
   b) Reaction distance takes 33 feet
   c) Combined distance equals 66 feet

4. Professional drivers
   a) Most people think professional drivers have fast perception and reaction skills
      1) This is false
      2) Professional drivers are trained to anticipate

5. Perception times and reaction times
   a) \( \frac{3}{4} \) second + \( \frac{3}{4} \) second = 1\( \frac{1}{2} \) seconds the apparatus travels before the driver acts
D. Braking lag
   1. The time required for brakes to engage after the brake pedal is pushed
   2. Only affects air brake systems

E. Apparatus braking distance (brakes engaged until stopped)
   1. Speed will directly affect the reaction and apparatus braking distances
   2. Double the speed of the apparatus
      a) Stopping distance is increased four times
   3. At 55 mph a vehicle will travel on dry pavement with good brakes 170 feet

4. Total stopping distance
   a) Perception distance + reaction distance + braking distance
   b) Example
      1) Perception distance = 60 feet
         Reaction distance = 60 feet
         Braking distance = 170 feet
         Total stopping distance = 290 feet

III. BRAKING TECHNIQUE

A. Evasive braking (panic)
   1. Sudden and aggressive braking when there is a need to slow or stop quickly

B. Threshold braking
   1. Applying brakes to their full potential without them locking
   2. ABS provides this type of braking capacity

SLIDE: 3-5-7

SLIDE: 3-5-8

SLIDE: 3-5-9

SLIDE: 3-5-10

What is "panic braking?"
3. Not all apparatus have ABS
   a) That is why it is important to know this technique

C. Straight line braking
1. Applying the brakes while traveling in a straight line
2. Applied before curves (approach zone)

D. Trail braking
1. Slowly releasing the pressure on the brakes while turning
2. Applied after straight line braking
   a) Between entry point and apex of curve (entry zone)
3. Transfers weight to the front tires
   a) Provides maximum traction and turning capability
4. Too much pressure on the brakes can cause oversteer
5. Should be completed when the apparatus gets to the apex

E. Downgrade braking
1. Apply brakes until the apparatus has slowed down
   a) Short application
      1) Just hard enough to feel a definite slowdown
   2. Reduces speed approximately 5 mph below your "safe" speed
   a) Safe for the driving conditions

What is a "safe" speed?
<table>
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<tr>
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<tbody>
<tr>
<td>3. When the apparatus speed has increased to a &quot;safe&quot; speed, apply brakes again</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Short application</td>
<td></td>
</tr>
<tr>
<td>4. Example</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>a) If safe speed is 40 mph, slow the apparatus to 35 mph, let-up on the brakes until the apparatus reaches 40 mph, then brake again</td>
<td></td>
</tr>
</tbody>
</table>
SUMMARY:
You govern your choice of speed according to a basic speed rule that can be stated in a very straightforward way, "Never exceed a speed that is reasonable and proper for existing conditions, even where law permits."

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 3-6: Principles Of Steering And Load Control

TIME FRAME: 1:30

LEVEL OF INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.3

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of the principles of steering and load control by completing the written test


MATERIALS NEEDED:

• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

REFERENCES:

• California Commercial Driver Handbook, DMV, 2008 Edition, Pages 22, 45, and 46
• dictionary.com
• Sacramento Regional Driver's Training Authority Student Manual, First Edition, Pages 29, 52-58, 66-68, and 72-76

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

Attention (attract) Begin
Curiosity (arouse) Association
Interest (create) Students
Desire (stimulate) Experience
Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. PHYSICAL FORCES THAT AFFECT CONTROL

A. Momentum
   1. Vehicle’s mass (weight) times its velocity (speed)
   2. The more momentum the apparatus has, the more energy or effort required to stop

B. Inertia
   1. Force that makes the apparatus retain its speed in the same direction
   2. As momentum increases, it is harder to overcome the effects of inertia

C. Centrifugal force
   1. Tends to push an apparatus traveling around a curve away from the center of the curve or turn
   2. Influenced by speed and radius of the curve
   3. Higher speed, the greater the centrifugal force

D. Friction
   1. Friction is the resistance to slipping
   2. Occurs whenever two surfaces contact each other
   3. Two areas of friction that are most important for apparatus control
      a) Tires and road surface
         1) Affects the amount of friction between the road and the tires
      b) Brake pad/shoe and disk/drum
         1) Condition of the brakes affects the amount of friction between these
II. WEIGHT TRANSFER
A. The shift of weight is called weight transfer
B. Effective use of weight transfer is critical for safe handling of an emergency apparatus
C. Weight transfer that affects apparatus handling
   1. Lateral weight transfer caused from turning the apparatus right or left
   2. Weight transfer to the front of the apparatus caused by braking (straight line, trail braking)
   3. Weight transfer to the rear of the apparatus caused from acceleration

III. TIRE CONTACT PATCHES
A. Tire contact patches are the area of tire contact (footprint) on a road surface
B. Weight transfer will change the size of the tire contact patches
C. The size of the tire contact patches will affect the amount of friction between the tires and the road
D. Amount of friction between the tires and the road will affect the amount of apparatus control in curves
   1. Braking will create larger front tire contact patches
   2. Accelerating will cause larger rear tire contact patches
   3. Right turn will create larger tire contact patches on the left
   4. Left turn will create larger tire contact patches on the right side
IV. SKIDS

A. An apparatus is supported on a cushion of air that exists within the tires

B. Control of the apparatus is transmitted through tire "footprints"
   1. Each footprint is about the size of a person's hand
   2. Changes of direction or speed are made by changing the direction of these footprints

C. The cohesive quality between the rubber and the roadway is called the coefficient of friction
   1. Will vary depending upon the roadway surface or foreign substances on the roadway such as sand, oil, water, or ice
   2. When one or more of the tires exceeds the coefficient of friction, a loss of adhesion to the roadway and subsequent skidding occurs

D. Acceleration skids
   1. Involve only the drive wheels
   2. To maintain control of the apparatus, wheel slippage may be reduced or stopped by easing up on the throttle, which will reduce torque to the drive wheels
   3. Accelerating to the point of breaking wheel traction serves no useful purpose, placing tremendous strain on drive train components, wearing out tires, and resulting in a slower start than is obtained with controlled acceleration

E. Locked-wheel skids
   1. Sacrifice all directional control of the apparatus and should be avoided

What is an "acceleration skid?"
2. The front wheels steer only by rolling friction
   a) With the brakes locked, all efforts to steer the apparatus are futile

What is a "four-wheel drift?"

F. Four-wheel drift
   1. Often misunderstood
   2. Describes that condition when a cornering apparatus is above the limits of adhesion and in a balanced understeer/oversteer attitude
   3. Apparatus is pointed in the direction it is traveling and all wheels are following a line of the curve, however, the apparatus is evenly drifting toward the outside of the curve
   4. If there is adequate roadway available, the apparatus may negotiate the turn without event

G. Oversteer (rear-wheel skid)
   1. Results from over acceleration, excessive steering, improper brake usage, or from road conditions that provide little traction (wet, bumpy, debris covered)
   2. Countersteer using a rapid and smooth steering input in the direction of the skid
      a) This allows the front end to stay ahead of the back end until recovery is complete

H. Understeer (front-wheel skid)
   1. Results from approaching the turn at an excessive speed, excessive steering, improper brake usage, or from road conditions that provide little traction (e.g., wet, bumpy, or covered with debris)
   2. Avoid additional steering input, and when the apparatus slows enough to regain rolling friction, the understeer condition will diminish
      a) Acceleration and brake use should be avoided
I. Hydroplaning
   1. Term used when an apparatus is skimming along the surface of a wet road
   2. Normal contact patch of the tire tread and the road begins to separate
   3. A serious condition because the driver/operator cannot control the apparatus

   4. Three factors contribute to the hydroplaning effect
      a) Water depth
         1) Normally a ¼" of water is enough to cause hydroplaning
      b) Tire condition
         1) Tread depth
         2) Air pressure
         3) Design
         4) Width
      c) Apparatus speed
         1) The faster the tires are rotating, the more likely that the apparatus will skim the surface of the water
         2) Total hydroplaning on 1" of water may be expected at about 58 mph
         3) Partial hydroplaning can occur at significantly slower speeds

V. STEERING IN CURVES

A. Types of curves
   1. Constant radius curve
      a) 90° corners (city streets)
      b) Roads, freeways, highways
2. Decreasing radius curves
   a) Curve continually tightens
   b) Freeway onramps and off ramps
   c) Roads, freeways, highways
3. Increasing radius curves
   a) Curve gradually straightens
   b) Freeway on ramps and off ramps
   c) Roads, freeways, highways

What are some reference points of curves?

B. Reference points of curves
   1. Entry point
      a) Extreme outside edge of roadway at the beginning of a curve
      b) The point of steering input to perform the turning maneuver
   2. Geometric apex
      a) The tightest, innermost part of a curve
      b) Directly centered in the driving arc
   3. Early apex
      a) In the early portion of a curve
      b) Not a good apex to use
      c) Apparatus may understeer and leave roadway
   4. Late apex
      a) In the late portion of a curve
      b) Best apex to use
      c) Allows greatest control of apparatus
C. Roadway position

1. Position of the apparatus on the roadway to best facilitate the negotiation of a turn or curve at a safe rate of speed

2. The use of the available roadway to its fullest advantage with the least amount of steering

3. Roadway position could also be referred to as the "driving line" through a turn

VI. TYPICAL TURN CLASSIFICATIONS

A. Constant radius (90° turn)

1. Most efficient driving line is one with a constant radius

2. This turn would become a full circle if permitted to continue a full 360°

3. Driving advantages
   a) Minimize weight transfer
   b) Minimize steering input
   c) Smooth apparatus control
   d) Greatest attainable safe speed through the turn

B. Decreasing radius

1. This is a continually tightening turn

2. Driving speed will be decreased in proportion to the tightening of the turn

3. Negotiate the turn by taking the line of least resistance to the apparatus' travel
C. Increasing radius
   1. This turn gradually straightens
   2. Apparatus speed will be slower at the entry point
      a) Can be increased upon exiting

D. 180° turn
   1. The configuration of this turn corresponds to driving through one half of a circle
   2. Entry should start from the extreme outside edge of the available roadway
      a) Driving line will be maintained to the approach of the apex
      b) Although not any faster speed-wise than an "inside" or "outside" driving line, this route provides a degree of safety for maneuvering in the case of a slide
   3. The apex area is relatively close to the exit of the turn, not geometrically located
   4. Exit point will be on the outside of the roadway, beyond the apex area

E. Multiple turn situation
   1. Multiple turns create a situation where apparatus control problems are likely to occur
   2. Correct roadway position through multiple turns is a path that will reduce the amount of directional change from one turn to another
      a) Lessens side-to-side weight transfer

Why is the entry at the outside edge safer?
b) Provides tires improved traction
c) Allows greater control

3. In order to drive the correct roadway position, the driver/operator will have to equalize turning motions from one turn to another while maintaining a consistent speed
   a) These two ingredients create centrifugal force

4. Correct road position will vary as to the configuration of the turns
   a) The driving line selected should provide for optimum efficiency and control at the exit of the final turn

VII. CONTROL CONSIDERATIONS

A. To establish proper roadway position through a turn, the driver/operator must scan the curve during the approach

B. The path of travel should bring the apparatus to the apex or low side just prior to the exit of the turn

C. The apparatus should be held as close as possible to the apex to allow adequate distance when exiting the turn

D. Apparatus stress and weight transfer may be reduced by allowing the apparatus to smoothly drift out to the high side (outside) upon leaving the turn

E. Driving zones
   1. Zone 1, approach zone
      a) This area consists of the approach up to the entry point of the curve
      b) Also the speed adjustment area
2. Zone 2, entry zone
   a) This area consists of the first portion of the turning arc between the entry point and the apex

3. Zone 3, exit zone
   a) This area consists of the turning arc from the apex to the exit point

VIII. STEERING CONTROL

A. Hand position
   1. Recommend 9-3 o'clock position
      a) Allows for greater turning and balanced steering

   2. Two hands on steering wheel
      a) With standard transmission, shift gear then return hand to the steering wheel
      b) Do not rest hand on gear shift

   3. Thumbs resting on steering wheel
      a) Not around steering wheel

1) Could cause injury if the apparatus were to hit a bump or pot hole

Why do you not place your thumbs around the steering wheel?

B. Turning
   1. Keep both hands on the wheel
   2. Turn wheel to make the turn
   3. Tight turns may require hand-over-hand or hand-shuffle
      a) Hand-over-hand method
         1) Movements made slowly
b) Best method when making an evasive maneuver hand-shuffle method
   1) Prepare before reaching turn
   2) Note degree of curve
   3) Hold steering wheel firmly
   4) Maintain control
      • Hands do not leave the wheel

C. Turning in curves

1. Turning arc
   a) The driving line or line of travel that the apparatus travels through a curve

2. Understeer
   a) Occurs when traveling too fast into a turn, resulting in a loss of friction
   b) Apparatus tends to travel in a straight line and not turn
   c) Tire contact patches of the front tires are too small for the speed of the apparatus
   d) Not enough friction between the front tires and the road surface
   e) Not enough weight has been transferred to the front tires

3. Oversteer
   a) Occurs when too much braking is applied
      1) Transfers too much weight to the front of the apparatus

What is a “turning arc?”

**SLIDE: 3-6-37**

What is “understeer?”

**SLIDE: 3-6-38**

What is “understeer?”

**SLIDE: 3-6-39**
b) The rear of the apparatus tends to travel to the outside of the turn (fish tail)

c) Tire contact patches of the rear tires are too small for the speed of the apparatus

d) Not enough friction between the rear tires and the road surface

**How does "power oversteer" differ?**

**SLIDE: 3-6-40**

4. Power oversteer
   a) Occurs when too much power is applied to the rear tires, causing them to break
   b) Rear of the apparatus tends to travel to the outside of the turn (fish tail)
   c) Rear tire contact patches are too small for the speed of the apparatus
   d) Not enough friction between the rear tires and road surface
   e) Power to the rear tires exceeds the traction ability of the rear tire contact patches

D. Steering in curves

**What are the three zones of steering in curves?**

**SLIDE: 3-6-41**

1. Zone 1, approach zone
   a) Eyes looking at entry point
   b) Straight line braking
      1) Weight is transferred to the front of the apparatus
      2) Front tire patches are increased
      3) Front tires have more traction
   c) Downshift apparatus (standard transmission)
      1) Heel-toe technique if possible
2. Zone 2, entry zone
   a) Eyes looking at apex
   b) Start turning apparatus
      1) Turning arc
      2) Weight is transferred to the side (lateral)
   c) Begin trail braking
      1) Gradually release brake pedal until apparatus reaches the apex
      2) Weight is transferred to front tires
         • Improving apparatus control
         • Proper brake input during trail braking balances the weight transfer between the front and rear of the apparatus
   3) Apparatus will oversteer with too much speed or braking
      • Too much weight in the front
   4) Apparatus will understeer with too much speed but not enough braking
      • Too much weight to the rear
   d) No acceleration or maintain speed to the apex
   e) Smooth steering
      1) Do not jerk steering wheel
         • Upsets the balance of the apparatus

3. Zone 3, exit zone
   a) Eyes looking at exit point
   b) Trail braking complete at or prior to the apex
   c) Accelerate
      1) Weight is transferred to rear of apparatus
   d) Aim apparatus at the exit point
   e) Smooth steering
### E. Front wheels returning to straight position
1. Without power steering
   a) Tend to straighten
   b) Because of caster
2. With power steering
   a) Designed to retain position

### F. Steering while stopped
1. Do not turn the steering wheel while stopped
   a) Causes stress on steering components and grinds tires

### G. Maneuvering in close quarters
1. Turning around before stopping
   a) Turn wheels in direction they will travel

### H. Axle location
1. When turning, the rear wheels do not follow the same path of the front
2. Cheating/cutting a shorter circumference
3. Longer the wheelbase, the sharper the turn, more the rear wheels will cheat
4. Understand cheating to avoid hitting
   a) Curbs
   b) Buildings
   c) Cars
<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>APPLICATION</th>
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</table>
| I. Rear end swing  
  1. Extended part of apparatus behind rear wheels  
    a) Outward opposite direction of turn  
| J. Front end swing  
| K. Know your apparatus  
  1. High points  
  2. Low points  
| IX. TIRE FAILURE  
A. Recognize tire failure  
  1. Hear a loud "bang"  
    a) Blowout  
    b) Could take a few seconds for the apparatus to react  
    c) May think it is another vehicle because of the delay  
  2. Feel of tire failure  
    a) Thumps or vibrates heavily  
      1) May be a sign that a tire has gone flat  
      2) May be the only sign of a rear failure with dual wheels  
    b) Steering feels "heavy"  
      1) Front tire has failed  
    c) Apparatus "fish tails"  
      1) Rear tire has failed  
| How does the apparatus feel after a tire failure?  
| SLIDE: 3-6-49  
| What corrective actions should you take during a tire failure?  
| SLIDE: 3-6-50  

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3-6: Principles Of Steering And Load Control  
Page 17
B. Corrective action
   1. Hold steering wheel firmly
      a) Both hands on the wheel
      b) Front tire failure can cause wheel to twist in the driver/operator's hand
   2. Stay off the brakes
      a) Hard braking
         1) Can cause a loss of control
         2) Transfers weight quickly
            • Compounds handling problem
   3. Pull off the road and stop
      a) After controlling the vehicle
   4. Follow SOPs

X. SKID CONTROL
A. Release the brakes, allowing the wheels to rotate freely
   1. Threshold braking

B. Turn apparatus toward the skid or direction you want to travel

C. Do not release the clutch until apparatus is under control
   1. Reduces weight transfer to the rear
   2. Will upset the balance of the apparatus

D. Understeer correction
   1. Release accelerator to transfer weight to the front tires
   2. Lightly apply brakes to transfer weight to front tires
3. Too much braking  
   a) Apparatus continues to skid  
   b) Loss of steering ability  
   c) Apparatus may go into an oversteer skid  

E. Oversteer correction  
1. Release the brakes  
   a) Allows the weight to transfer to the rear tires  
2. Continue to steer in direction desired  

F. Power oversteer correction  
1. Release the accelerator  
   a) Allows rear tires to gain traction  
2. Do not step on the brake pedal  
3. Continue to steer in direction desired
SUMMARY:
You must understand the principles of physical forces, weight transfer, and how the driver/operator's input during driving situations affects the balance and control of the apparatus. Once you can confidently apply these principles to your driving, your skill in controlling the apparatus while driving through turns and skids will greatly improve.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 3-7: Driving During Adverse Weather Conditions

TIME FRAME: 0:15

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 4.3

BEHAVIORAL OBJECTIVE:

**Condition:** Given a written test

**Behavior:** The student will confirm a knowledge of driving during adverse weather conditions by completing the written test


MATERIALS NEEDED:
- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials

REFERENCES:

PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

- **Attention (attract)**
- **Begin**
- **Curiosity (arouse)**
- **Association**
- **Interest (create)**
- **Students**
- **Desire (stimulate)**
- **Experience**

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. ADVERSE WEATHER CONDITIONS

A. Factors to consider
   1. Rain
   2. Snow
   3. Ice
   4. Mud
   5. Fog
   6. Dust

B. Must recognize these conditions and adjust speed accordingly
   1. Crown of roads
   2. Sharpness of curves
   3. Condition of road surfaces
   4. Decreased visibility
      a) Frosted and ice covered windows
      b) Heavy rain conditions
      c) Decrease speed gradually
      d) Keep off low or soft shoulders

C. Recognize areas that become slippery first
   1. Bridge surfaces
   2. Northern slopes
   3. Shaded spots
   4. Areas where snow blows across road
D. Stopping distance
1. Greatly increased on slippery roads
2. Try brakes while in an area free of traffic
3. Speed adjusted so stopping or maneuvering can be done safely
4. Snow or ice
   a) It takes 3-15 times more distance to stop than on dry pavement
5. Fog
   a) Be prepared to stop within the space you can see in front of your vehicle
6. Dust
   a) Can decrease visibility very rapidly

II. EQUIPMENT
A. Must be prepared for adverse weather conditions
B. Windshield
   1. Windshield wipers and defrosters must keep windshield clean and clear
C. Snow tire and chains
   1. Will reduce stopping distances
   2. Will increase traction
   3. Chains
      a) Traditional
         1) Manually applied
      b) Automatic
         1) Short lengths of chain on a rotating hub in front of each rear wheel
         2) Hubs swing down into place when cab switch is activated
3) Hub throws the chains underneath the rolling tires
4) They tend to lose effectiveness in snow greater than 8 inches deep

D. Lights
1. Headlights
   a) Use low beams

   1) High beams will be reflected back and cause glare

2. Fog lights
   a) Always use in conjunction with low beam headlights
   b) Never use alone

3. Turn off emergency lights
   a) In nonemergency situations and are off to the side of the road
      1) To avoid being hit by other vehicles

**NOTE:** Refer to department SOPs for additional information.
SUMMARY:
You must understand the potential effects that adverse weather conditions have on driving. By understanding the effects that adverse weather has on driving conditions, you can make allowances to afford a larger margin of safety to avoid possible accidents.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 3-8: Positioning Apparatus

TIME FRAME: 1:00

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Section 5.2

BEHAVIORAL OBJECTIVE:

Condition: Given a written test

Behavior: The student will confirm a knowledge of positioning apparatus by completing the written test


MATERIALS NEEDED:

• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials

REFERENCES:


PREPARATION:

Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

- Attention (attract)
- Begin
- Curiosity (arouse)
- Association
- Interest (create)
- Students
- Desire (stimulate)
- Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section “from the heart.” Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. POSITIONING APPARATUS AT INCIDENTS
   A. Fire attack
   B. Wildland incidents
   C. Support
   D. Special situations

II. FIRE ATTACK
   A. Multiple factors must be considered
   B. Begins with size-up
      1. Nothing showing
         a) Park near main entrance
         b) Be prepared to support fire attack operations
            1) Connect to water supply
            2) Connect to sprinkler/standpipes
            3) Pull attack hoselines
      2. Smoke showing
         a) Park upwind out of smoke
            1) Best tactical position
      3. Fire involvement
         a) Park away from heat and smoke
            1) Best tactical position

C. Department SOPs
   1. Follow based on situation
2. Allow for safety
3. Allow for next-in apparatus to position effectively

D. Rescue situations
1. Primary objective
2. Consider need for ground ladder position
3. Position of aerial ladder if needed

E. Water supply
1. Can incident be handled with tank water?
2. Does a supply hoseline need to be used?
   a) Lay supply hoseline to side of street
3. Is there a need to use a fire department connection (FDC)?
4. Will aerial/ladder support be needed?

F. Method of attack
1. Whether or not these methods can be used, depends on the position of the apparatus
   a) Handline use
      1) Position so that nozzle can reach seat of fire
   b) Master streams
      1) Position so that hoseline can effectively supply them
   c) Turret or deck guns
      1) Position so that fire stream can reach intended target

G. Exposures
1. Where are your exposures in relation to the fire?
2. What are your exposures?
3. Do not make the apparatus an exposure
H. Wind direction

1. Park upwind if possible
   a) Keep out of smoke
   b) Negates need for driver/operator to wear SCBA
   c) Reduces possibility of apparatus becoming an exposure if fire conditions worsen
   d) If hazardous materials involved it will lessen chances of contamination of apparatus and personnel

I. Terrain

1. Best on paved surface
2. Uphill if possible
   a) Except on wildland incidents

J. Relocation potential

1. Always leave yourself an out

K. Structural collapse zone considerations

1. Equal to height of building
2. Position apparatus at corners
   a) If not being used by aerial/ladder apparatus
3. Indicators of possible unstableness in building
   a) Bulging walls
b) Large cracks in exterior
c) Falling bricks, blocks, or mortar
d) Interior collapses
e) Falling debris
   1) Large pieces of glass

4. Pre-incident planning can identify old or poorly maintained buildings
   a) Ornamental stars at intervals on exterior walls
   b) Large bolts with washers on exterior walls

**SLIDE: 3-8-11**

L. Utilities
   1. Overhead electrical lines
      a) Identified
      b) Illuminated if at night
      c) Down electrical lines
         1) Assume they are live/hot
   2. Gas lines
      a) If leaking, stay out of gas cloud

**SLIDE: 3-8-12**

III. WILDLAND INCIDENTS
   A. Can be dynamic
      1. Potential to relocate several time during the incident
      2. Must be more flexible

   B. Structure protection factors
      1. Back in from last known turnaround

      a) Ensures easy exit from area

   Why should you back the apparatus into a driveway?
2. Note any landmarks
3. Park off the roadway to allow for other apparatus or evacuating private vehicles
4. Avoid flammable vegetation
   a) Park in the burn if possible
5. Position on leeside of structure to protect apparatus from heat and embers
6. Position near structure to keep hoselines short
   a) But not too close
7. Keep apparatus doors and windows closed
8. Identify and avoid potential hazards
   a) Power lines
   b) Trees or snags
   c) LPG tanks or other pressure vessels
   d) Exposures that might burn

C. Making a wildland fire attack
   1. Wildland fire attack will incorporate a variety of positions
   2. Driver/operator must be constantly aware of fires current location and direction of travel
   3. Smoke, high brush, and dense vegetation often limit vision

   4. Safety is the top priority for crew and apparatus
      a) Reduce speed appropriately
      b) Use spotters to help avoid obstacles
         1) Logs
         2) Stumps and stobs
         3) Rocks

What is the highest priority during a wildland fire attack?
<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>4) Low hanging limbs</td>
<td></td>
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<td>5) Ditches</td>
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<tr>
<td>6) Gullies</td>
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<tr>
<td>7) Unstable ground</td>
<td></td>
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<tr>
<td>8) Other apparatus in area</td>
<td></td>
</tr>
<tr>
<td>• Engines</td>
<td></td>
</tr>
<tr>
<td>• Dozers</td>
<td></td>
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<tr>
<td>• Hand crew</td>
<td></td>
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<tr>
<td>• Aircraft</td>
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<tr>
<td>c) Spotters should stay in view of the driver/operator at all times and be equipped with</td>
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<tr>
<td>1) Handlights</td>
<td></td>
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<tr>
<td>2) Highly visible PPE</td>
<td></td>
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<tr>
<td>3) Radios</td>
<td></td>
</tr>
</tbody>
</table>

5. Slipping, sliding, and overturning hazards can be present
   a) Steep hillsides
   b) Loose or unstable ground
   c) Sand, mud, or soft ground
   d) Rocks
   e) Shoulders of railroad beds

6. Weight limitations
   a) Can be hazardous crossing bridges if bridge will not support weight of apparatus

7. Keep hoselines as short as possible
   Why should you keep hoselines short?
   a) To reduce the chance of being tangled around objects
8. Use tandem approach
   a) First engine goes along fire edge and knocks fire down as much as possible
   b) Second engine follows and makes sure fire is completely extinguished and mops up
   c) Helps ensure complete extinguishment

9. If apparatus is stationary during fire attack
   a) Position to protect from heat and flames
      1) Use natural or artificial barriers
         • Streams or roads
   b) Evaluate for possible hazards
      1) Falling debris
      2) Rolling rocks
      3) Air drops
      4) Heavy equipment building control lines
   c) Short 1½" or 1¾" hoseline should be deployed and charged for protection
   d) Wheels should always be chocked
   e) Always face apparatus in exit direction

10. Basic safety procedures for wildland fire attack
    a) Engine parked in safety zones
    b) Engine should not be left unattended
    c) Effective communication/coordination with rest of fireground organization
    d) Headlights on whenever engine is running

   Why do you leave the headlights on when the engine is running?
   1) Allows for easy location during heavy smoke conditions
<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2) Engine should be backed into one-way roads and driveways</td>
<td>SLIDE: 3-8-18</td>
</tr>
<tr>
<td>3) Facing the escape route</td>
<td></td>
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<tr>
<td>e) All windows rolled up</td>
<td></td>
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<tr>
<td>1) To prevent burning embers from entering cab</td>
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<tr>
<td>f) Engine and crew should draw back to flanks if fire is spreading rapidly upslope</td>
<td></td>
</tr>
<tr>
<td>g) Engine position should maximize protection from heat and fire while considering hazards</td>
<td></td>
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<tr>
<td>1) Overhead power lines</td>
<td></td>
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<tr>
<td>2) Heavy fuel stands</td>
<td></td>
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<tr>
<td>3) Incoming air drops</td>
<td></td>
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<tr>
<td>h) Take advantage of natural barriers and use protection lines</td>
<td></td>
</tr>
<tr>
<td>i) Use spotters in unburned fuels higher than bumper or running board levels</td>
<td>SLIDE: 3-8-19</td>
</tr>
<tr>
<td>j) Attack fires from the burned area</td>
<td></td>
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<tr>
<td>k) Be aware of fire conditions</td>
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<tr>
<td>l) Know where crews are if you are moving apparatus near them</td>
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<tr>
<td>m) If you have to drive through smoke</td>
<td></td>
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<tr>
<td>1) Sound horn or siren intermittently</td>
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<tr>
<td>2) Use warning lights and headlights</td>
<td></td>
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<tr>
<td>3) Drive slowly</td>
<td>SLIDE: 3-8-20</td>
</tr>
</tbody>
</table>

IV. SUPPORT APPARATUS POSITIONING

A. Rescue/squad apparatus

1. Position near the incident without blocking access of incoming apparatus
B. Command vehicle
   1. Provide maximum visibility of incident

C. Breathing air supply apparatus
   1. Positioning much the same as rescue vehicles

V. SPECIAL POSITIONING SITUATIONS

A. Staging
   1. Level 1
      a) When two companies performing like-functions are dispatched
      b) First engine goes to the scene
      c) Second engine stages a block away
         1) Near incident
         2) But out of the way of working apparatus
      d) Quick and easy response is possible
      e) Sidestreet or access route
         1) Do not block-in apparatus in driveways, alleyways, etc.
      f) Uphill and upwind if possible
      g) In accordance with department SOPs
   2. Level 2
      a) When numerous apparatus respond
      b) Additional units stage at a designated area
      c) First-in company officer can be used as staging officer

What would be the apparatus placement for a Level 1 staging?

What would be the apparatus placement for Level 2 staging?
1) Staging officer's apparatus' emergency lights should be left on to easily identify his or her location

d) Additional apparatus reports to staging officer
e) Staging officer communicates resources to IC
f) IC will communicate needs to staging officer
   1) Staging officer will then notify staged apparatus to respond
g) Staging area
   1) Should be free of nonemergency traffic
h) Apparatus in staging should turn off emergency lights when parked

B. Highways and freeways
1. Use warning devices in accordance with state law and department SOPs
   a) Keep warning lights to a minimum
      1) Prevent blinding or distracting other drivers
2. Follow law enforcement direction if they are on-scene and it is best for incident operations
3. Identify fluid spills from vehicles
   a) Position accordingly
4. Angle apparatus across lanes
   a) Use as a barrier to protect personnel

NOTE: See Figure 5.73 on page 127 in Pumping Apparatus Driver/Operator Handbook, IFSTA, Second Edition.
5. Turn front wheels away from where fire fighters are working
6. Allow plenty of working space between fire fighters and apparatus
7. Consider positioning additional apparatus 150-200 feet behind initial apparatus position
8. Use extreme caution when personnel are exiting and entering the apparatus
   a) Use same caution when deploying handlines and other equipment

C. Hazardous materials
   1. Do not drive directly into scene without first attempting to identify the material
   2. Determine wind speed and direction
      a) Ensures you are not downwind of the incident

   3. Use routes that will allow the apparatus to approach from uphill or upwind side
   4. Position apparatus to accommodate isolation and denial of entry if possible
   5. Identify hot, warm, and cold zones
      a) Communicate to additional apparatus responding
   6. Avoid positioning in same location if incident is a bomb threat or potential terrorism
      a) Devices could be located in these areas

D. Near railroads
   1. Always treat railroad tracks as potential active lines
   2. Never position the apparatus across railroad tracks
   3. Position apparatus far enough away so that it will not be struck by a passing train
   4. Position apparatus on same side of tracks as incident
   5. If hose needs to be laid across tracks
      a) Try and confirm train traffic has been halted
b) If unable to do so
   1) Use aerial apparatus to run hose overhead
      • Use caution due to overhead power lines
   2) Run hose underneath tracks
      • Run uncharged hoselines under tracks
      • Charge hoseline once in place

What factors should you consider when positioning apparatus at an EMS incident?

SLIDE: 3-8-25

E. EMS
   1. Position near scene
      a) Allow for transport access
      b) Park legally first, if possible
   2. If on the roadway, position apparatus as a barrier to protect crews

NOTE: See Figure 5.73 on page 127 in Pumping Apparatus Driver/Operator Handbook, IFSTA, Second Edition.

VI. APPARATUS SECURITY

A. At stations
   1. Secure station grounds
      a) Shut and lock gates
      b) Close apparatus bay doors
      c) Set security system
      d) Turn on security lighting

SLIDE: 3-8-26

B. At incidents
   1. When possible do not leave apparatus unattended
   2. If necessary to leave unattended

SLIDE: 3-8-27
a) Roll up windows  
b) Lock cab and compartment doors

C. In staging
1. Stay with apparatus at all times  
2. Stay alert for possible problems  
a) Riot situations  
b) Suspicious individuals or groups

D. Other
1. Inspections  
a) Park in safe area  
   1) Well lit if at night  
   2) Highly visible areas  
b) Lock apparatus  
2. Repairs/maintenance  
a) If outside shop area, lock apparatus  
b) Roll up windows  
c) In well lit areas if possible  
3. Drills  
a) Keep apparatus in view  
b) Lock apparatus  
4. Public service venues  
a) Try to leave one person with apparatus  
b) If unable to leave one person  
   1) Park in safe area  
      • Well lit if at night  
      • Highly visible areas  
   2) Lock apparatus  

What should you do if you must leave your apparatus?

SLIDE: 3-8-28
SUMMARY:
Whether you are involved in fire attack, wildland, EMS, hazardous materials, or rescue incidents, apparatus positioning is vital to the overall success of an incident. Water supply, structure and exposure locations, wind direction, terrain, and potential hazards are factors that can determine where the most optimal apparatus position should be. Knowing and using all of this information will help ensure a safe and efficient incident operation.

EVALUATION:
The student will complete the written test at a time determined by the instructor.

ASSIGNMENT:
TOPIC: 4-1: Introduction To The Mandatory Driving Exercises

TIME FRAME: 0:30 (Introduction only)

LEVEL of INSTRUCTION: Level II

AUTHORITY: 2009 NFPA 1002: Appendix A

BEHAVIORAL OBJECTIVE:
Condition: Given an activity
Behavior: The student will demonstrate the ability to negotiate a fire apparatus through the mandatory driving exercises

MATERIALS NEEDED:
• Writing board/pad with markers/erasers
• Appropriate audiovisual equipment
• Appropriate audiovisual materials
• Mandatory Driving Exercise 4-1-1: Diminishing Clearance Exercise
• Mandatory Driving Exercise 4-1-2: Serpentine Exercise
• Mandatory Driving Exercise 4-1-3: Three-Point Turnaround Exercise
• Mandatory Driving Exercise 4-1-4: Station Apparatus Backing Exercise
• Mandatory Driving Exercise 4-1-5: Alley Dock Exercise

REFERENCES:
• Fire Apparatus Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 80-92

PREPARATION: Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.
Attention (attract)  Begin
Curiosity (arouse)  Association
Interest (create)  Students
Desire (stimulate)  Experience

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. MANDATORY DRIVING EXERCISES
   A. Designed to assist the driver/operator in becoming familiar with how an apparatus handles under various situations

II. DIMINISHING CLEARANCE
   A. Overview
      1. Steer the apparatus in a straight line
      2. Judge distances from wheel to object
      3. Stop at a designated finish line
      4. The speed at which the apparatus is driven is fast enough to require the driver/operator to exercise quick judgment

   B. Course description
      1. Two rows of markers forming a lane
      2. 75 feet long
      3. Starting width – 9'6"
      4. Diminishing width – 8'2"
      5. Finish line is 50 feet from the last marker
      6. Markers are placed no more than 20 feet apart

   C. Apparatus operation
      1. Accelerate to the course speed in the approach area
         a) 15-20 mph
      2. Maneuver the apparatus through the lane without touching the side markers
      3. The designated end marker, bring the apparatus to a complete stop
         a) Front bumper short of the end marker
4. Wait for the end measurement to be taken
5. When instructed, back the apparatus through the lane without touching the side markers
6. Bring the apparatus to a complete stop
   a) After clearing entry markers

D. Scoring criteria
   1. 100 points possible
   2. 5 points subtracted each time the apparatus touches a side marker
   3. 5 points subtracted each time the apparatus stops while in the diminishing alley
   4. 10 points subtracted if apparatus stops 6-12 inches before the end marker or 20 points subtracted if apparatus stops more >12-18 inches before the end marker. The student fails if the apparatus stops >18 inches from the end marker
      a) Distance is measure from the end marker to the front bumper.
   5. The student fails if the apparatus touches the end marker
   6. The student fails if a speed of 15-20 mph is not maintained during the exercise
   7. The student fails if he or she does not maintain control of the apparatus during the exercise
   8. Passing score is 80%

III. SERPENTINE EXERCISE
   A. Overview
      1. Simulates maneuvering around parked and stopped vehicles and tight corners
      2. The driver/operator maneuvers the apparatus forward and backward in one continuous motion without touching any of the course markers
B. Course description
   1. Three markers forming a straight line
   2. Each marker is placed an equal distance apart
      a) From 30 feet to 38 feet
      b) Based on the size of the apparatus
C. Apparatus operation
   1. Drive the apparatus along the left side of the markers in a straight line
   2. Bring the apparatus to a complete stop
      a) Just beyond the last marker
   3. Back the apparatus between the markers by passing to the left of Marker #1, to the right of Marker #2, and to the left of Marker #3
   4. Bring the apparatus to a complete stop
   5. Drive the apparatus forward between the markers by passing to the right of Marker #3, to the left of Marker #2, and to the right of Marker #1

D. Scoring criteria
   1. 100 points possible
   2. 5 points subtracted for each marker passed on the wrong side
   3. 5 points subtracted each time the apparatus stops during the exercise
   4. The student fails if the apparatus touches a marker
   5. The student fails the performance exam if he or she does not maintain control of the apparatus during the exercise
   6. Passing score is 80%
IV. THREE-POINT TURNAROUND EXERCISE

A. Overview
   1. Turn the apparatus around within a confined space without striking obstacles

B. Course description
   1. The turn is accomplished within a 50'x100' area
   2. Entry point at one end is 12 feet wide

C. Apparatus operation
   1. Drive forward through the 12-foot opening in the center of one of the 50-foot legs
   2. Turn the apparatus
      a) Either direction (left or right)
   3. Bring the apparatus to a complete stop
      a) Without touching a cone or extending beyond the course boundaries
   4. Back the apparatus far enough to accommodate the turn to proceed out
      a) Without touching a cone or extending beyond the course boundaries
   5. Make the turn
   6. Proceed to the exit point
   7. Bring the apparatus to a complete stop
      a) After clearing the exit point

D. Scoring criteria
   1. 100 points possible
   2. 10 points subtracted if the wheels turn while the apparatus is stopped
   3. The student fails if the apparatus touches a marker
   4. The student fails if the apparatus travels outside the exercise boundaries
5. The student fails if he or she exceeds three directional changes as outlined in the diagram
6. The student fails if he or she does not maintain control of the apparatus during the exercise
7. Passing score is 80%

V. STATION APPARATUS BACKING EXERCISE

A. Overview
1. Move the apparatus backward within a restricted area and into a fire station without striking the walls
2. Bring the apparatus to a smooth stop
   a) Close to a rear wall

B. Course description
1. Simulated street 30 feet wide
2. Apron off the street is 20 feet deep and 24 feet wide
3. Engine bay off the apron is 12 feet wide x apparatus length plus 10 feet for depth

C. Apparatus operation
1. Drive down the simulated street in a straight line
   a) Past the apron located on your left
2. Bring the apparatus to a complete stop
   a) After passing the apron opening
3. Back the apparatus into the designated bay
4. Bring the apparatus to a complete stop
   a) After the front bumper clears the first two 48-inch markers
5. Drive the apparatus forward
   a) Making a right turn
VI. ALLEY DOCK EXERCISE

A. Overview
   1. Move the apparatus backward within a restricted area and into an alley, dock, or fire station without striking the walls
   2. Bring the apparatus to a smooth stop
      a) Close to a rear wall

B. Course description
   1. Restricted area is 40 feet wide
   2. Alley dock is 12 feet x 20 feet
   3. Rear center marker indicates the end of the alley dock

C. Apparatus operation
   1. Drive past the alley dock area
      a) Located on the driver's left side
2. Bring the apparatus to a complete stop  
   a) After passing the alley dock area  
3. Back the apparatus into the alley dock area  
   a) Hard left turn  
4. Bring the apparatus to a complete stop  
   a) Within 18 inches of the center marker  
5. Set the parking brake  
6. When instructed, drive forward  
   a) Out of the alley dock area  
7. Repeat the exercise from opposite direction  

NOTE: This exercise should be practiced while backing from both sides of the alley dock area. The student will be tested while backing only from the left side.

D. Scoring criteria  
1. 100 points possible  
2. 5 points subtracted each time the apparatus touches a marker in the restricted area  
3. 10 points subtracted if apparatus stops 6-12 inches before the end marker  
4. Or 20 points subtracted if apparatus stops more >12-18 inches before the end marker  
5. The student fails if the apparatus stops >18 inches from the end marker  
   a) Distance is measure from the end marker to the front bumper.  
6. The student fails if the apparatus touches the end marker  
7. The student fails if the apparatus touches a side marker  
8. The student fails if the apparatus breaks the plane denoted by the markers  
9. The student fails if he or she does not maintain control of the apparatus during the exercise  
10. Passing score is 80%
VII. SAFETY CONSIDERATIONS

A. Check your apparatus before operating
   1. Ensure everything is in proper operating condition

B. Check the condition of the surface where the exercise will take place
   1. Cracks
   2. Holes
   3. Fluid spills
      a) Oil
      b) Water
      c) Fuel
   4. Ice
   5. Foreign objects
      a) Nails
      b) Glass

C. Wear appropriate PPE
   1. As required by testing department/college SOPs

D. Review and follow all instructions with your evaluator before beginning any exercise

E. Operate the apparatus with due regard at all times
   1. Maintain control at all times

F. Use spotters for safety
   1. Cannot be used as backers

G. Check your apparatus after completing the exercise
   1. Advise staff of any problems found
SUMMARY:
Although no driver/operator can prepare for every driving situation that can occur in the field, understanding apparatus dynamics and how they affect apparatus control on the roadway is imperative. Just as important is the opportunity to apply the knowledge of apparatus dynamics in a controlled environment to develop the skills necessary to drive safely and efficiently.

EVALUATION:
The student will complete the mandatory driving exercises at a time determined by the instructor.

ASSIGNMENT:
MANDATORY DRIVING EXERCISE 4-1-1

EXERCISE: Diminishing Clearance Exercise

This exercise measures the students' ability to steer the apparatus in a straight line, to judge distances from wheel to object, and to stop at a designated finish line. The speed at which the apparatus is driven is fast enough to require the students to exercise quick judgment.

TIME FRAME: None

AUTHORITY: 2009 NFPA 1002: Section A.4.3.5

MATERIALS NEEDED:
- Fire apparatus
- 8,250 square foot area
- 48-inch pillars (9)
- Stopwatch
- 100-foot tape measure

INSTRUCTOR DIRECTIONS:
1. Student should accelerate to the course speed of 15-20 mph in the approach area.
2. To ensure this speed is maintained, it should take the student no more than 3 seconds to travel the 75-foot lane.
3. Provide adequate space to perform the exercise without risk of collision.

STUDENT DIRECTIONS:
1. Accelerate to the course speed in the approach area.
2. Maneuver the apparatus through the lane without touching the side markers.
3. At the designated end marker, stop the apparatus with the front bumper short of the end marker.
4. Wait for the end measurement to be taken.
5. When instructed, back the apparatus through the lane without touching the side markers.
6. Stop the apparatus after clearing entry markers.
**SCORING:**

<table>
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<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100 points possible</td>
</tr>
<tr>
<td>80%</td>
<td>80% passing</td>
</tr>
<tr>
<td>5</td>
<td>5 points subtracted each time the apparatus touches a side marker.</td>
</tr>
<tr>
<td>5</td>
<td>5 points subtracted each time the apparatus stops before reaching the end marker.</td>
</tr>
<tr>
<td>10</td>
<td>10 points subtracted if apparatus stops 6-12 inches before the end marker or 20 points subtracted if apparatus stops more &gt;12-18 inches before the end marker. The student fails if the apparatus stops &gt;18 inches from the end marker. Distance is measure from the end marker to the front bumper.</td>
</tr>
<tr>
<td></td>
<td>4. The student fails if the apparatus touches the end marker.</td>
</tr>
<tr>
<td></td>
<td>5. The student fails if a speed of 15-20 mph is not maintained during the exercise.</td>
</tr>
<tr>
<td></td>
<td>6. The student fails if he or she does not maintain control of the apparatus during the exercise.</td>
</tr>
</tbody>
</table>

**SITE PREPARATION:**

- Markers are set up as shown.
- Unless indicated, marker spacing shall be of equal distance.
- Two rows of side markers form a lane 75-feet long.
- Beginning width of 9 inches wider than the apparatus.
- Lane diminishes to a clearance width of 1 inch.
MANDATORY DRIVING EXERCISE 4-1-2

EXERCISE: Serpentine Exercise

This exercise simulates maneuvering around parked and stopped vehicles and tight corners. The students maneuver the apparatus forward and backward in one continuous motion without touching any of the course markers.

TIME FRAME: None

AUTHORITY: 2009 NFPA 1002: Section A.4.3.3

MATERIALS NEEDED:
- Fire apparatus
- 8,000 square foot area
- 48-inch pillars (3)
- 100-foot tape measure

INSTRUCTOR DIRECTIONS:
1. For the purposes of this exercise, apparatus length is measured from the front bumper to the end of the tailboard.
2. For the purposes of this exercise, apparatus width is 8 feet.
3. Provide adequate space to perform the exercise without risk of collision.

STUDENT DIRECTIONS:
1. Drive the apparatus along the left side of the markers in a straight line.
2. Stop just beyond the last marker.
3. Back the apparatus between the markers by passing to the left of Marker #1, to the right of Marker #2, and to the left of Marker #3.
4. Stop the apparatus.
5. Drive the apparatus forward between the markers by passing to the right of Marker #3, to the left of Marker #2, and to the right of Marker #1.
SCORING: 100 points possible 80% passing

1. **5 points** subtracted for each marker passed on the wrong side.
2. **5 points** subtracted each time the apparatus stops during the exercise.
3. The student **fails** if the apparatus touches a marker.
4. The student **fails** the performance exam if he or she does not maintain control of the apparatus during the exercise.

SITE PREPARATION:

- Markers are set up as shown.
- Place three markers in a straight line, equal distance apart.
- Ensure adequate space is available on both sides of the markers for the apparatus to move freely.

30'-38'
Based on the size of the apparatus
MANDATORY DRIVING EXERCISE 4-1-3

**EXERCISE:** Three-Point Turnaround Exercise

This exercise tests the students' ability to turn the apparatus around within a confined space without striking obstacles.

**TIME FRAME:** None

**AUTHORITY:** 2009 NFPA 1002: Section A.4.3.4

**MATERIALS NEEDED:**
- Fire apparatus
- 5,000 square foot area
- 18-inch cones (16)
- 100-foot tape measure

**INSTRUCTOR DIRECTIONS:**
1. The turn is accomplished within a 50'x100' area. Provide adequate space to perform the exercise without risk of collision.

**STUDENT DIRECTIONS:**
1. Drive forward through the 12-foot opening in the center of one of the 50-foot legs.
2. Turn the apparatus either direction (left or right).
3. Bring the apparatus to a complete stop without touching a marker or extending beyond the course boundaries.
4. Back the apparatus far enough to accommodate the turn to proceed out without touching a marker or extending beyond the course boundaries.
5. Make the turn.
6. Proceed to the exit point.
7. Bring the apparatus to a complete stop after clearing the exit point.
**SCORING:**

<table>
<thead>
<tr>
<th>100 points possible</th>
<th>80% passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 10 points subtracted if the wheels are turned when the apparatus is stopped.</td>
<td></td>
</tr>
<tr>
<td>2. The student <strong>fails</strong> if the apparatus touches a marker.</td>
<td></td>
</tr>
<tr>
<td>3. The student <strong>fails</strong> if the apparatus travels outside the exercise boundaries.</td>
<td></td>
</tr>
<tr>
<td>4. The student <strong>fails</strong> if he or she exceeds three directional changes as outlined in the diagram.</td>
<td></td>
</tr>
<tr>
<td>5. The student <strong>fails</strong> if he or she does not maintain control of the apparatus during the exercise.</td>
<td></td>
</tr>
</tbody>
</table>

**SITE PREPARATION:**

- Markers are set up as shown.
- Align markers in straight lines, equal distance apart.
- Size of exercise is 50’x100’.
- Width of approach gate is 12 feet.
MANDATORY DRIVING EXERCISE 4-1-4
Exercise 4-1-5, the Alley Dock, may be substituted for this exercise.

**EXERCISE:** Station Apparatus Backing Exercise

This exercise tests the students’ ability to move the apparatus backward within a restricted area and into a fire station without striking the walls and to bring the apparatus to a smooth stop close to a rear wall.

**TIME FRAME:** None

**AUTHORITY:** 2009 NFPA 1002: Section A.4.3.2(b)

**MATERIALS NEEDED:**
- Fire apparatus
- 5,000 square foot area
- 48-inch pillars (4)
- 18-inch cones (14)
- 100-foot tape measure

**INSTRUCTOR DIRECTIONS:**
1. Provide adequate space to perform the exercise without risk of collision.

**STUDENT DIRECTIONS:**
1. Drive down the simulated street in a straight line, past the driveway apron located on your left.
2. Bring the apparatus to a complete stop after passing the driveway apron opening.
3. Back the apparatus into the designated bay.
4. Bring the apparatus to a complete stop after the front bumper clears the first two 48-inch pillars.
5. Drive the apparatus forward, making a right turn.
6. Bring the apparatus to a complete stop after finishing the turn.
7. Back the apparatus into the designated bay.
8. Bring the apparatus to a complete stop after the front bumper clears the first two 48-inch pillars.
**SCORING:**

1. **5 points** subtracted each time the apparatus stops within the alley before reaching the end.
2. The student **fails** if the apparatus touches a marker.
3. The student **fails** if he or she does not maintain control of the apparatus during the exercise.

**SITE PREPARATION:**

- Markers are set up as shown.
- Unless indicated, marker spacing shall be of equal distance.
- The boundary lines for the restricted area should be 30 feet wide, similar to curb-to-curb distance.
- Along one side and perpendicular is another simulated area 20’ x 24’ and again reduced to 12 feet x vehicle length plus 10 feet.
- Each simulated area shall be centered end from end of next largest area.

Depth of parking bay is Apparatus length + 10'
MANDATORY DRIVING EXERCISE 4-1-5
Exercise 4-1-4, Station Apparatus Backing, may be substituted for this exercise.

**EXERCISE:** Alley Dock Exercise

This exercise tests the students' ability to move the apparatus backward within a restricted area and into an alley, dock, or fire station without striking the walls and to bring the apparatus to a smooth stop close to a rear wall.

**TIME FRAME:** None

**AUTHORITY:** 2009 NFPA 1002: Section A.4.3.2(a)

**MATERIALS NEEDED:**
- Fire apparatus
- 6,000 square foot area (60x100)
- 48-inch pillars (5)
- 18-inch cones (12)
- 100-foot tape measure

**INSTRUCTOR DIRECTIONS:**
1. Provide adequate space to perform the exercise without risk of collision.

**STUDENT DIRECTIONS:**
1. Drive past the alley dock area located on the your left.
2. Bring the apparatus to a complete stop after passing the alley dock area.
3. Back the apparatus into the alley dock area, making a hard left turn.
4. Bring the apparatus to a complete stop within 18 inches of the center marker.
5. Set the parking brake.
6. When instructed, drive forward out of the alley dock area.

**SCORING:**

100 points possible 80% passing

1. **5 points** subtracted each time the apparatus stops within the alley before reaching the end marker.
2. **10 points** subtracted if apparatus stops 6-12 inches before the end marker or **20 points** subtracted if apparatus stops more >12-18 inches before the end marker.
**EXERCISE:** Alley Dock Exercise

The student **fails** if the apparatus stops >18 inches from the end marker. Distance is measured from the end marker to the front bumper.

3. The student **fails** if the apparatus touches the end marker.
4. The student **fails** if the apparatus touches a side marker.
5. The student **fails** if he or she breaks the plane denoted by the markers.
6. The student **fails** if he or she does not maintain control of the apparatus during the exercise.

**SITE PREPARATION:**

- Markers are set up as shown.
- Markers shall be aligned in straight lines.
- Unless indicated, marker spacing shall be of equal distance.
- The boundary lines for the restricted area should be 40-feet wide, similar to curb-to-curb distance.
- Along one side and perpendicular is another simulated area 12' x 20'.
- Smaller simulated area is 60 feet from the end of the opposite approach.
# MANDATORY DRIVING EXERCISES SCORING SHEET

## 4-1-1: DIMINISHING CLEARANCE EXERCISE

<table>
<thead>
<tr>
<th>Rated Component</th>
<th>Frequency</th>
<th>Value</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apparatus touches a side marker</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2. Apparatus stops before reaching the end marker</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3. Apparatus stops 0-6 inches before the end marker</td>
<td></td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>OR Apparatus stops &gt;6-12 inches before the end marker</td>
<td>□ 0-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR Apparatus stops &gt;12-18 inches before the end marker</td>
<td>□ &gt;6-12</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>OR Apparatus stops &gt;18 inches before the end marker</td>
<td>□ &gt;12-18</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>□ &gt;18 Failure</td>
<td></td>
<td></td>
<td>Fail</td>
</tr>
<tr>
<td>4. Apparatus touches the end marker</td>
<td>□ Yes</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>5. Speed is not maintained (&gt;3 seconds in lane)</td>
<td>□ Yes</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>6. Driver/operator fails to maintain control of the apparatus</td>
<td>□ Yes</td>
<td>Failure</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL POINTS:**

**PASSING SCORE:** 80

Scorer's Name: ____________________________________________________________

Signature: ______________________________________________________________

4-1-1 NOTES:

---

## 4-1-2: SERPENTINE EXERCISE

<table>
<thead>
<tr>
<th>Rated Component</th>
<th>Frequency</th>
<th>Value</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apparatus passes a marker on the wrong side</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2. Apparatus stops during the exercise</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3. Apparatus touches a marker</td>
<td>□ Yes</td>
<td>Failure</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL POINTS:**

**PASSING SCORE:** 80

Scorer's Name: ____________________________________________________________

Signature: ______________________________________________________________

4-1-2 NOTES:
### 4-1-3: THREE-POINT TURNAROUND EXERCISE

Penalty points subtracted from 100 possible points.

<table>
<thead>
<tr>
<th>Rated Component</th>
<th>Frequency</th>
<th>Value</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wheels turned while the apparatus is stopped</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2. Apparatus touches a marker</td>
<td>Yes</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>3. Apparatus travels outside the exercise boundaries</td>
<td>Yes</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>4. Driver/operator exceeds three directional changes</td>
<td>Yes</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>5. Driver/operator fails to maintain control of the apparatus</td>
<td>Yes</td>
<td>Failure</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL POINTS:**

**PASSING SCORE:** 80

Score of Name: __________________________
Signature: __________________________

**PASS/FAIL:**
- ☐ Pass
- ☐ Fail
- ☐ Retest

### 4-1-4: STATION APPARATUS BACKING EXERCISE

Penalty points subtracted from 100 possible points.

<table>
<thead>
<tr>
<th>Rated Component</th>
<th>Frequency</th>
<th>Value</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apparatus stops within the alley before reaching the end</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2. Apparatus touches a marker</td>
<td>Yes</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>3. Driver/operator fails to maintain control of the apparatus</td>
<td>Yes</td>
<td>Failure</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL POINTS:**

**PASSING SCORE:** 80

Score of Name: __________________________
Signature: __________________________

**PASS/FAIL:**
- ☐ Pass
- ☐ Fail
- ☐ Retest

### 4-1-4 NOTES:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
### 4-1-5: ALLEY DOCK EXERCISE

Penalty points subtracted from 100 possible points.

<table>
<thead>
<tr>
<th>Rated Component</th>
<th>Frequency</th>
<th>Value</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apparatus stops within the alley before reaching the end marker</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2. Apparatus stops 0-6 inches before the end marker</td>
<td>□ 0-6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>OR Apparatus stops &gt;6-12 inches before the end marker</td>
<td>□ &gt;6-12</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>OR Apparatus stops &gt;12-18 inches before the end marker</td>
<td>□ &gt;12-18</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>OR Apparatus stops &gt;18 inches before the end marker</td>
<td>□ &gt;18</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>3. Apparatus touches the end marker</td>
<td>□ Yes</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>4. Apparatus touches a side marker</td>
<td>□ Yes</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>5. Apparatus breaks the plane denoted by the markers</td>
<td>□ Yes</td>
<td>Failure</td>
<td></td>
</tr>
<tr>
<td>6. Driver/operator fails to maintain control of the apparatus</td>
<td>□ Yes</td>
<td>Failure</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL POINTS:**

**PASSING SCORE:** 80

Scorer’s Name: ____________________________
Signature: ____________________________

**PASS/FAIL:**
- □ Pass
- □ Fail
- □ Retest

**4-1-5 NOTES:**

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October 2008

4-1: Introduction To The Mandatory Driving Exercises

Page 24
**TOPIC:** 5-1: Introduction To The Optional Driving Exercises

**TIME FRAME:** 0:15 (Introduction only)

**LEVEL of INSTRUCTION:** Level II

**AUTHORITY:** 2009 NFPA 1002: Appendix A

**BEHAVIORAL OBJECTIVE:**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Given an activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior</td>
<td>The student will demonstrate the ability to negotiate a fire apparatus through the mandatory driving exercises</td>
</tr>
</tbody>
</table>

**Standard:** With a minimum 80% accuracy according to the information contained in the Fire Apparatus Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 93-102

**MATERIALS NEEDED:**

- Writing board/pad with markers/erasers
- Appropriate audiovisual equipment
- Appropriate audiovisual materials
- Optional Driving Exercise 5-1-1: Lane Change Exercise
- Optional Driving Exercise 5-1-2: Offset Alley Exercise
- Optional Driving Exercise 5-1-3: Dogleg Exercise
- Optional Driving Exercise 5-1-4: Parallel Parking Exercise

**REFERENCES:**


**PREPARATION:** Each instructor must develop a motivational statement on why the student should learn the upcoming material. The purpose is to establish relevancy of the lesson to the audience. The ACID BASE acronym can be used to help develop student motivation.

<table>
<thead>
<tr>
<th>Attention (attract)</th>
<th>Begin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curiosity (arouse)</td>
<td>Association</td>
</tr>
<tr>
<td>Interest (create)</td>
<td>Students</td>
</tr>
<tr>
<td>Desire (stimulate)</td>
<td>Experience</td>
</tr>
</tbody>
</table>

Cite examples or use related illustrations of near-miss incidents, injuries, or fatalities. Write this section "from the heart." Be creative! Have fun with it or be serious, but remember the goal is to stimulate student motivation.
I. OPTIONAL DRIVING EXERCISES
   A. Designed to assist the driver/operator in becoming familiar with how an apparatus handles under various situations

II. LANE CHANGE EXERCISE
   A. Overview
      1. Change lanes while moving at a constant speed
      2. Judge distances from wheel to object

   B. Course description
      1. Entry point
      2. First lane
         a) Two rows of markers
         b) 10 feet wide
      3. Second set of lanes
         a) Three lanes
         b) Four rows of markers
         c) 10 feet wide
      4. Third set of lanes
         a) Five lanes
         b) Six rows of markers
            a) 10 feet wide
      5. Exit point
         a) 10 feet wide
      6. Exit curve
         a) Two rows of markers
            1) Five on inside of the curve
2) Six on the outside of the curve
   3) Evenly spaced
   b) Widens to 12 feet wide at the last two markers

C. Apparatus operation
   1. Time begins when the instructor signals to proceed through the entry gate
   2. Time ends when the front bumper of the apparatus passes the exit gate
   3. Lane assignments will be displayed just before the apparatus enters the first lane
   4. Maneuver the apparatus through the assigned lanes
   5. Time allow to drive from entry gate to exit gate is 25 seconds
   6. Proceed through the exit curve until the apparatus clears the last set of markers
   7. Bring the apparatus to a complete stop

D. Scoring criteria
   1. 100 points possible
   2. 5 points subtracted for each marker touched by the apparatus
   3. The student fails if the apparatus stops or fails to maintain a constant forward motion within the course
   4. The student fails if he or she does not take the lane marked by the evaluator
   5. The student fails if time exceeds 25 seconds
   6. The student fails if he or she does not maintain control of the apparatus during the exercise
   7. Passing score is 80%

SLIDE: 5-1-5
III. OFFSET ALLEY EXERCISE

A. Overview
1. Simulates responding to an emergency and making a lane change through a narrow passageway without striking any nearby vehicles
2. Maneuver the apparatus at a constant speed within a confined space
3. Accurately judge the distance between the apparatus and the barriers

B. Course description
1. Entry gate
   a) 10 feet wide
2. Entry lane
   a) 10 feet long
3. Offset lane
   a) Length plus width of the apparatus
4. Exit lane
   a) 10 feet long
5. Exit gate
   a) 10 feet wide

C. Apparatus operation
1. Maintain a constant speed throughout the exercise
2. Drive through the entry gate
3. Turn the apparatus into the offset lane
4. Exit the offset lane
5. Enter the exit lane
6. Bring the apparatus to a complete stop
7. After rear bumper clears the exit gate
8. Back the apparatus following the same path
   a) Maintaining a constant speed
9. Bring the apparatus to a complete stop
   a) After front bumper clears the entry/exit gate

D. Scoring criteria
   1. 100 points possible
   2. 10 points subtracted for each marker touched by
      the apparatus
   3. 10 points subtracted each time the apparatus stops
      before reaching the end markers
   4. The student fails if he or she continues the exercise
      without realigning the apparatus after touching a
      marker
   5. The student fails if he or she does not maintain
      control of the apparatus during the exercise
   6. Passing score is 80%

IV. DOGLEG EXERCISE
   A. Overview
      1. Maneuver the apparatus within a confined space
      2. Judge distance between apparatus and objects
      3. Drive at a constant speed in both forward and
         reverse

   B. Course description
      1. Entry point
         a) 10 feet wide
      2. Changing spaces
         a) 50 feet long
      3. Direction gates
         a) 10 feet wide
      4. Diminishing lane entry point
         a) 10 feet wide
5. Diminishing lane  
   a) 50 feet long  
6. Last set of markers in diminishing lane  
   a) 8 feet-6 inches wide  
7. Center marker at end of diminishing lane  

C. Apparatus operation  
1. Maintain a constant speed throughout the exercise  
2. Drive through the entry gate  
3. Drive through first direction gate  
4. Turn in the changing space  
5. Align apparatus to enter next direction gate  
6. Proceed through all direction gates in the same manner  
7. Enter the diminishing gate  
8. Bring the apparatus to a complete stop  
   a) Before touching the center marker  
9. Back the apparatus through the course following the same path  
   a) Maintaining a constant speed  
10. Bring the apparatus to a complete stop after the front bumper passes the entry/exit gate  
11. Minimum time to complete this exercise is 0:50 seconds  
12. Maximum time to complete this exercise: 1:15  

D. Scoring criteria  
1. 100 points possible  
2. 5 points subtracted for each marker touched by the apparatus  
3. The student fails if he or she completes the course in less than 0:50 seconds  
4. The student fails he or she completes the exercise in more than 1:15 minutes
5. The student fails if he or she does not maintain control of the apparatus during the exercise

6. Passing score is 80%

V. PARALLEL PARKING EXERCISE

A. Overview
   1. Simulates aligning an apparatus for hydrant hookups or elevating device operations
   2. Parallel park within 18 inches of the curb
   3. Align the apparatus with the curb without hitting the curb or markers and with a minimum loss of apparatus motion

B. Course description
   1. Four markers
      a) 9 feet wide
      b) Distance equals apparatus length plus width
   2. Two markers next to an actual curb
      a) Or use a line to simulate a curb

C. Apparatus operation
   1. Drive the apparatus along the left side of the designated parking area
   2. Bring the apparatus to a complete stop after the rear bumper passes the last markers
   3. Back the apparatus between the markers
      a) Turning as needed
   4. Bring the apparatus to a complete stop before touching the markers or exceeding the parking area boundaries
   5. Drive the apparatus forward to straighten, if needed
   6. Bring the apparatus to a complete stop
7. Set the parking brake
8. Apparatus must be within 18 inches of the curb

D. Scoring criteria
1. 100 points possible
2. 5 points subtracted if apparatus tire brushes the curb
3. The student fails if the apparatus touches a marker
4. The student fails if the rear wheels roll up and onto the curb
5. The student fails if the front or rear wheels are >18 inches from the curb when the parking brake is set
6. The student fails if he or she exceeds two directional changes as outlined in the diagram
7. The student fails if he or she does not maintain control of the apparatus during the exercise
8. Passing score is 80%

VI. SAFETY CONSIDERATIONS
A. Check your apparatus before operating
   1. Ensure everything is in proper operating condition
B. Check the condition of the surface where the exercise will take place
   1. Cracks
   2. Holes
   3. Fluid spills
      a) Oil
      b) Water
      c) Fuel
   4. Ice
<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>APPLICATION</th>
</tr>
</thead>
</table>

5. Foreign objects
   a) Nails
   b) Glass

C. Wear appropriate PPE
   1. As required by testing department/college SOPs

D. Review and follow all instructions with your evaluator before beginning any exercise

E. Operate the apparatus with due regard at all times
   1. Maintain control at all times

F. Use spotters for safety
   1. Cannot be used as backers

G. Check your apparatus after completing the exercise
   1. Advise staff of any problems found
SUMMARY:
Although no driver/operator can prepare for every driving situation that can occur in the field, understanding apparatus dynamics and how they affect apparatus control on the roadway is imperative. Just as important is the opportunity to apply the knowledge of apparatus dynamics in a controlled environment to develop the skills necessary to drive safely and efficiently.

EVALUATION:
The student will complete the optional driving exercises at a time determined by the instructor.

ASSIGNMENT:
Review your notes and read Fire Apparatus Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 93-102 in order to prepare yourself for the upcoming test. Study for our next session.
EXERCISE: Lane Change Exercise

This exercise tests the students' ability to change lanes and judge distances from wheel to object while moving at a constant speed.

TIME FRAME: 25 seconds maximum

AUTHORITY: SBFS

MATERIALS NEEDED:
- Fire apparatus
- 1 assistant instructor
- 36,000 square foot area
- 48-inch pillars (4)
- 18-inch cones (59)
- 8½"x11" numbered cards (8)
  "1" (2)
  "2" (2)
  "3" (2)
  "4" (1)
  "5" (1)
- 8½"x11" "STOP" card (1)
- Stopwatch
- 100-foot tape measure

INSTRUCTOR DIRECTIONS:
1. Time begins when the instructor signals the student to proceed through the entry gate (48-inch pillars).
2. Time ends when the front bumper of the apparatus passes the exit gate (48-inch pillars).
3. Display the lane assignment cards just before the apparatus enters the first lane.
4. Student adjusts accordingly to take the assigned lanes.
**EXERCISE:** Lane Change Exercise

**STUDENT DIRECTIONS:**

1. Time begins when the instructor signals you to proceed through the entry gate.
2. Time ends when the front bumper of the apparatus passes the exit gate.
3. Lane assignments will be displayed just before the apparatus enters the first lane.
4. Maneuver the apparatus through the assigned lanes.
5. You have 25 seconds from entry gate to exit gate.
6. Proceed through the exit curve until the apparatus clears the last set of markers.
7. Bring the apparatus to a complete stop.

**SCORING:**

<table>
<thead>
<tr>
<th>100 points possible</th>
<th>80% passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>5 points</strong> subtracted for each marker touched by the apparatus.</td>
<td></td>
</tr>
<tr>
<td>2. The student <strong>fails</strong> if the apparatus stops or fails to maintain a constant forward motion within the course.</td>
<td></td>
</tr>
<tr>
<td>3. The student <strong>fails</strong> if he or she does not take the lane marked by the evaluator.</td>
<td></td>
</tr>
<tr>
<td>4. The student <strong>fails</strong> if time exceeds 25 seconds.</td>
<td></td>
</tr>
<tr>
<td>5. The student <strong>fails</strong> if he or she does not maintain control of the apparatus during the exercise.</td>
<td></td>
</tr>
</tbody>
</table>

**SITE PREPARATION:**

- Markers are set up as shown, with each set of lanes being 30-feet long and each lane 10-feet wide.
- Measure the markers base to base.
- The distance from one set of lane markers to the next is 60 feet. This area is called the change space.
- The entry and exit gates are in line with the first lane, #2 lane of the first set, and #3 lane of the second set.
- Exit curve width is 12 feet, starting at the first set of markers after the exit gate.
LANE CHANGE EXERCISE

All gates are 10 feet wide
### OPTIONAL DRIVING EXERCISE 5-1-2

**EXERCISE:** Offset Alley Exercise (Forward And Backward)

This exercise simulates responding to an emergency and making a lane change through a narrow passageway without striking any nearby vehicles. It tests the students' ability to maneuver the apparatus at a constant speed within a confined space. To do this, the driver/operator must accurately judge the distance between the apparatus and the barriers.

**TIME FRAME:** None

**AUTHORITY:** SBFS

**MATERIALS NEEDED:**
- Fire apparatus
- 100 square foot area
- 48-inch pillars (4)
- 18-inch cones (12)
- 100-foot tape measure

**INSTRUCTOR DIRECTIONS:**
1. For this exercise, apparatus length is measured from the front bumper to the end of the tailboard.
2. Provide adequate space to perform the exercise without risk of collision.

**STUDENT DIRECTIONS:**
1. Maintain a constant speed throughout the exercise.
2. Drive through the entry gate.
3. Turn the apparatus into the offset lane.
4. Exit the offset lane.
5. Enter the exit lane.
6. Bring the apparatus to a complete stop after rear bumper clears the exit gate.
7. Back the apparatus following the same path, maintaining a constant speed.
8. Bring the apparatus to a complete stop after front bumper clears the entry gate.
**SCORING:**

<table>
<thead>
<tr>
<th>100 points possible</th>
<th>80% passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 10 points subtracted for each marker touched by the apparatus.</td>
<td></td>
</tr>
<tr>
<td>2. 10 points subtracted each time the apparatus stops before reaching the end markers.</td>
<td></td>
</tr>
<tr>
<td>3. The student <strong>fails</strong> if he or she continues the exercise without realigning the apparatus after touching a marker.</td>
<td></td>
</tr>
<tr>
<td>4. The student <strong>fails</strong> if he or she does not maintain control of the apparatus during the exercise.</td>
<td></td>
</tr>
</tbody>
</table>

**SITE PREPARATION:**

- Place two sets of markers in line and one apparatus length apart to form an alley.
- These alleys are arranged with course markers and are 10 feet wide.
- The 10 foot alley from which the driver/operator must exit is arranged 10 feet out of line to the opposite 10 foot alley into which the apparatus must be maneuvered.
- No set speed should be established for this exercise, but the driver/operator should not stop or back the apparatus during the maneuver.
OPTIONAL DRIVING EXERCISE 5-1-3

EXERCISE: Dogleg Exercise

This measures the students' ability to maneuver apparatus within a confined space. Judging distance between apparatus and objects while driving at a constant speed in both forward and reverse.

TIME FRAME:
Minimum: 0:50
Maximum: 1:15

AUTHORITY: SBFS

MATERIALS NEEDED:
- Fire apparatus
- 1 assistant instructor
- 8,400 square foot area
- 48-inch pillars (17)
- 18-inch cones (46)
- Stopwatch
- 100-foot tape measure

INSTRUCTOR DIRECTIONS:
1. Time begins when the front bumper of the apparatus passes the entry/exit gate (48-inch pillars).
2. Time ends when the front bumper of the apparatus passes the entry/exit gate (48-inch pillars).

STUDENT DIRECTIONS:
1. Maintain a constant speed throughout the exercise.
2. Drive through the entry gate.
3. Drive through first direction gate.
4. Turn in the changing space.
5. Align apparatus to enter next direction gate.
6. Proceed through all direction gates in the same manner.
7. Enter the diminishing gate.
8. Bring the apparatus to a complete stop.
9. Before touching the center marker.
10. Back the apparatus through the course following the same path.
EXERCISE: Dogleg Exercise

11. Maintaining a constant speed.
12. Bring the apparatus to a complete stop after the front bumper passes the entry/exit gate.
13. Minimum time to complete this exercise is 0:50.
14. Maximum time to complete this exercise is 1:15.

SCORING:

<table>
<thead>
<tr>
<th>Points Possible</th>
<th>100</th>
<th>80% passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>The student fails if he or she completes the course in less than 0:50 seconds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The student fails if he or she completes the exercise in more than 1:15 minutes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The student fails if he or she does not maintain control of the apparatus during the exercise.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SITE PREPARATION:

- Markers are set up as shown, with each gate being 10-feet wide.
- Opposing gates are spaced at 50-foot intervals.
- Perimeter markers are spaced evenly throughout.
- Marker spacing is measured from base to base.
OPTIONAL DRIVING EXERCISE 5-1-4

**EXERCISE:** Parallel Parking Exercise

In this exercise, students are required to parallel park within 18 inches of the curb. This exercise tests the students’ ability to align the apparatus with the curb without hitting the curb or markers and with a minimum loss of apparatus motion. This exercise simulates aligning an apparatus for hydrant hookups or elevating device operations.

**TIME FRAME:** None

**AUTHORITY:** SBFS

**MATERIALS NEEDED:**
- Fire apparatus
- 1 assistant instructor
- 1,800 square foot area
- 48-inch pillars (4)
- 100-foot tape measure

**INSTRUCTOR DIRECTIONS:**
1. For pumper-sized vehicles, the driver/operator must get the truck into the designated space.
2. For tractor-trailer units, the trailer must be spotted and jackknifed in the designated space.

**STUDENT DIRECTIONS:**
1. Drive the apparatus along the left side of the designated parking area.
2. Bring the apparatus to a complete stop after the rear bumper passes the last markers.
3. Back the apparatus between the markers, turning as needed.
4. Bring the apparatus to a complete stop before touching the markers or exceeding the parking area boundaries.
5. Drive the apparatus forward to straighten, if needed.
6. Bring the apparatus to a complete stop.
7. Set the parking brake.
8. Apparatus must be within 18 inches of the curb.
**EXERCISE:** Parallel Parking Exercise

**SCORING:** 100 points possible 80% passing

1. **5 points** subtracted if apparatus tire brushes the curb.
2. The student **fails** if the apparatus touches a marker.
3. The student **fails** if the rear wheels roll up and onto the curb.
4. The student **fails** if the front or rear wheels are >18 inches from the curb when the parking brake is set.
5. The student **fails** if he or she exceeds two directional changes as outlined in the diagram.
6. The student **fails** if he or she does not maintain control of the apparatus during the exercise.

**SITE PREPARATION:**
- Site must be free of all obstacles.
- Measure the markers from base to base.

![Diagram of parallel parking exercise]
OPTIONAL DRIVING EXERCISES
These exercises are for skill development only and are not part of the testing process.

STUDENT: ___________________________ DATE: ___________________________

<table>
<thead>
<tr>
<th>5-1-1: LANE CHANGE EXERCISE</th>
<th>Penalty points subtracted from 100 possible points.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Component</td>
<td>Frequency</td>
</tr>
<tr>
<td>1. Apparatus touches a marker</td>
<td></td>
</tr>
<tr>
<td>2. Apparatus stops or fails to maintain a constant forward motion</td>
<td>25</td>
</tr>
<tr>
<td>3. Failure to take the lane marked by the proctors</td>
<td>No</td>
</tr>
<tr>
<td>4. Driver/operator fails to maintain control of the apparatus</td>
<td>No</td>
</tr>
</tbody>
</table>

TOTAL POINTS: ______

Scorer's Name: __________________________________________
Signature: __________________________________________

5-1-1 NOTES:
________________________________________________________________________
________________________________________________________________________

<table>
<thead>
<tr>
<th>5-1-2: OFFSET ALLEY EXERCISE</th>
<th>Penalty points subtracted from 100 possible points.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Component</td>
<td>Frequency</td>
</tr>
<tr>
<td>1. Apparatus touches a marker</td>
<td></td>
</tr>
<tr>
<td>2. Failure to realign the apparatus after touching a marker</td>
<td>25</td>
</tr>
<tr>
<td>3. Driver/operator fails to maintain control of the apparatus</td>
<td>Yes</td>
</tr>
</tbody>
</table>

TOTAL POINTS: ______

Scorer's Name: __________________________________________
Signature: __________________________________________

5-1-2 NOTES:
________________________________________________________________________
________________________________________________________________________

October 2008
5-1: Introduction To The Optional Driving Exercises
Page 20
## 5-1-3: DOGLEG EXERCISE

Penalty points subtracted from 100 possible points.

<table>
<thead>
<tr>
<th>Rated Component</th>
<th>Frequency</th>
<th>Value</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apparatus touches a marker</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2. Driver/operator completes the course in less than 0:50</td>
<td>☐ Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Driver/operator completes the course in more than 1:15</td>
<td>☐ Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Driver/operator fails to maintain control of the apparatus</td>
<td>☐ Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL POINTS: ______

Scorer's Name: __________________________________________

Signature: __________________________________________

5-1-3 NOTES: __________________________________________

---

## 5-1-4: PARALLEL PARKING EXERCISE

Penalty points subtracted from 100 possible points.

<table>
<thead>
<tr>
<th>Rated Component</th>
<th>Frequency</th>
<th>Value</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apparatus touches a marker</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2. Rear wheels cross over or touch the curb</td>
<td>☐ Yes</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>3. Wheels are more than 18 inches from the curb at the end of the exercise</td>
<td>☐ Yes</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>4. Driver/operator exceeds two directional changes</td>
<td>☐ Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Driver/operator fails to maintain control of the apparatus</td>
<td>☐ Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL POINTS: ______

Scorer's Name: __________________________________________

Signature: __________________________________________

5-1-4 NOTES: __________________________________________
APPENDIX A: GLOSSARY

Adjust .................To maintain or regulate, within prescribed limits, by setting the operating characteristics to specified parameters.

AHJ ....................Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

Alignment ............To adjust components to bring about optimum or desired performance.

Camber Angle ........The angle of the wheel, measured in degrees, when viewed from the front of the apparatus.

CCDH ..................California Commercial Driver Handbook


Combination Fire.....A vehicle consisting of a pulling tractor and trailer. Apparatus

Component..........A constituent part of a mechanical or electrical device.

Decibel...............A unit used to express relative difference in power or intensity, usually between two acoustic or electric signals, equal to ten times the common logarithm of the ratio of the two levels.

Defect .................A discontinuity in a part or a failure to function that interferes with the service or reliability for which the pan was intended.

Defective.............Having a defect, or faulty.

Deformation ..........Abnormal wear, defects, cracks or fractures, warpage, and deviations from the original condition that would affect safe and correct operation.

Documentation .......The process of gathering, classifying, and storing information.

DOT ...................Department of Transportation. The department of the U.S. government that coordinates and institutes national transportation programs.

Driveline .............See power train.
Failure.................... A cessation of proper functioning or performance.

Frame...................... The basic structural system that transfers the weight of the fire apparatus to the suspension system.

High Voltage............. Voltage that is above the normal 12 or 24 volts.

Inspect.................... To determine the condition or operation of a component(s) by comparing its physical, mechanical, and/ or electrical characteristics with established standards, recommendations, and requirements through examination by sight, sound, or feel.

Interlock................... A device or arrangement by means of which the functioning of one part is controlled by the functioning of another.

Leakage.................... The escape of a fluid from its intended containment, generally at a connection. The three classes of leakage are defined.

Leakage, Class 1...... Seepage of fluid, as indicated by wetness or discoloration, not great enough to form drops.

Leakage, Class 2...... Leakage of fluid great enough to form drops, but not enough to cause drops to fall from the item being inspected.

Leakage, Class 3...... Leakage of fluid great enough to cause drops to fall from the item being inspected.

Liability................... The state of being responsible for one’s actions. This could be civil or criminal, financial, moral, or legal.

Low Voltage .............. Voltage that is usually 12 or 24 volts.

Manufacturer’s........... Any requirement or suggestion a fire apparatus builder or component producer makes concerning care and maintenance of its product(s).

Modification............... An alteration or adjustment to any component that is a deviation from the original specifications or design of the fire apparatus.

Operational Test ...... A test to determine the operational readiness of a component on a fire apparatus by observing the actual operation of the component.
Operator Alert .......... Any device, whether visual, audible, or both, installed in the driving compartment or at an operator’s panel, to alert the operator to either a pending failure, an occurring failure, or a situation that requires his or her immediate attention.

Optical Source .......... Any single, independently mounted, light-emitting component in a lighting system.

Overhaul ................ To inspect, identify deficiencies, and make necessary repairs to return a component to operational condition.

Power Train ............. The parts of a fire apparatus that transmit power from the engine to the wheels, including the transmission, split shaft power takeoff, midship pump transmission, drive shaft(s), clutch, differential(s), and axles.

Powered.................. A power-operated device that is intended to provide storage of hard suction hoses, ground ladders, or other equipment, generally in a location above apparatus compartments.

Preventive .............. The act or work of keeping something in proper condition by performing necessary preventive actions, in a routine manner, to prevent failure or breakdown.

Primary Ignition ...... The low voltage components of the ignition system including solenoids, relays, and valves that will allow the engine to start. On a gasoline driven engine, it begins with the battery and ends at the coil.

Qualified Person ...... A person who, by possession of a recognized degree, certificate, professional standing, or skill, and who, by knowledge, training, and experience, has demonstrated the ability to deal with problems relating to a particular subject matter, work, or project.

Proper.................... As recommended by the manufacturer.

Repair ..................... To restore to sound condition after failure or damage.

Secondary ............... The high voltage components of an ignition system. This system is most often associated with gasoline-powered engines. It starts at the ignition coil and ends at the spark plug.
Severe Service ....... Those conditions that apply to the rigorous, harsh, and unique applications of fire apparatus, including but not limited to local operating and driving conditions, frequency of use, and manufacturer’s severe service (duty) parameters.

Shall ......................... Indicates a mandatory requirement.

Shoreline ................. A 120-volt electrical cord that attaches to the fire apparatus to maintain a full charge in the battery, run temperature control systems, maintain air pressure, and other vital systems.

Should ........................ Indicates a recommendation or that which is advised but not required.

Single Fire .............. A vehicle on a single chassis frame.

Apparatus

SOP .......................... Standard Operating Procedure. A method of performing a task that is developed by a department.

Steering Axle.......... Any axle designed such that the wheels have the ability to turn the vehicle.

Systems .................... A regularly interacting or interdependent group of components forming a unified whole.

Test .......................... To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

Title 49 ................... A portion of the CFR that deals with transportation. The CFR is divided into 50 titles, which represent broad areas subject to Federal regulation.

Toe Angle ............... The difference in the distance between the front of the tires and the back of the tires.

Troubleshooter ....... An expert in discovering and eliminating the cause of trouble in mechanical equipment.

Troubleshooting ...... To act or be employed as a troubleshooter.

Tunnel Vision .......... Vision in which the visual field is severely constricted, as from within a tunnel looking out.
Instructor Answer Key

Each answer space is worth five points. You have 30 minutes to complete the entire test.

INSTRUCTIONS: This is a true-false test. If the statement is true, draw a circle around the “T.” If the statement is false, draw a circle around the “F.”

EXAMPLE: T F The Incident Command System was developed by the fire service.

1. Spring brakes are used to meet emergency and parking brake requirements.
   "T"

2. The safety relief valve activates the spring brakes when the pressure drops to a range of 20-45 psi.
   California Commercial Driver Handbook, DMV, 2008 Edition, Pages 64
   "T"

3. An air compressor that fails to maintain 80-90 psi in the system with the service brakes applied and the engine at idle is to be placed out-of-service.
   Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Page 50
   "T"

4. Fire apparatus that have defective defrosters are to be placed out-of-service.
   "T"

5. According to the NFPA, a fire apparatus that has one torn passenger's seat belt should be placed out-of-service.
   "T"

6. An air pressure protection valve prevents the air horns from operating when the air pressure in the reservoir drops below 80 psi.
   "T"

7. The minimum tread depth for a nonsteering tire is 4/32”.
   "T"
8. Apparatus batteries that are corroded should be cleaned with a mixture of baking soda and water.


9. A fire apparatus cooling system with a Class 1 leak should be placed out-of-service.

*Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Page 28*

10. The load monitor is intended to prevent an overload of the apparatus suspension system.


11. The process of automatically shutting down less important electrical systems so that other systems may continue to function is called load shedding.


12. The maximum amount of free play in an apparatus steering wheel is 20 degrees of total play.


13. According to the CCDH, a fire apparatus with a missing or broken leaf spring should be placed out-of-service.


14. A Class 2 Leakage is defined as seepage of fluid that is indicated by wetness or discoloration not great enough to form drops.

*Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Page 104*

15. It is important to keep apparatus and maintenance records to assist in deciding to purchase new apparatus or continue repairs on an older unit.


16. Department SOPs should indicate items that a driver/operator can repair on their own.


17. In the event of a collision, maintenance records are not likely to be scrutinized by accident investigators.


18. Fire departments typically do a pretrip inspection at the beginning of each shift.

T F 19. The minimum licensing requirements to drive fire apparatus in the State of California is a "Class B" driver license.


T F 20. On an authorized emergency vehicle, the flashing of the headlamps shall consist of upper-beam flashing, and not the flashing of any other light beam.

Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Page 8

T F 21. Every authorized emergency vehicle shall be equipped with one steady burning red lamp visible from at least 1,200 feet to the front.

Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Page 8

T F 22. Before leaving the fire station, the driver/operator should ensure that all members on the apparatus are seated, with their seat belts on and secured.

Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 5

T F 23. When placing an apparatus at an incident, ground integrity is of little concern to the driver/operator.

Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Pages 6

T F 24. Low tire pressure can cause poor road-handling characteristics.


T F 25. Oil leaks on older apparatus are common and the driver/operator should not be concerned with the leaks.

Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Page 33

T F 26. A gradual increase in exhaust noise starting with a slight ticking noise could be caused by a failing exhaust manifold gasket.

Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Page 34

T F 27. In an alternating current (AC) circuit, voltage and current remain constant.

Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Page 42

T F 28. Current can be defined as the rate of flow of electron flow and is measured in amperes.

Driver/Operator 1A Student Supplement, SFT, 2008 Edition, Page 41

T F 29. On an air brake system, automatic slack adjusters should only be worked on by a certified air brake technician.

30. Fire apparatus equipped with a hydraulic braking system and a Class 2 leakage shall be considered when developing out-of-service criteria.

31. Growling or whining coming from the rear axle could be caused by low oil or bearing failure.

32. The overfilling of an automatic transmission with fluid may cause the transmission case to become overpressurized.

33. If an automatic transmission is low on fluid, there is a risk of overheating.

34. The first component of an electrical system is the batteries.

35. Voltage is the difference between negative and positive charges.

---

**QUIZ SCORING**

<table>
<thead>
<tr>
<th>Each question blank is worth five points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Possible</td>
</tr>
<tr>
<td>80% Minimum</td>
</tr>
<tr>
<td>Score</td>
</tr>
<tr>
<td>Pass or Fail?</td>
</tr>
</tbody>
</table>
Instructor Answer Key

Test 2

Each answer space is worth five points. You have 30 minutes to complete the entire test.

INSTRUCTIONS: This is a true-false test. If the statement is true, draw a circle around the “T.” If the statement is false, draw a circle around the “F.”

EXAMPLE: T F The Incident Command System was developed by the fire service.

1. According to the NFPA Journal, in the year 2000, 87.5% of all fire fighters killed were not wearing seat belts while riding in apparatus.


2. Some of the concepts involved with defensive driving include visual lead times, reaction times, and response times.


3. The preemption device that controls traffic signals uses a radio signal.


4. A large percentage of collisions occur in front of driveways.


5. When proceeding through intersections avoid eye contact with other drivers because it is distracting.


6. Defensive driving techniques include "leaving yourself an out" and "getting the big picture."


7. When anticipating another driver's actions, expect the unexpected.


8. There are times when the use of audible warning devices is inappropriate.

9. Always travel in the innermost lane on multilane roads.

10. Spotters should precede wildland engines when driving through smoke.

11. Apparatus should never be driven into unburned fuels higher than the bumper or running board.

12. The total stopping distance is the sum of the driver/operator reaction distance, vehicle braking distance, and tire to road surface time.

13. The use of brakes on a long and/or steep downgrade is only a supplement to the braking effect of the engine.

14. The braking distance is the distance the vehicle travels from the time the brakes are applied until the apparatus comes to a complete stop.

15. When the apparatus goes into a skid, it is recommended that you turn the front wheels in the opposite direction of the skid.

16. The weight transfer experienced by an apparatus when steering action is too abrupt can contribute to skidding or rollover.

17. Because the stopping distance is greatly increased on slippery road surfaces, it is sometimes a good policy to try the brakes in traffic before you need to stop.

18. Snow tires or tire chains will reduce the stopping distance and increase traction on hills in snow or ice.

19. When arriving at a location where no fire is evident, stop the apparatus at the front entrance.
20. Level II staging is used where numerous emergency vehicles will be responding to an incident.


### QUIZ SCORING

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Each question blank is</td>
<td></td>
</tr>
<tr>
<td>worth five points</td>
<td></td>
</tr>
<tr>
<td>Total Possible</td>
<td>100</td>
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<tr>
<td>80% Minimum</td>
<td>80</td>
</tr>
<tr>
<td>Score</td>
<td></td>
</tr>
<tr>
<td>Pass or Fail?</td>
<td></td>
</tr>
</tbody>
</table>
Test 1

Each answer space is worth five points. You have 30 minutes to complete the entire test.

INSTRUCTIONS: This is a true-false test. If the statement is true, draw a circle around the “T.” If the statement is false, draw a circle around the “F.”

EXAMPLE: T F The Incident Command System was developed by the fire service.

T F 1. Spring brakes are used to meet emergency and parking brake requirements.

T F 2. The safety relief valve activates the spring brakes when the pressure drops to a range of 20-45 psi.

T F 3. An air compressor that fails to maintain 80-90 psi in the system with the service brakes applied and the engine at idle is to be placed out-of-service.

T F 4. Fire apparatus that have defective defrosters are to be placed out-of-service.

T F 5. According to the NFPA, a fire apparatus that has one torn passenger’s seat belt should be placed out-of-service.

T F 6. An air pressure protection valve prevents the air horns from operating when the air pressure in the reservoir drops below 80 psi.

T F 7. The minimum tread depth for a nonsteering tire is 4/32".

T F 8. Apparatus batteries that are corroded should be cleaned with a mixture of baking soda and water.
9. A fire apparatus cooling system with a Class 1 leak should be placed out-of-service.

10. The load monitor is intended to prevent an overload of the apparatus suspension system.

11. The process of automatically shutting down less important electrical systems so that other systems may continue to function is called load shedding.

12. The maximum amount of free play in an apparatus steering wheel is 20 degrees of total play.

13. According to the CCDH, a fire apparatus with a missing or broken leaf spring should be placed out-of-service.

14. A Class 2 Leakage is defined as seepage of fluid that is indicated by wetness or discoloration not great enough to form drops.

15. It is important to keep apparatus and maintenance records to assist in deciding to purchase new apparatus or continue repairs on an older unit.

16. Department SOPs should indicate items that a driver/operator can repair on their own.

17. In the event of a collision, maintenance records are not likely to be scrutinized by accident investigators.

18. Fire departments typically do a pretrip inspection at the beginning of each shift.
T  F  19. The minimum licensing requirements to drive fire apparatus in the State of California is a "Class B" driver license.

T  F  20. On an authorized emergency vehicle, the flashing of the headlamps shall consist of upper-beam flashing, and not the flashing of any other light beam.

T  F  21. Every authorized emergency vehicle shall be equipped with one steady burning red lamp visible from at least 1,200 feet to the front.

T  F  22. Before leaving the fire station, the driver/operator should ensure that all members on the apparatus are seated, with their seat belts on and secured.

T  F  23. When placing an apparatus at an incident, ground integrity is of little concern to the driver/operator.

T  F  24. Low tire pressure can cause poor road-handling characteristics.

T  F  25. Oil leaks on older apparatus are common and the driver/operator should not be concerned with the leaks.

T  F  26. A gradual increase in exhaust noise starting with a slight ticking noise could be caused by a failing exhaust manifold gasket.

T  F  27. In an alternating current (AC) circuit, voltage and current remain constant.

T  F  28. Current can be defined as the rate of flow of electron flow and is measured in amperes.

T  F  29. On an air brake system, automatic slack adjusters should only be worked on by a certified air brake technician.
T  F  30. Fire apparatus equipped with a hydraulic braking system and a Class 2 leakage shall be considered when developing out-of-service criteria.

T  F  31. Growling or whining coming from the rear axle could be caused by low oil or bearing failure.

T  F  32. The overfilling of an automatic transmission with fluid may cause the transmission case to become overpressurized.

T  F  33. If an automatic transmission is low on fluid, there is a risk of overheating.

T  F  34. The first component of an electrical system is the batteries.

T  F  35. Voltage is the difference between negative and positive charges.

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Each answer space is worth five points. You have 30 minutes to complete the entire test.

INSTRUCTIONS: This is a true-false test. If the statement is true, draw a circle around the “T.” If the statement is false, draw a circle around the “F.”

EXAMPLE: T F The Incident Command System was developed by the fire service.

1. According to the NFPA Journal, in the year 2000, 87.5% of all firefighters killed were not wearing seat belts while riding in apparatus.

2. Some of the concepts involved with defensive driving include visual lead times, reaction times, and response times.

3. The preemption device that controls traffic signals uses a radio signal.

4. A large percentage of collisions occur in front of driveways.

5. When proceeding through intersections avoid eye contact with other drivers because it is distracting.

6. Defensive driving techniques include "leaving yourself an out" and "getting the big picture."

7. When anticipating another driver’s actions, expect the unexpected.

8. There are times when the use of audible warning devices is inappropriate.
9. Always travel in the innermost lane on multilane roads.

10. Spotters should precede wildland engines when driving through smoke.

11. Apparatus should never be driven into unburned fuels higher than the bumper or running board.

12. The total stopping distance is the sum of the driver/operator reaction distance, vehicle braking distance, and tire to road surface time.

13. The use of brakes on a long and/or steep downgrade is only a supplement to the braking effect of the engine.

14. The braking distance is the distance the vehicle travels from the time the brakes are applied until the apparatus comes to a complete stop.

15. When the apparatus goes into a skid, it is recommended that you turn the front wheels in the opposite direction of the skid.

16. The weight transfer experienced by an apparatus when steering action is too abrupt can contribute to skidding or rollover.

17. Because the stopping distance is greatly increased on slippery road surfaces, it is sometimes a good policy to try the brakes in traffic before you need to stop.

18. Snow tires or tire chains will reduce the stopping distance and increase traction on hills in snow or ice.

19. When arriving at a location where no fire is evident, stop the apparatus at the front entrance.
T   F   20. Level II staging is used where numerous emergency vehicles will be responding to an incident.

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