Emergency Vehicle Systems: Chassis, Cab, Body, Tank and Accessories (2020)

Course Plan

Course Details

Certification: Emergency Vehicle Technician 1


Description: *Emergency Vehicle Technician 101 Module*: This course module provides an overview of the roles and responsibilities of an emergency vehicle technician from entry-level technician knowledge and skills to personnel and fleet management.

*Chassis Systems and Components Module*: This course module provides an overview of the knowledge and skills needed to inspect, maintain, repair, and test emergency vehicle chassis systems and components.

*Cab and Body Module*: This course module provides an overview of the knowledge and skills needed to inspect, maintain, repair, and test emergency vehicle cab and body systems and components.

*Tanks and Accessories Module*: This course module provides an overview of the knowledge and skills utilized by an emergency vehicle technician to inspect, maintain, and repair tanks and their accessories.

Designed For: The emergency vehicle technician pursuing SFT-certification or anyone seeking an overview of the roles and responsibilities of an emergency vehicle technician

Prerequisites: None

Standard: Complete all summative test with a minimum score of 80%.

Hours:
- Lecture: 35:00
- Activities: 0:00 (TBD)
- Testing: 1:00

Hours (Total): 36:00
Emergency Vehicle Technician 1A

Maximum Class Size: 40
Instructor Level: Primary
Instructor/Student Ratio: 1:40
SFT Designation: CFSTES
## Required Resources

### Instructor Resources
To teach this course, instructors need:
- NFPA 1500: Standard on Fire Department Occupational Safety and Health Program (current edition / physical copy or access to digital copy)
- NFPA 1901: Standard for Automotive Fire Apparatus (current edition / physical copy)
- Student Supplement
  - Provided by California Fire Mechanics Academy, Inc.
- Manufacturer manuals
- Personal protective equipment (PPE)

### Online Instructor Resources
The following instructor resources are available online at [https://osfm.fire.ca.gov/divisions/state-fire-training/cfstes-professional-certification/](https://osfm.fire.ca.gov/divisions/state-fire-training/cfstes-professional-certification/):
- None

### Student Resources
To participate in this course, students need:
- NFPA 1071: Standard for Emergency Vehicle Technician Professional Qualifications (current edition / physical copy or access to a digital copy)
- NFPA 1500: Standard on Fire Department Occupational Safety and Health Program (current edition / physical copy or access to digital copy)
- NFPA 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Emergency Vehicle (current edition / physical copy or access to a digital copy)
- Student Supplement
  - Provided by California Fire Mechanics Academy, Inc.
- Personal protective equipment (PPE)

### Facilities, Equipment, and Personnel
The following facilities, equipment, or personnel are required to deliver this course:
- Standard classroom equipped for 40 students
- Projector with appropriate laptop connections
- Wifi/Internet access

Facilities
- OSHA compliant shop
Emergency Vehicle Technician 1A

• Lifts
• Safety stands

Equipment
• Apparatus
• Test, calibration, and diagnostic equipment
• Tools required to inspect, maintain, and repair chassis systems and components
• Appropriate safety gear
Unit 1: Introduction

Topic 1-1: Orientation and Administration

Terminal Learning Objective
At the end of this topic, a student will be able to identify facility and classroom requirements and identify course objectives, events, requirements, assignments, activities, resources, evaluation methods, and participation requirements in the course syllabus.

Enabling Learning Objectives
1. Identify facility requirements
   - Restroom locations
   - Food locations
   - Smoking locations
   - Emergency procedures
2. Identify classroom requirements
   - Start and end times
   - Breaks
   - Electronic device policies
   - Special needs and accommodations
   - Other requirements as applicable
3. Review course syllabus
   - Course objectives
   - Calendar of events
   - Course requirements
   - Student evaluation process
   - Assignments
   - Activities
   - Required student resources
   - Class participation requirements

Discussion Questions
1. What is a formative test? What is a summative test?

Activities
1. To be determined by the instructor

Topic 1-2: Emergency Vehicle Technician Certification Process

Terminal Learning Objective
At the end of this topic, a student will be able to identify different levels in the Emergency Vehicle Technician certification track, the courses and requirements for State Fire Training (SFT) Emergency Vehicle Technician (EVT) certification, and can describe the task book and testing process.
Enabling Learning Objectives

1. Identify the different levels of certification in the Emergency Vehicle Technician (EVT) certification track
   - EVT 1
   - EVT 2
   - EVT 3

2. Identify the courses required for EVT 1
   - State Fire Training
     - Emergency Vehicle Technician 1A: Chassis, Cab, Body, Tank and Accessories (2020)
     - Emergency Vehicle Technician 1B: Electrical Systems A (2020)
     - Emergency Vehicle Technician 1C: Pumps and Accessories (2020)
   - National Institute for Auto Service Excellence (ASE)
     - Gasoline Engines [T1]
     - Diesel Engines [T2]
     - Drive Train [T3]
     - Brakes [T4]
     - Suspension and Steering [T5]
     - Preventative Maintenance Inspections [T8]
   - Brake Inspector Qualification (CFR 396.25) - Department of Transportation (DOT)

3. Identify the courses required for EVT 2
   - State Fire Training
   - National Institute for Auto Service Excellence (ASE)
     - Gasoline Engines (T1)
     - Diesel Engines (T2)
     - Drive Train (T3)
     - Brakes (T4)
     - Suspension and Steering (T5)
     - Electrical / Electronic Systems (T6)
     - Heating, Ventilation and Air Conditioning (HVAC) (T7)
     - Preventative Maintenance Inspections (T8)

4. Identify the courses required for EVT 3
   - State Fire Training
   - National Institute for Auto Service Excellence (ASE)
     - Gasoline Engines (T1)
     - Diesel Engines (T2)
     - Drive Train (T3)
     - Brakes (T4)
     - Suspension and Steering (T5)
5. Identify additional requirements for Emergency Vehicle Technician 1
   - Experience (one of the following)
     o Have a minimum of two (2) years full-time, paid experience in a California fire department, public agency, or private industry as an automotive or truck mechanic, with one (1) year of which must be related to the maintenance of emergency response vehicles; or
     o Have a minimum of three (3) years full-time, paid experience in a California fire department, public agency, or private industry as a truck mechanic with no emergency response vehicles required; or
     o Have a minimum of four (4) years volunteer time or paid part-time, paid experience in a California fire department, public agency, or private industry as a truck mechanic with primary duties performing as a truck mechanic.

6. Identify additional requirements for Emergency Vehicle Technician 2
   - Experience (one of the following)
     o Have a minimum of three (3) years full-time, paid experience in a California fire department, public agency, or private industry as an automotive or truck mechanic, with one (1) year of which must be related to the maintenance of emergency response vehicles; or
     o Have a minimum of four (4) years full-time, paid experience in a California fire department, public agency, or private industry as a truck mechanic with no emergency response vehicles required; or
     o Have a minimum of five (5) years volunteer time or paid part-time, paid experience in a California fire department, public agency, or private industry as a truck mechanic with primary duties performing as a truck mechanic.

7. Identify additional requirements for Emergency Vehicle Technician 3
   - Have a minimum of four (4) years full-time, paid experience in a California fire department, public agency, or private industry as an automotive or truck mechanic, with one (1) year of which must be related to the maintenance of emergency response vehicles; or
   - Have a minimum of five (5) years full-time, paid experience in a California fire department, public agency, or private industry as a truck mechanic with no emergency response vehicles required; or
   - Have a minimum of six (6) years volunteer time or paid part-time, paid experience in a California fire department, public agency, or private industry as a truck mechanic with primary duties performing as a truck mechanic.

8. The following requirements are required for each EVT 1, EVT 2, and EVT 3
   - Code of Federal Regulations (CFR) 396.25: Department of Transportation Brake Inspector Qualification
Emergency Vehicle Technician 1A

- Successful completion of the Emergency Vehicle Technician Certification Commission (EVTCC) for the respective SFT Level of Certification. This exam is administered by the California Fire Mechanics Academy (CFMA).

9. Describe the task book process
   - Complete all prerequisites and course work
   - Submit application and fees and to request task book
     - A candidate may apply for the EVT 1 and EVT 2 task books at the same time (two applications and two fees), but may not submit the EVT 2 task book until he or she receives EVT 1 certification (a prerequisite for EVT 2)
   - Complete all job performance requirements included in the task book
   - Must have identified evaluator verify individual task completion via signature
   - Must have Fire Chief or authorized representative verify task book completion via signature
   - Must be employed by a California Fire Agency in the position prior to submitting completed task book to State Fire Training

10. Complete Continuing Education
    - Persons with EVT Certification are required to renew their certification every five years. The recertification requires that the applicant completes 36 hours of approved continuing education (CE) and meet the all prerequisites stated for Recertification Requirements. All recertification applications must be postmarked on or before the certification expiration date. If the certified EVT did not meet all recertification requirements by the expiration date, the EVT Certification is considered to be lapsed.
    - If the EVT Certification lapsed, the applicant will be required to complete 36 hours of CE in addition to the completion of additional CE hours. If the certification lapsed less than 6 months, you can regain EVT Certification by completing an additional 8 hours of approved CE. If the certification lapsed between 6 months and less than 12 months, you can regain EVT Certification by completing an additional 16 hours of approved CE. If the certification lapsed between 12 months and less than 18 months, you can regain EVT Certification by completing an additional 24 hours of approved CE.
    - For lapses, greater than 18 months, the applicant will need to retake all SFT courses listed in the Certification Requirements Education section and reapply for initial EVT certification, which will require the completion of a new Certification Task Book.

11. Complete all formative and summative tests administered during the course deliveries

Discussion Questions
   1. To be determined by the instructor

Activities
   1. To be determined by the instructor
Instructor Notes

1. SFT teaches most EVT 1 (inspect and maintain) and EVT 2 (repair and replace) content together because depending on the size of the agency or shop, there are different expectations of the technician.
Emergency Vehicle Technician 101 Module

Unit 2: Roles and Responsibilities

Topic 2-1: Emergency Vehicle Technician 1

Terminal Learning Objective
At the end of this topic, a student, given general knowledge and skill requirements, will be able to identify the roles and responsibilities of an Emergency Vehicle Technician (EVT) I, in accordance with State Fire Training (SFT) and NFPA 1071 (current edition)

Enabling Learning Objectives
1. Identify the general knowledge requirements associated with the roles and responsibilities of an EVT 1
   - Mission of the fire service
   - Organization of the fire agency and the maintenance facility
   - Role of the EVT in the organization
   - Fire agency’s standard operating procedures (SOPs) and rules and regulations as they apply to the EVT
   - Critical aspects of NFPA 1500, NFPA 1901, and NFPA 1911, as they apply to the EVT
   - Federal motor carrier safety regulations
   - Applicable federal, state, and local regulations
   - Interpretation and use of manufacturer specifications, inspection checklists, maintenance schedules, maintenance checklists, and agency SOPs
   - Selection of tools
   - Fastener types and their usage
   - Maintenance equipment and its usage
   - Workplace safety practices
   - Selection and use of cleaning products and procedures
   - Housekeeping
   - Identification and handling of hazardous materials
2. Identify the general skill requirements associated with the roles and responsibilities of an EVT 1
   - Use tools in a recognized safe manner
   - Operate emergency response vehicles in compliance with applicable federal, state, and local regulations
   - Locate information in agency documents, standards, and reference materials
3. Identify the inspection and preventative maintenance duties associated with chassis systems
4. Identify the inspection and maintenance duties associated with cabs (fixed and tilt) and vehicle bodies
5. Identify the operational checks duties associate with a vehicle’s electronic and electrical systems (low voltage)
6. Identify the inspection, maintenance, and operational testing duties associated with at least one of the following systems:
   • Fire pump, auxiliary pump, and tank systems
   • Aerial systems
   • Specialized systems
     o Foam
     o Line-voltage electrical
     o Breathing air
     o Auxiliary air

Discussion Questions
1. Where will you find personal protective safety requirements?
2. What is the general skill set of an EVT 1?
3. What systems are unique to an emergency vehicle?

Activities
1. Determined by the instructor

CTS Guide Reference: CTS 1-1

Topic 2-2: Emergency Vehicle Technician 2

Terminal Learning Objective
At the end of this topic, a student, given general knowledge and skill requirements, will be able to identify the roles and responsibilities of an Emergency Vehicle Technician (EVT) 2, in accordance with State Fire Training (SFT) and NFPA 1071 (current edition)

Enabling Learning Objectives
1. Identify the repair, performance testing, and weight verification duties associated with chassis systems of an EVT 2
2. Identify the repair duties associated with cabs (fixed and tilt) and vehicle bodies of an EVT 2
3. Identify the repair, operational testing, and performance testing duties associated with electronic and electrical systems (low voltage) of an EVT 2
4. Identify the inspection, repair, maintenance, and operational testing duties associated with at least one of the following systems: pump and tank systems, aerial systems, or specialized (foam, line voltage electrical, breathing air, auxiliary air) systems of an EVT 2

Discussion Questions
1. In what ways does responsibility increase between EVT 1 and EVT 2?

Activities
1. Determined by the instructor

CTS Guide Reference: CTS 1-2

Topic 2-3: Emergency Vehicle Technician 3
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Terminal Learning Objective
At the end of this topic, a student, given general knowledge and skills requirements, will be able to identify the roles and responsibilities of an Emergency Vehicle Technician (EVT) 3, in accordance with State Fire Training (SFT) and NFPA 1071 (current edition)

Enabling Learning Objectives
1. Identify the human resource management and performance evaluation duties of an EVT 3
2. Identify the inspection duties of an EVT 3
3. Identify the equipment and parts management duties of an EVT 3
4. Identify the documentation duties of an EVT 3
5. Identify the specifications development duties of an EVT 3

Discussion Questions
1. How does the job change between EVT 2 and EVT 3?
2. Why is it valuable for an EVT 3 to have been an EVT 1 and 2?
3. How do roles and responsibilities of an EVT 1, 2, and 3 change depending on fleet size and shop staffing levels?

Activities
1. Determined by the instructor

Instructor Notes
1. Facilitate open discussion to involve all students regardless of shop size and experience

CTS Guide Reference: CTS 1-3

Topic 2-4: Administrative Quality Assurance

Terminal Learning Objective
At the end of this topic, a student, given manufacturer specifications, effective communication tools, and basic record-keeping requirements, will be able to successfully manage the administrative day-to-day activities an Emergency Vehicle Technician (EVT), in accordance with the authority having jurisdiction (AHJ), State Fire Training (SFT), and NFPA 1071 (current edition)

Enabling Learning Objectives
1. Describe manufacturer specifications
   • Design and performance specifications of an apparatus
   • Specific to each manufacturer
   • Should be included with vehicle delivery
2. Identify the importance of inspecting, maintaining, and repairing a vehicle to manufacturer specifications
   • Potential to void warranty
   • Potential component failure
   • Potential for injury or death
3. Identify successful communication loops
   • Effective listening, validation, and follow up between:
     o EVT and end user
o EVT and staff (superiors and peers)
o EVT and manufacturer/vendor

- Verbal communication vs. written communication vs. electronic communication

4. Identify the importance of consistent, positive communication

5. Identify basic record-keeping requirements

- Inspection requirements, checklists, and records
- Maintenance requirements, checklists, and records
- Repair requirements, requests, checklists, and records
- Warranties
- Technical service bulletins (TSB)
- Service requests and records
- Department of Transportation (DOT) requirements
- NFPA requirements
- Manufacturer specifications
- Communications
- AHJ requirements

6. Identify the importance of accurate and organized record keeping

- Accountability
- If you don’t write it down, it didn’t happen
- Can be used for litigation

Discussion Questions
1. What is the benefit of a complete “as-built” manufacturer document?
2. Why is it important to document any changes to the manufacturer’s design?
3. Why should communications be documented?
4. How long should records be maintained?
5. What happens to a vehicle’s documentation if it is involved in an incident?

Activities
1. Determined by the instructor

Instructor Notes
1. The general theme of this topic is accountability. Weave that concept into each ELO.

CTS Guide Reference: None

Unit 3: Road and/or Performance Testing

Topic 3-1: Road and/or Performance Testing

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, an applicable driver license (if required), and an approved driving course, will be able to describe how to complete a road performance test on apparatus in accordance with NFPA 1911 so that apparatus system performance is verified to ensure that the drivability of the apparatus complies with requirements of NFPA 1911 and federal and state regulations; and all testing
is documented in accordance with the requirements of NFPA standards and the authority having jurisdiction (AHJ)

**Enabling Learning Objectives**
1. Identify the difference between a road test and a performance test
2. Describe the legal operation of fire apparatus
3. Demonstrate familiarity with apparatus drivability
4. Identify road performance requirements of NFPA 1911 and federal and state regulations
5. Identify record-keeping requirements of NFPA 1911 and the AHJ
6. Recognize the need for a road and/or performance test

**Discussion Questions**
1. What are some of the legal requirements to operate a vehicle in California?
2. Where can you find weight standards for legal vehicle operation?
3. What safety aspects need to be considered during the testing process?

**Activities**
1. Determined by the instructor

**Instructor Notes**
1. This topic is only intended to cover the cognitive component of road and/or performance testing. Actual testing activities are carried out within each system-specific course.

**CTS Guide Reference:** CTS 2-9
Chassis Systems and Components Module

Unit 4: Systems Overview

Topic 4-1: Terminology

Terminal Learning Objective
At the end of this topic, a student, given NFPA 1071 terminology, will be able to define inspection, maintenance, repair, and overhaul (rebuild) in accordance NFPA standards

Enabling Learning Objectives
1. Define “inspect(ion)"
   • 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
2. Define “maintenance”
   • The act of servicing a fire apparatus or a component in order to keep the vehicle and its components in proper operating condition
3. Define “repair”
   • To restore to sound condition after failure or damage
4. Define “overhaul (rebuild)”
   • To make extensive repairs in order to restore a component to like-new condition in accordance with the original manufacturer’s specifications

Discussion Questions
1. Where would you find these NFPA definitions?
2. What is an AHJ?
   • What is the AHJ over your shop or agency?

Activities
1. Determined by instructor

CTS Guide Reference: None

Topic 4-2: The Inspection, Maintenance, Repair, and Testing Cycle

Terminal Learning Objective
At the end of this topic, a student, given circumstances that initiate the inspection process, safety requirements, and an overview of appropriate facilities and equipment, will be able to describe the cycle of inspecting, maintaining, repairing, and testing emergency vehicle chassis systems in accordance with NFPA standards

Enabling Learning Objectives
1. Identify circumstances that initiate the inspection process
   • Acceptance test of new vehicle
   • Meeting manufacturer and/or AHJ inspection cycle
   • Responding to a suspected or reported problem
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- Acceptance test of repaired vehicle

2. Identify safety requirements
- Vehicle safety
- Technician safety

3. Identify facilities and equipment
- Proper location(s) for inspection, maintenance, repair/replace, testing
- Required tools/equipment
  - Test, calibration, and diagnostic
    - Tire pressure gauge
    - Tire tread-depth gauge
    - Voltmeter (independent digital voltmeter or onboard unit)
    - Ammeter
    - Tape measure
    - Appropriate electronic diagnostic (e.g. scan tool, laptop, tablet, etc.) equipment
  - Inspection
    - Inspection mirror
    - Flashlight
    - Creeper
    - Basic hand tools
    - Marking tool (e.g. paint pen or chalk)
    - Personal protective equipment (PPE)
  - Maintenance and repair
    - Torque wrench (properly calibrated)
    - Laser level
    - Cleaning supplies (e.g. appropriate cleaners, chemicals, wire brush, etc.)
    - Spectrochemical kit (if adjusting coolant concentrates in-house)
    - Metal fabrication equipment
    - Drill press
    - Hydraulic press
    - Hoists
    - Safety stands
    - Ventilation equipment
    - Lighting
    - Air compressor
    - Fluids and lubricants
    - Parts and hardware

4. Describe the inspection process
- Gather tools and safety equipment
- Secure vehicle in a safe environment
- Evaluate reported conditions (if applicable)
• Perform operational tests
  o What if you can’t duplicate or validate the concern?
• Identify and report defects and deficiencies, including broken, loose, worn, or missing parts
• Complete checklist and document findings
  o Checklists vary by manufacturer and authority having jurisdiction (AHJ)
  o Chassis checklist should, at a minimum, include:
    ▪ Vehicle identification number (VIN) or unit number
    ▪ Engine hours or mileage
    ▪ Manufacturer inspection requirements
    ▪ AHJ inspection requirements
    ▪ Inspector name and signature
    ▪ Inspection date
• Return vehicle to service or move to maintenance or repair

5. Identify the role of a maintenance schedule and a maintenance checklist
• Scheduling
• Budgeting
  o Allocation
  o Cost reduction
  o Forecasting
• Fleet lifecycle
• Research and development
• Audits
• Legal protection

6. Describe the maintenance process
• Identify the appropriate scope and authority for maintenance vs. repair activities
• Identify individual technician’s authorization for maintenance activities
• Identify maintenance needs from inspection report
• Gather tools and safety equipment
• Secure vehicle in a safe environment
• Evaluate reported conditions
  o Review inspection report
  o Identify repairs (outside maintenance scope)
  o Prioritize maintenance activities
• Perform operational tests
• Perform maintenance duties
• Conduct performance tests
• Complete checklist and document findings
• Return vehicle to service or move to repair

7. Describe the repair and/or replacement process
• Identify the appropriate scope and authority for internal vs. external repair activities
• Identify individual technician’s authorization for repair activities
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- Identify repair needs from inspection and/or maintenance report
- Gather tools and safety equipment
- Secure vehicle in a safe environment
- Evaluate reported conditions
- Perform operational tests
- Repair or replace deformed, broken, loose, worn, or missing parts
- Conduct performance tests
- Complete checklist and document findings
- Release to manufacturer or third-party shop for repair (if applicable)
  - Acceptance testing (inspection) on returned/repaired vehicle
  - Complete checklist and document findings
- Return vehicle to service

Discussion Questions
1. How can an AHJ build an inspection form?
2. Where should the inspection checklists reside?
3. What are the advantages to using quality tools?

Activities
1. Determined by instructor

CTS Guide Reference: None

Unit 5: Chassis Systems and Components

Topic 5-1: Function, Construction, and Operation

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPs, and manufacturer specifications, will be able to describe the function, construction, and operation of chassis systems and components in accordance with manufacturer specifications and the authority having jurisdiction (AHJ) requirements

Enabling Learning Objectives
1. Describe the function, construction, and operation of frames, crossmembers, and related components
2. Describe the function, construction, and operation of the steering system
   - Steering wheel to hub
   - Steering column(s)
   - Steering gear(s)
   - Auxiliary steering systems
     - All wheel steering systems
     - Tractor-drawn aerials (TDA)
   - Power steering pump
   - Power steering lines
3. Describe the function, construction, and operation of the suspension system
• Conventional
• Independent
• Air
• Spring
  o Leaf
  o Coil
  o Torsion bar
  o Combination leaf/air spring

4. Describe the function, construction, and operation of the axles
• Drive
• Non-drive
• Conventional beam
• Steering
• Tag
• Pusher
• Custom (new products entering the market annually)

5. Describe the function, construction, and operation of the brake system
• Hydraulic
• Air
• Electric
• Auxiliary or secondary

6. Describe the function, construction, and operation of the wheels
• Aluminum
• Steel
• Stud mounted
• Hub mounted

7. Describe the function, construction, and operation of the tires
• Bias ply
• Steel belted
• Single
• Super single
• Wide base single
• Dual

8. Describe the function, construction, and operation of the driveline
• Primary drive
• Power take off (PTO)
• Steering

9. Describe the function, construction, and operation of the auxiliary drive systems
• Transfer case
• Driveline
• Front differential
• Power take off (PTO)
• Power dividers
• Hydraulic systems

10. Describe the function, construction, and operation of the cooling systems
• Engine
• Transmission
• Pump transmission
• Fuel
• Power steering
• Compressed air foam system (CAFS)
• Hydraulic
• Auxiliary
  o Direct cooling
  o Indirect cooling

Discussion Questions
1. What is the primary purpose of a chassis?
2. What is the function of the suspension system?

Activities
1. Determined by instructor

CTS Guide Reference: CTS 2-1

Topic 5-2: Electricity and Electronics

Terminal Learning Objective
At the end of this topic, a student, given principles of electricity and operational theory, will be able to apply those principles and theories to the electrical systems in a chassis in accordance with manufacturer specifications and authority having jurisdiction (AHJ) requirements

Enabling Learning Objectives
1. Identify the principles of electricity and the operational theory of electronics
   • Principles of electricity and electronics
     o Ohm’s law
       ▪ Resistance goes up / amperage goes down
       ▪ Amperage goes up / resistance goes down
     o Watt’s law
       ▪ Electrical law of work
     o Kirchhoff’s law
       ▪ All voltage is used up by the time the circuit is complete
       ▪ Amperage will be the same throughout the circuit
   • Electrical systems in a chassis
     o Low voltage
       ▪ Batteries
       ▪ Starter
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- Alternator
- Wiring
  - Line voltage
    - Power generation system
    - Shore power
  - Electronic
    - Interface electronics (e.g. pump control module, engine status center, transmission control module, anti-lock brake system module, etc.)
    - Load management systems

2. Describe electrical troubleshooting procedures
   - Test system’s all-inclusive voltage drop

Discussion Questions
1. How is a DVOM utilized in a chassis system inspection?
2. How do you test voltage drop?

Activities
1. Determined by instructor

Instructor Notes
1. Electrical is referenced here as part of the complete chassis system. Complete curriculum for inspecting electrical systems is found in Emergency Vehicle Technician 1D: Electrical Systems A and Emergency Vehicle Technician 2A: Electrical Systems B. Keep this brief.
2. Cover the proper use of a DVOM

CTS Guide Reference: CTS 2-1

Unit 6: Inspection, Maintenance, and Repair

Topic 6-1: Frames and Crossbars

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPS, manufacturer specifications, an inspection checklist, a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the frames, crossbars, and related components so that the structural integrity, operation, and condition of frames, crossbars, and related components are verified to be within manufacturer specifications; the mounting is verified; systems and components are preserved, or restored and operational and within manufacturer specifications; multiplexing, interface electronics, and load management systems are operationally checked for proper operation; all checklist items are inspected; defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; components are lubricated; fluid levels are maintained; calibrations and adjustments are performed; applicable tests are conducted; performance is verified; and
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inspections, services, activities, tests, repairs, and operational checks are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

Enabling Learning Objectives

1. List types of defects, deficiencies, and potential problems associated with frames, crossbars, and related components
   - Corrosion
   - Rust, oxidation, electrolysis
   - Warping
   - Leaks
     - Class I
     - Class II
     - Class III
   - Fluid and lubrication levels
   - Cracks, fractures, breaks
   - Loose, broken, worn, or missing components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction (AHJ)
3. Describe how to select and use test, calibration, and diagnostic equipment
4. Describe operational, diagnostic, and performance tests
   - Component must meet manufacturer, AHJ, and NFPA specifications (if applicable) to be considered operational
5. Identify the role of inspection, maintenance, and repair schedules
6. Describe how to use inspection, maintenance, and repair checklists
7. Identify and evaluate conditions and recognize deficiencies
8. Identify and describe troubleshooting and adjustment methods and procedures
   - Corrosion
     - Clean
     - Correct cause (if possible)
     - Recoat or repaint (if necessary)
   - Rust, oxidation, electrolysis
     - Clean
     - Spectrochemical analysis of fluids (onsite or offsite)
     - Neutralize
     - Correct cause (if possible)
     - Recoat or repaint (if necessary)
   - Warping
     - Send for repair
   - Leaks
     - Clean
     - Correct cause (if possible)
     - Send for repair
• Fluid and lubrication levels
  o Use recommended fluids
  o Adjust to appropriate fluid levels at operating temperature
• Cracks, fractures, breaks
  o Send for repair
• Loose, broken, worn, or missing components
  o Tighten
  o Replace
  o Adjust
  o Send for repair
9. Describe electrical troubleshooting procedures
10. Describe adjustment and calibration procedures
11. Describe repair and overhaul procedures
12. Identify inspection, maintenance, and repair record-keeping requirements
  • Manufacturer
  • AHJ (vary)
  • Federal, state, and local government (vary)
    o Manufacturer
    o AHJ
13. Evaluate reported conditions
14. Use test, calibration, and diagnostic equipment and any additional maintenance and repair equipment
15. Perform operational checks and verification tests
16. Recognize and identify symptoms and conditions
17. Perform all required maintenance (including checklist items)
18. Recognize, determine, and correct defects, deficiencies, and potential problems
19. Perform required repairs to resolve deficiencies
20. Complete and submit required inspection, maintenance, and repair documentation

Discussion Questions
1. How do you identify a broken bolt?
2. What are some causes of corrosion?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the frame and crossbars, identify maintenance requirements, and recommend potential repairs.
2. ELO 3: Describe how to select and use tools and equipment from Topic 2-2 / ELO 3 appropriate to this chassis component or system. Applies to all topics in Unit 4.
3. ELO 11: Describe the repair and overhaul procedures for each chassis component or system to the level of detail needed to meet student need. Applies to all topics in Unit 4.
4. ELO 12: Identify record-keeping requirements for each chassis component or system identified. Applies to all topics in Unit 4.
5. Describe how to inspect the physical parts of the multiplexing system.

**CTS Guide Reference:** CTS 2-1 / CTS 2-2 / CTS 2-3 / CTS 2-4 / CTS 2-5

**Topic 6-2: Steering System – Inspection, Maintenance, and Repair**

**Terminal Learning Objective**

At the end of this topic, a student, given an emergency response vehicle, SOPS, manufacturer specifications, an inspection checklist, a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the steering system and related components so that the structural integrity, operation, and condition of the steering system and related components are verified to be within manufacturer specifications; the mounting is verified; systems and components are preserved, or restored and operational and within manufacturer specifications; multiplexing, interface electronics, and load management systems are operationally checked for proper operation; all checklist items are inspected; defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; components are lubricated; fluid levels are maintained; calibrations and adjustments are performed; applicable tests are conducted; performance is verified; and inspections, activities, tests, repairs, operation checks, and diagnostic checks are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

**Enabling Learning Objectives**

1. List types of defects, deficiencies, and potential problems associated with the steering system and related components
   - Corrosion
   - Rust, oxidation, electrolysis
   - Warping
   - Leaks
     - Class I
     - Class II
     - Class III
   - Fluid and lubrication levels
   - Cracks, fractures, breaks
   - Loose, broken, worn, or missing components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction (AHJ)
3. Describe how to select and use test, calibration, and diagnostic equipment
4. Describe operational, diagnostic, and performance tests
5. Identify the role of inspection, maintenance, and repair schedules
6. Describe how to use inspection, maintenance, and repair checklists
7. Identify and evaluate conditions and recognize deficiencies
8. Identify and describe troubleshooting and adjustment methods and procedures
   • Corrosion
     o Clean
     o Correct cause (if possible)
     o Reccoat or repaint (if necessary)
   • Rust, oxidation, electrolysis
     o Clean
     o Spectrochemical analysis of fluids (onsite or offsite)
     o Neutralize
     o Correct cause (if possible)
     o Reccoat or repaint (if necessary)
   • Warping
     o Send for repair
   • Leaks
     o Clean
     o Correct cause (if possible)
     o Send for repair
   • Fluid and lubrication levels
     o Use recommended fluids
     o Adjust to appropriate fluid levels at operating temperature
   • Cracks, fractures, breaks
     o Send for repair
   • Loose, broken, worn, or missing components
     o Tighten
     o Replace
     o Adjust
     o Send for repair

9. Describe electrical troubleshooting procedures
10. Describe adjustment and calibration procedures
11. Describe repair and overhaul procedures
12. Identify inspection, maintenance, and repair record-keeping requirements
13. Evaluate reported conditions
14. Use test, calibration, and diagnostic equipment and any additional maintenance and repair equipment
15. Perform operational checks and verification tests
16. Recognize and identify symptoms and conditions
17. Perform all required maintenance (including checklist items)
18. Recognize, determine, and correct defects, deficiencies, and potential problems
19. Perform diagnostic checks, and required repairs to resolve deficiencies
20. Complete and submit required inspection, maintenance, and repair documentation

Discussion Questions
1. What conditions would cause you to check the steering system fluids?
2. How do you test component integrity?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the steering system, identify maintenance requirements, and recommend potential repairs.


Topic 6-3: Suspension System

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPS, manufacturer specifications, an inspection checklist, a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the suspension system and related components so that the structural integrity, operation, and condition of the suspension system and related components are verified to be within manufacturer specifications; the mounting is verified; systems and components are preserved, or restored and operational and within manufacturer specifications; multiplexing, interface electronics, and load management systems are tested for proper operation; all checklist items are inspected; defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; components are lubricated; fluid levels are maintained; calibrations and adjustments are performed; applicable tests are conducted; performance is verified; and inspections, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

Enabling Learning Objectives
1. List types of defects, deficiencies, and potential problems associated with the suspension system and related components
   - Corrosion
   - Rust, oxidation, electrolysis
   - Warping
   - Leaks
     - Class I
     - Class II
     - Class III
   - Fluid and lubrication levels
   - Cracks, fractures, breaks
   - Loose, broken, worn, or missing components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction (AHJ)
3. Describe how to select and use test, calibration, and diagnostic equipment
4. Describe operational, diagnostic, and performance tests
5. Identify the role of inspection, maintenance, and repair schedules
6. Describe how to use inspection, maintenance, and repair checklists
7. Identify and evaluate conditions and recognize deficiencies
8. Identify and describe troubleshooting and adjustment methods and procedures
   - Corrosion
     - Clean
     - Correct cause (if possible)
     - Reccoat or repaint (if necessary)
   - Rust, oxidation, electrolysis
     - Clean
     - Spectrochemical analysis of fluids (onsite or offsite)
     - Neutralize
     - Correct cause (if possible)
     - Reccoat or repaint (if necessary)
   - Warping
     - Send for repair
   - Leaks
     - Clean
     - Correct cause (if possible)
     - Send for repair
   - Fluid and lubrication levels
     - Use recommended fluids
     - Adjust to appropriate fluid levels at operating temperature
   - Cracks, fractures, breaks
     - Send for repair
   - Loose, broken, worn, or missing components
     - Tighten
     - Replace
     - Adjust
     - Send for repair
9. Describe electrical troubleshooting procedures
10. Describe adjustment and calibration procedures
11. Describe repair and overhaul procedures
12. Identify inspection, maintenance, and repair record-keeping requirements
13. Evaluate reported conditions
14. Use test, calibration, and diagnostic equipment and any additional maintenance and repair equipment
15. Perform operational and verification tests
16. Recognize and identify symptoms and conditions
17. Perform all required maintenance (including checklist items)
18. Recognize, determine, and correct defects, deficiencies, and potential problems
19. Perform required repairs to resolve deficiencies
20. Complete and submit required inspection, maintenance, and repair documentation

Discussion Questions
1. What are the general maintenance requirements of the suspension system?
2. How many leaf springs can be broken before vehicle must be removed from service?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the suspension system, identify maintenance requirements, and recommend potential repairs.


Topic 6-4: Axles

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPS, manufacturer specifications, an inspection checklist, a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the axles and related components so that the structural integrity, operation, and condition of the axles and related components are verified to be within manufacturer specifications; the mounting is verified; systems and components are preserved, or restored and operational and within manufacturer specifications; multiplexing, interface electronics, and load management systems are tested for proper operation; all checklist items are inspected; defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; components are lubricated; fluid levels are maintained; calibrations and adjustments are performed; applicable tests are conducted; performance is verified; and inspections, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

Enabling Learning Objectives
1. List types of defects, deficiencies, and potential problems associated with the axles and related components
   • Corrosion
   • Rust, oxidation, electrolysis
   • Warping
   • Leaks
     o Class I
     o Class II
     o Class III
   • Fluid and lubrication levels
   • Cracks, fractures, breaks
• Loose, broken, worn, or missing components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction (AHJ)
3. Describe how to select and use test, calibration, and diagnostic equipment
4. Describe operational, diagnostic, and performance tests
5. Identify the role of inspection, maintenance, and repair schedules
6. Describe how to use inspection, maintenance, and repair checklists
7. Identify and evaluate conditions and recognize deficiencies
8. Identify and describe troubleshooting and adjustment methods and procedures
   • Corrosion
     o Clean
     o Correct cause (if possible)
     o Reccoat or repaint (if necessary)
   • Rust, oxidation, electrolysis
     o Clean
     o Spectrochemical analysis of fluids (onsite or offsite)
     o Neutralize
     o Correct cause (if possible)
     o Reccoat or repaint (if necessary)
   • Warping
     o Send for repair
   • Leaks
     o Clean
     o Correct cause (if possible)
     o Send for repair
   • Fluid and lubrication levels
     o Use recommended fluids
     o Adjust to appropriate fluid levels at operating temperature
   • Cracks, fractures, breaks
     o Send for repair
   • Loose, broken, worn, or missing components
     o Tighten
     o Replace
     o Adjust
     o Send for repair
9. Describe electrical troubleshooting procedures
10. Describe adjustment and calibration procedures
11. Describe repair and overhaul procedures
12. Identify inspection, maintenance, and repair record-keeping requirements
13. Evaluate reported conditions
14. Use test, calibration, and diagnostic equipment and any additional maintenance and repair equipment
15. Perform operational and verification tests
16. Recognize and identify symptoms and conditions
17. Perform all required maintenance (including checklist items)
18. Recognize, determine, and correct defects, deficiencies, and potential problems
19. Perform required repairs to resolve deficiencies
20. Complete and submit required inspection, maintenance, and repair documentation

Discussion Questions
1. Can an axle housing be welded?
2. Does a warped axle housing remove a vehicle from service?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the axles, identify maintenance requirements, and recommend potential repairs.


Topic 6-5: Brake System

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPS, manufacturer specifications, an inspection checklist, a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the brake system and related components so that the structural integrity, operation, and condition of the brake system and related components are verified to be within manufacturer specifications; the mounting is verified; systems and components are preserved, or restored and operational and within manufacturer specifications; multiplexing, interface electronics, and load management systems are tested for proper operation; all checklist items are inspected; defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; components are lubricated; fluid levels are maintained; calibrations and adjustments are performed; applicable tests are conducted; performance is verified; and inspections, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

Enabling Learning Objectives
1. List types of defects, deficiencies, and potential problems associated with the brake system and related components
   - Corrosion
   - Rust, oxidation, electrolysis
   - Warping
   - Leaks
     - Class I
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- Class II
- Class III
- Fluid and lubrication levels
- Cracks, fractures, breaks
- Loose, broken, worn, or missing components

2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction (AHJ)

3. Describe how to select and use test, calibration, and diagnostic equipment

4. Describe operational, diagnostic, and performance tests

5. Identify the role of inspection, maintenance, and repair schedules

6. Describe how to use inspection, maintenance, and repair checklists

7. Identify and evaluate conditions and recognize deficiencies

8. Identify and describe troubleshooting and adjustment methods and procedures

- Corrosion
  - Clean
  - Correct cause (if possible)
  - Recoat or repaint (if necessary)

- Rust, oxidation, electrolysis
  - Clean
  - Spectrochemical analysis of fluids (onsite or offsite)
  - Neutralize
  - Correct cause (if possible)
  - Recoat or repaint (if necessary)

- Warping
  - Send for repair

- Leaks
  - Clean
  - Correct cause (if possible)
  - Send for repair

- Fluid and lubrication levels
  - Use recommended fluids
  - Adjust to appropriate fluid levels at operating temperature

- Cracks, fractures, breaks
  - Send for repair

- Loose, broken, worn, or missing components
  - Tighten
  - Replace
  - Adjust
  - Send for repair

9. Describe electrical troubleshooting procedures

10. Describe adjustment and calibration procedures

11. Describe repair and overhaul procedures
12. Identify inspection, maintenance, and repair record-keeping requirements
13. Evaluate reported conditions
14. Use test, calibration, and diagnostic equipment and any additional maintenance and repair equipment
15. Perform operational and verification tests
16. Recognize and identify symptoms and conditions
17. Perform all required maintenance (including checklist items)
18. Recognize, determine, and correct defects, deficiencies, and potential problems
19. Perform required repairs to resolve deficiencies
20. Complete and submit required inspection, maintenance, and repair documentation

Discussion Questions
1. What methods would you use to evaluate the brake system?
2. How do you identify worn slack adjusters?
3. What can cause an out of service of brake drum?

Activities
1. Determined by instructor

Instructor Notes
1. Brakes are only referenced here as part of the complete chassis system. Brake curriculum through the Federal Motor Carrier Safety Administration (CFR 396.25) is required for State Fire Training EVT I certification.
2. Throughout hands-on lecture in the shop, utilize students to inspect the brake system, identify maintenance requirements, and recommend potential repairs.


Topic 6-6: Wheels and Tires

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPS, manufacturer specifications, an inspection checklist, a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the wheels and tires and related components so that the structural integrity, operation, and condition of the wheels and tires and related components are verified to be within manufacturer specifications; the mounting is verified; systems and components are preserved, or restored and operational and within manufacturer specifications; all checklist items are inspected; defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; components are lubricated; calibrations and adjustments are performed; applicable tests are conducted; performance is verified; and inspections, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)
Enabling Learning Objectives

1. List types of defects, deficiencies, and potential problems associated with the wheels and tires and related components
   • Corrosion
   • Rust, oxidation, electrolysis
   • Warping
   • Cracks, fractures, breaks
   • Tire age
   • Improper inflation
   • Improper vehicle loading
   • Loose, broken, worn, or missing components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction (AHJ)
3. Describe how to select and use test, calibration, and diagnostic equipment
4. Describe operational, diagnostic, and performance tests
5. Identify the role of inspection, maintenance, and repair schedules
6. Describe how to use inspection, maintenance, and repair checklists
7. Identify and evaluate conditions and recognize deficiencies
8. Identify and describe troubleshooting and adjustment methods and procedures
   • Corrosion
     o Clean
     o Correct cause (if possible)
     o Reccoat or repaint (if necessary)
   • Rust, oxidation, electrolysis
     o Clean
     o Spectrochemical analysis of fluids (onsite or offsite)
     o Neutralize
     o Correct cause (if possible)
     o Reccoat or repaint (if necessary)
   • Warping
     o Send for repair
   • Cracks, fractures, breaks
     o Send for repair
   • Loose, broken, worn, or missing components
     o Tighten
     o Replace
     o Adjust
     o Send for repair
9. Describe electrical troubleshooting procedures
10. Describe adjustment and calibration procedures
11. Describe repair and overhaul procedures
12. Identify inspection, maintenance, and repair record-keeping requirements
13. Evaluate reported conditions
14. Use test, calibration, and diagnostic equipment and any additional maintenance and repair equipment
15. Perform operational and verification tests
16. Recognize and identify symptoms and conditions
17. Perform all required maintenance (including checklist items)
18. Recognize, determine, and correct defects, deficiencies, and potential problems
19. Perform required repairs to resolve deficiencies
20. Complete and submit required inspection, maintenance, and repair documentation

Discussion Questions
1. How do you read the tire date codes?
2. How do you check for worn rims?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the wheels and tires, identify maintenance requirements, and recommend potential repairs.


Topic 6-7: Driveline

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPS, manufacturer specifications, an inspection checklist, a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the driveline and related components so that the structural integrity, operation, and condition of the driveline and related components are verified to be within manufacturer specifications; the mounting is verified; systems and components are preserved, or restored and operational and within manufacturer specifications; all checklist items are inspected; defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; components are lubricated; fluid levels are maintained; calibrations and adjustments are performed; applicable tests are conducted; performance is verified; and inspections, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

Enabling Learning Objectives
1. List types of defects, deficiencies, and potential problems associated with the driveline and related components
   - Corrosion
   - Rust, oxidation, electrolysis
   - Warping
• Leaks
  o Class I
  o Class II
  o Class III
• Fluid and lubrication levels
• Cracks, fractures, breaks
• Loose, broken, worn, or missing components

2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction (AHJ)
3. Describe how to select and use test, calibration, and diagnostic equipment
4. Describe operational, diagnostic, and performance tests
5. Identify the role of inspection, maintenance, and repair schedules
6. Describe how to use inspection, maintenance, and repair checklists
7. Identify and evaluate conditions and recognize deficiencies
8. Identify and describe troubleshooting and adjustment methods and procedures
• Corrosion
  o Clean
  o Correct cause (if possible)
  o Recoil or repaint (if necessary)
• Rust, oxidation, electrolysis
  o Clean
  o Spectrochemical analysis of fluids (onsite or offsite)
  o Neutralize
  o Correct cause (if possible)
  o Recoil or repaint (if necessary)
• Warping
  o Send for repair
• Leaks
  o Clean
  o Correct cause (if possible)
  o Send for repair
• Fluid and lubrication levels
  o Use recommended fluids
  o Adjust to appropriate fluid levels at operating temperature
• Cracks, fractures, breaks
  o Send for repair
• Loose, broken, worn, or missing components
  o Tighten
  o Replace
  o Adjust
  o Send for repair

9. Describe electrical troubleshooting procedures
10. Describe adjustment and calibration procedures
11. Describe repair and overhaul procedures
12. Identify inspection, maintenance, and repair record-keeping requirements
13. Evaluate reported conditions
14. Use test, calibration, and diagnostic equipment and any additional maintenance and repair equipment
15. Perform operational and verification tests
16. Recognize and identify symptoms and conditions
17. Perform all required maintenance (including checklist items)
18. Recognize, determine, and correct defects, deficiencies, and potential problems
19. Perform required repairs to resolve deficiencies
20. Complete and submit required inspection, maintenance, and repair documentation

Discussion Questions
1. What are the components of a driveline?
2. What can cause a driveline failure?

Activities
1. Given a chassis system, have students inspect the driveline system, identify maintenance requirements, and recommend potential repairs.

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the driveline system, identify maintenance requirements, and recommend potential repairs.


Topic 6-8: Auxiliary Drive Systems

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPS, manufacturer specifications, an inspection checklist, a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the auxiliary drive systems and related components so that the structural integrity, operation, and condition of the auxiliary drive systems and related components are verified to be within manufacturer specifications; the mounting is verified; systems and components are preserved, or restored and operational and within manufacturer specifications; all checklist items are inspected; defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; components are lubricated; fluid levels are maintained; calibrations and adjustments are performed; applicable tests are conducted; performance is verified; and inspections, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)
Enabling Learning Objectives

1. List types of defects, deficiencies, and potential problems associated with the auxiliary drive systems and related components
   - Corrosion
   - Rust, oxidation, electrolysis
   - Warping
   - Leaks
     - Class I
     - Class II
     - Class III
   - Fluid and lubrication levels
   - Cracks, fractures, breaks
   - Loose, broken, worn, or missing components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction (AHJ)
3. Describe how to select and use test, calibration, and diagnostic equipment
4. Describe operational, diagnostic, and performance tests
5. Identify the role of inspection, maintenance, and repair schedules
6. Describe how to use inspection, maintenance, and repair checklists
7. Identify and evaluate conditions and recognize deficiencies
8. Identify and describe troubleshooting and adjustment methods and procedures
   - Corrosion
     - Clean
     - Correct cause (if possible)
     - Recoat or repaint (if necessary)
   - Rust, oxidation, electrolysis
     - Clean
     - Spectrochemical analysis of fluids (onsite or offsite)
     - Neutralize
     - Correct cause (if possible)
     - Recoat or repaint (if necessary)
   - Warping
     - Send for repair
   - Leaks
     - Clean
     - Correct cause (if possible)
     - Send for repair
   - Fluid and lubrication levels
     - Use recommended fluids
     - Adjust to appropriate fluid levels at operating temperature
   - Cracks, fractures, breaks
     - Send for repair
• Loose, broken, worn, or missing components
  o Tighten
  o Replace
  o Adjust
  o Send for repair
9. Describe electrical troubleshooting procedures
10. Describe adjustment and calibration procedures
11. Describe repair and overhaul procedures
12. Identify inspection, maintenance, and repair record-keeping requirements
13. Evaluate reported conditions
14. Use test, calibration, and diagnostic equipment and any additional maintenance and repair equipment
15. Perform operational and verification tests
16. Recognize and identify symptoms and conditions
17. Perform all required maintenance (including checklist items)
18. Recognize, determine, and correct defects, deficiencies, and potential problems
19. Perform required repairs to resolve deficiencies
20. Complete and submit required inspection, maintenance, and repair documentation

Discussion Questions
1. What might cause vibration in the auxiliary drive system?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the auxiliary drive system, identify maintenance requirements, and recommend potential repairs.


Topic 6-9: Cooling Systems

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPS, manufacturer specifications, an inspection checklist, a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the cooling systems and related components so that the structural integrity, operation, and condition of the cooling systems and related components are verified to be within manufacturer specifications; the mounting is verified; systems and components are preserved, or restored and operational and within manufacturer specifications; multiplexing and interface electronics systems are tested for proper operation; all checklist items are inspected; defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; fluid levels are maintained; calibrations and adjustments are performed; applicable tests are conducted;
performance is verified; and inspections, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

**Enabling Learning Objectives**

1. List types of defects, deficiencies, and potential problems associated with the cooling systems and related components
   - Corrosion
   - Rust, oxidation, electrolysis
   - Warping
   - Leaks
     - Class I
     - Class II
     - Class III
   - Fluid and lubrication levels
   - Cracks, fractures, breaks
   - Loose, broken, worn, or missing components

2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction (AHJ)

3. Describe how to select and use test, calibration, and diagnostic equipment

4. Describe operational, diagnostic, and performance tests

5. Identify the role of inspection, maintenance, and repair schedules

6. Describe how to use inspection, maintenance, and repair checklists

7. Identify and evaluate conditions and recognize deficiencies

8. Identify and describe troubleshooting and adjustment methods and procedures
   - Corrosion
     - Clean
     - Correct cause (if possible)
     - Recoil or repaint (if necessary)
   - Rust, oxidation, electrolysis
     - Clean
     - Spectrochemical analysis of fluids (onsite or offsite)
     - Neutralize
     - Correct cause (if possible)
     - Recoil or repaint (if necessary)
   - Warping
     - Send for repair
   - Leaks
     - Clean
     - Correct cause (if possible)
     - Send for repair
   - Fluid and lubrication levels
     - Use recommended fluids
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- Adjust to appropriate fluid levels at operating temperature
- Cracks, fractures, breaks
  - Send for repair
- Loose, broken, worn, or missing components
  - Tighten
  - Replace
  - Adjust
  - Send for repair

9. Describe electrical troubleshooting procedures
10. Describe adjustment and calibration procedures
11. Describe repair and overhaul procedures
12. Identify inspection, maintenance, and repair record-keeping requirements
13. Evaluate reported conditions
14. Use test, calibration, and diagnostic equipment and any additional maintenance and repair equipment
15. Perform operational and verification tests
16. Recognize and identify symptoms and conditions
17. Perform all required maintenance (including checklist items)
18. Recognize, determine, and correct defects, deficiencies, and potential problems
19. Perform required repairs to resolve deficiencies
20. Complete and submit required inspection, maintenance, and repair documentation

Discussion Questions
1. What cooling systems are evaluated as part of the chassis system?
2. How do you test coolant?
3. How do you test a radiator cap?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the cooling system, identify maintenance requirements, and recommend potential repairs.


Unit 7: Testing

Topic 7-1: Axle Weight Performance Testing

Terminal Learning Objective

At the end of this topic, a student, given an emergency response vehicle, an applicable driving license (if required), and a commercial certified scale, will be able to complete an axle weight performance test on an apparatus in accordance with NFPA 1911 so that the apparatus weight is determined to ensure that the weight on the vehicle does not exceed the gross axle weight rating (GAWR) and the gross vehicle weight rating (GVWR) or gross combination weight rating (GCWR) as shown on the rating plate on the fire apparatus; and
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all testing is documented in accordance with the requirements of NFPA standards and the authority having jurisdiction (AHJ)

Enabling Learning Objectives
1. Describe the legal operation of fire apparatus
   • Department of Motor Vehicles (DMV) identifies vehicle licensing requirements
   • Individual license holders bear responsibility for knowing which vehicle(s) they may legally operate
2. Identify the location of a certified scale
   • US DOT provides lists of certified scales (www.transportation.gov)
   • California Highway Patrol (CHP) has lists of certified commercial scales
3. Identify record-keeping requirements of NFPA 1911 and the AHJ
   • NFPA 1911 (2012) / Chapter 16: Road Tests and Annual Weight Verification
4. Describe the axle weight performance testing process
5. Complete required documentation
   • Forms identified in NFPA 1911
   • Any additional AHJ requirements

Discussion Questions
1. Why is it important to weigh an apparatus?
2. Who determines apparatus weight limits?

Activities
1. Determined by instructor

Instructor Notes
1. ELO 1: Provide the licensing information current at the time of course offering
2. ELO 3: Use the current NFPA 1911 edition (provide digital or paper copy of Chapter 16)
3. ELO 4: Use current NFPA 1911 edition paragraphs as the outline to teach the process

CTS Guide Reference: CTS 2-6

Topic 7-2: Brake Performance Testing

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, an applicable driving license (if required), and a calibrated driving course, will be able to complete a braking performance test on an apparatus in accordance with NFPA 1911 so that the apparatus braking system performance is verified to ensure that the braking ability of the apparatus complies with the requirements of NFPA 1911 and federal and state regulations; and all testing is documented in accordance with the requirements of NFPA standards and the authority having jurisdiction (AHJ)

Enabling Learning Objectives
1. Recognize the need for brake performance testing
   • Validate vehicle ability
   • Fire personnel and public safety
   • Budgeting and forecasting
2. Demonstrate familiarity with brake testing course
4. Identify brake performance requirements of NFPA 1911 and federal and state regulations
   - NFPA 1911 (2012) / Chapter 16: Road Tests and Annual Weight Verification
   - US DOT Federal Motor Carrier Safety Administration / Part 393
5. Identify record-keeping requirements of NFPA 1911 and the AHJ
   - NFPA 1911 (2012) / Chapter 16: Road Tests and Annual Weight Verification
   - AHJ (vary)
6. Describe the brake performance testing process
   - NFPA covers emergency vehicles / fire apparatus
   - US DOT covers commercial vehicles
   - CVC covers any vehicle with a brake
7. Complete required documentation
   - Forms identified in NFPA 1911
   - Any additional AHJ requirements

Discussion Questions
1. Who determines brake test requirements?
2. When is a brake performance test required?

Activities
1. Determined by instructor

Instructor Notes
1. ELO 4: Use the current NFPA 1911 edition (provide digital or paper copy of Chapter 16)
2. ELO 5: Use the appropriate published regulations or requirements depending on vehicle type as the outline to teach this process

CTS Guide Reference: CTS 2-7

Topic 7-3: Parking Brake Performance Testing

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, an applicable driving license (if required), and an appropriate road grade, will be able to complete a parking brake performance test on an apparatus in accordance with NFPA 1911 so that the apparatus parking brake system performance is verified to ensure that the park braking ability of the apparatus complies with the requirements of NFPA 1911 and federal and state regulations; and all testing is documented in accordance with the procedures of NFPA standards and the authority having jurisdiction (AHJ)

Enabling Learning Objectives
1. Recognize the need for parking brake testing
2. Demonstrate familiarity with parking brake testing course
3. Identify parking brake performance requirements of NFPA 1911 and federal and state regulations
   - NFPA 1911 (2012) / Chapter 16: Road Tests and Annual Weight Verification
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- US DOT Federal Motor Carrier Safety Administration / Part 393

4. Identify record-keeping requirements of NFPA 1911 and the AHJ
   - NFPA 1911 (2012) / Chapter 16: Road Tests and Annual Weight Verification

5. Describe the performance brake testing process
6. Complete required documentation

Discussion Questions
1. How do you position a vehicle for park brake testing?
2. What action is required if a vehicle fails park brake testing?

Activities
1. Determined by instructor

Instructor Notes
1. ELO 3: Use the current NFPA 1911 edition (provide digital or paper copy of Chapter 16)
2. ELO 5: Use the appropriate published regulations or requirements depending on vehicle type as the outline to teach this process

CTS Guide Reference: CTS 2-8
Unit 8: Cab and Body Overview

Topic 8-1: Terminology

Terminal Learning Objective
At the end of this topic, a student, given NFPA 1071 terminology, will be able to define inspection, maintenance, repair, and overhaul (rebuild) in accordance NFPA standards

Enabling Learning Objectives
1. Define “inspect(ion)"
   - 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
2. Define “maintenance”
   - The act of servicing a fire apparatus or a component in order to keep the vehicle and its components in proper operating condition
3. Define “repair”
   - To restore to sound condition after failure or damage
4. Define “overhaul (rebuild)”
   - To make extensive repairs in order to restore a component to like-new condition in accordance with the original manufacturer’s specifications

Discussion Questions
1. Determined by instructor

Activities
1. Determined by instructor

CTS Guide Reference: None

Topic 8-2: The Inspection, Maintenance, Repair, and Testing Cycle

Terminal Learning Objective
At the end of this topic, a student, given circumstances that initiate the inspection process, safety requirements, and an overview of appropriate facilities and equipment, will be able to describe the cycle of inspecting, maintaining, repairing, and testing emergency vehicle cabs and bodies and related components in accordance with NFPA standards

Enabling Learning Objectives
1. Identify circumstances that initiate the inspection process
   - Acceptance test of new vehicle
   - Meeting manufacturer and/or AHJ inspection cycle
   - Responding to a suspected or reported problem
• Acceptance test of repaired vehicle

2. Identify safety requirements
   • Vehicle safety
   • Technician safety

3. Identify facilities and equipment
   • Proper location(s) for inspection, maintenance, repair/replace, testing
   • Required tools/equipment
     o Test, calibration, and diagnostic
     o Inspection
     o Maintenance and repair

4. Describe the inspection process
   • Gather tools and safety equipment
   • Secure vehicle in a safe environment
   • Evaluate reported conditions (if applicable)
   • Perform operational tests
     o What if you can’t duplicate or validate the concern?
   • Identify and report defects and deficiencies, including broken, loose, worn, or missing parts
   • Complete checklist and document findings
     o Checklists vary by manufacturer and authority having jurisdiction (AHJ)
     o Chassis checklist should, at a minimum, include:
       ▪ Vehicle identification number (VIN) or unit number
       ▪ Engine hours or mileage
       ▪ Manufacturer inspection requirements
       ▪ AHJ inspection requirements
       ▪ Inspector name and signature
       ▪ Inspection date
   • Return vehicle to service or move to maintenance or repair

5. Identify the role of a maintenance schedule and a maintenance checklist
   • Scheduling
   • Budgeting
     o Allocation
     o Cost reduction
     o Forecasting
   • Fleet lifecycle
   • Research and development
   • Audits
   • Legal protection

6. Describe the maintenance process
   • Identify the appropriate scope and authority for maintenance vs. repair activities
   • Identify individual technician’s authorization for maintenance activities
   • Identify maintenance needs from inspection report
• Gather tools and safety equipment
• Secure vehicle in a safe environment
• Evaluate reported conditions
  o Review inspection report
  o Identify repairs (outside maintenance scope)
  o Prioritize maintenance activities
• Perform operational tests
• Perform maintenance duties
• Conduct performance tests
• Complete checklist and document findings
• Return vehicle to service or move to repair

7. Describe the repair and/or replacement process
• Identify the appropriate scope and authority for internal vs. external repair activities
• Identify individual technician’s authorization for repair activities
• Identify repair needs from inspection and/or maintenance report
• Gather tools and safety equipment
• Secure vehicle in a safe environment
• Evaluate reported conditions
• Perform operational tests
• Repair or replace deformed, broken, loose, worn, or missing parts
• Conduct performance tests
• Complete checklist and document findings
• Release to manufacturer or third-party shop for repair (if applicable)
  o Acceptance testing (inspection) on returned/repaired vehicle
  o Complete checklist and document findings
• Return vehicle to service

Discussion Questions
1. Determined by instructor

Activities
1. Determined by instructor

CTS Guide Reference: None

Unit 9: Cab and Body Systems and Components

Topic 9-1: Function, Construction, and Operation

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle, SOPs, and manufacturer specifications, will be able to describe the function, construction, and operation of cab and body systems and components in accordance with manufacturer specifications and the authority having jurisdiction (AHJ) requirements
Enabling Learning Objectives

1. Describe the function, construction, and operation of the crew and passenger compartments
   • Glass, windows, and mirrors
     o Manual
     o Electronic
   • Seats
   • Seatbelts and safety restraints
   • Doors, door hinges, latches, and door stops
   • Lighting
   • Climate control system
   • Instrumentation
   • Cab mounting system
     o Mounting brackets
     o Cab base structure
     o Resilient cushions
     o Securing fasteners
   • Equipment mounting systems
     o Mounting racks
       ▪ Manual
       ▪ Electronic
     o Brackets
     o Latches
     o Interlocks and warning systems
       ▪ Visual
       ▪ Audible
     o Radios, computers, and siren controls
     o Self-contained breathing apparatus (SCBA)
     o Portable lights
     o Hand tools
     o Emergency medical service (EMS) equipment
     o Books, street directories, maps
   • Cab tilting systems
     o Switches and remote controls
     o Interlocks
     o Motors and pumps
     o Reservoirs
     o Hoses and fittings
     o Cylinders and lifting devices
     o Cab support devices
     o Pivot points
     o Latches and hold-down devices
Describe the function, construction, and operation of the body and compartmentation

- Compartments and storage areas
- Lighting
- Hinges, latches, and seals
- Doors
- Shelves and dividers
- Hazard warning lights and interlocks
  - Visual
  - Audible
- Steps, platforms, handrails, access ladders
- Slip-resistant surfaces
- Mechanical steps
- Equipment mounting racks and brackets
- Finishes and reflective stripping
- Signs and labels

Discussion Questions
1. What is the main purpose of the safety systems?
2. What might cause corrosion in the cab or body?

Activities
1. Determined by instructor

CTS Guide Reference: CTS 3-1 / CTS 3-3 / CTS 3-4 / CTS 3-6 / CTS 3-7 / CTS 3-8 / CTS 3-9 / CTS 3-11

Topic 9-2: Electricity and Electronics

Terminal Learning Objective
At the end of this topic, a student, given principles of electricity, electrical connection, and operational theory, will be able to apply those principles and theories to the electrical systems in the cab and body in accordance with manufacturer specifications and authority having jurisdiction (AHJ) requirements

Enabling Learning Objectives
1. Identify the principles of electricity and the operational theory of electronics
   - Principles of electricity and electronics
     - Ohm’s law
       - Resistance goes up / amperage goes down
       - Amperage goes up / resistance goes down
     - Watt’s law
       - Electrical law of work
     - Kirchhoff’s law
       - All voltage is used up by the time the circuit is complete
       - Amperage will be the same throughout the circuit
   - Electrical systems in the cab and body
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- Low voltage
  - Batteries
  - Starter
  - Alternator
  - Wiring
- Line voltage
  - Power generation system
  - Shore power
- Electronic
  - Interface electronics (e.g. pump control module, engine status center, transmission control module, anti-lock brake system module, etc.)
  - Load management systems

2. Identify electrical connection theory and maintenance
3. Describe electrical troubleshooting procedures
   - Test system’s all-inclusive voltage drop
4. Measure voltage, amperage, and resistance

Discussion Questions
1. What are some grounding sources?

Activities
1. Determined by instructor

Instructor Notes
1. Electrical is referenced here as part of the complete cab and body system. Complete curriculum for inspecting electrical systems is found in Emergency Vehicle Technician 1B: Electrical Systems A and Emergency Vehicle Technician 2A : Electrical Systems B. Keep this brief.

CTS Guide Reference: CTS 3-5 / CTS 3-6 / CTS 3-8

Topic 9-3: Welding and Fabrication

Terminal Learning Objective
At the end of this topic, a student, given basic welding and fabrication principles and techniques, will be able to apply welding and fabrication procedures needed to maintain and repair systems and components and in the cab and body in accordance with manufacturer specifications and authority having jurisdiction (AHJ) requirements

Enabling Learning Objectives
1. Describe basic welding and fabrication procedures
2. Identify welding experience and/or certification requirements for different parts of an apparatus

Discussion Questions
1. Determined by instructor

Activities
1. Determined by instructor
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Instructor Notes

1. It is beyond the scope of this course to teach welding. However students should be familiar with basic techniques for minor repairs.

CTS Guide Reference: CTS 3-3 / CTS 3-6 / CTS 3-8 / CTS 3-11

Unit 10: Inspection, Maintenance, and Repair

Topic 10-1: Crew and Passenger Compartments

Terminal Learning Objective

At the end of this topic, a student, given an emergency response vehicle (with a cab tilt system) and its assigned equipment, SOPs, manufacturer specifications, an inspection checklist (or assignment), a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the crew and passenger compartments and related components so that the operation and condition of the crew and passenger compartments and related components are verified, or preserved and restored, to be within manufacturer specifications; the condition of finishes, signs, labels, and paint is determined and documented; climate control systems are tested for proper operation; the tilt mechanism is readied safe; the structural integrity is assessed; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; warning system components function; all hoses are tight; leaks are stopped; latches are aligned and adjusted to operational condition; fluids are checked and filled; any electrical connections are clean and tight; worn pads are replaced; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; components are fabricated, adjusted, aligned, and lubricated; all checklist items are inspected; additional repair needs are reported; defective components are diagnosed; defects and deficiencies, including broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; operational tests are conducted and performance is verified; hazardous conditions are avoided or resolved; and inspections, activities, tests, and checks are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

Enabling Learning Objectives

1. Identify types of defects, deficiencies, and potential problems associated with crew and passenger compartments and related components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction
3. Describe how to select test, calibration, and diagnostic equipment
4. Identify materials used in crew and passenger compartments and related components
5. Identify and describe types of fluids and lubricants
6. Identify failures and restoration of finishes, signs, labels, and paint
7. Identify leak classifications and methods to stop them
8. Describe troubleshooting procedures
9. Describe adjustment, calibration, and alignment methods and procedures
10. Identify personnel safety restraint systems that may present hazards during cab repair
11. Describe principles of pneumatic, hydraulic, and electric operation
12. Describe repair, rebuild, and replacement procedures
13. Identify required verification testing
14. Identify inspection, maintenance, and repair record-keeping requirements
15. Recognize and identify symptoms and conditions of crew and passenger compartments and related components
16. Use test, calibration, and diagnostic equipment
17. Determine defects, deficiencies, and potential problems
18. Recognize, identify, and evaluate reported conditions
19. Perform all required maintenance (including checklist items) to resolve deficiencies
20. Mitigate personnel safety restraint system hazards
21. Apply paint and finish materials
22. Perform all required repairs to resolve deficiencies
23. Perform operational checks and verification tests
24. Complete inspection, maintenance, and repair checklists and documentation

**Discussion Questions**
1. What can cause an out of service seat belt?

**Activities**
1. Determined by instructor

**Instructor Notes**
1. Throughout hands-on lecture in the shop, utilize students to inspect the crew and passenger compartments, identify maintenance requirements, and recommend potential repairs.

**CTS Guide Reference:** CTS 3-3 / CTS 3-1 / CTS 3-2 / CTS 3-11

**Topic 10-2: Cab Mounting System**

**Terminal Learning Objective**
At the end of this topic, a student, given an emergency response vehicle (with a cab tilt system) and its assigned equipment, SOPs, manufacturer specifications, an inspection checklist (or assignment), a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the cab mounting system and related components so that the operation and condition of the cab mounting system and related components are verified, or preserved and restored, to be within manufacturer specifications; the condition of finishes, signs, labels, and paint is determined and documented; climate control systems are tested for proper operation; the tilt mechanism is readied safe; the structural integrity is assessed; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; warning system components function; all hoses are tight; leaks are stopped; latches are aligned and adjusted to operational condition; fluids are checked and filled; any electrical...
connections are clean and tight; worn pads are replaced; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; components are fabricated, adjusted, aligned, and lubricated; all checklist items are inspected; additional repair needs are reported; defective components are diagnosed; defects and deficiencies, including broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; operational tests, diagnostic checks, are conducted and performance is verified; hazardous conditions are avoided or resolved; and inspections, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

**Enabling Learning Objectives**

1. Identify types of defects, deficiencies, and potential problems associated with cab mounting system and related components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction
3. Describe how to select test, calibration, and diagnostic equipment
4. Identify materials used in cab mounting system and related components
5. Identify and describe types of fluids and lubricants
6. Identify failures and restoration of finishes, signs, labels, and paint
7. Identify leak classifications and methods to stop them
8. Describe troubleshooting procedures
9. Describe adjustment, calibration, and alignment methods and procedures
10. Identify personnel safety restraint systems that may present hazards during cab repair
11. Describe principles of pneumatic, hydraulic, and electric operation
12. Describe repair, rebuild, and replacement procedures
13. Identify required verification testing
14. Identify inspection, maintenance, and repair record-keeping requirements
15. Recognize and identify symptoms and conditions of cab mounting system and related components
16. Use test, calibration, and diagnostic equipment
17. Determine defects, deficiencies, and potential problems
18. Recognize, identify, and evaluate reported conditions
19. Perform all required maintenance (including checklist items) to resolve deficiencies
20. Mitigate personnel safety restraint system hazards
21. Apply paint and finish materials
22. Perform all required repairs to resolve deficiencies
23. Perform operational checks, diagnostic checks, and verification tests
24. Complete inspection, maintenance, and repair checklists and documentation

**Discussion Questions**

1. What might cause worn cab bushings?
2. Does fluid type matter?

**Activities**

1. Determined by instructor
2. Throughout hands-on lecture in the shop, utilize students to inspect the cab mounting system, identify maintenance requirements, and recommend potential repairs.

**CTS Guide Reference:** CTS 3-3 / CTS 3-4 / CTS 3-5 / CTS 3-6

**Topic 10-3: Equipment Mounting Systems**

**Terminal Learning Objective**

At the end of this topic, a student, given an emergency response vehicle (with a cab tilt system) and its assigned equipment, SOPs, manufacturer specifications, an inspection checklist (or assignment), a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the equipment mounting systems and related components so that the operation and condition of the equipment mounting systems and related components are verified, or preserved and restored, to be within manufacturer specifications; the condition of finishes, signs, labels, and paint is determined and documented; the tilt mechanism is readied safe; the structural integrity is assessed; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; warning system components function; all hoses are tight; leaks are stopped; latches are aligned and adjusted to operational condition; fluids are checked and filled; any electrical connections are clean and tight; worn pads are replaced; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; components are fabricated, adjusted, aligned, and lubricated; all checklist items are inspected; additional repair needs are reported; defective components are diagnosed; defects and deficiencies, including broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer’s specifications; operational checks and diagnostic checks are conducted and performance is verified; hazardous conditions are avoided or resolved; and inspections and checks, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

**Enabling Learning Objectives**

1. Identify types of defects, deficiencies, and potential problems associated with equipment mounting system and related components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction
3. Describe how to select test, calibration, and diagnostic equipment
4. Identify materials used in equipment mounting system and related components
5. Identify and describe types of fluids and lubricants
6. Identify failures and restoration of finishes, signs, labels, and paint
7. Identify leak classifications and methods to stop them
8. Describe troubleshooting procedures
9. Describe adjustment, calibration, and alignment methods and procedures
10. Identify personnel safety restraint systems that may present hazards during cab repair
11. Describe principles of pneumatic, hydraulic, and electric operation
12. Describe repair, rebuild, and replacement procedures
13. Identify required verification testing
14. Identify inspection, maintenance, and repair record-keeping requirements
15. Recognize and identify symptoms and conditions of equipment mounting system and related components
16. Use test, calibration, and diagnostic equipment
17. Determine defects, deficiencies, and potential problems
18. Recognize, identify, and evaluate reported conditions
19. Perform all required maintenance (including checklist items) to resolve deficiencies
20. Mitigate personnel safety restraint system hazards
21. Apply paint and finish materials
22. Perform all required repairs to resolve deficiencies
23. Perform operational checks, diagnostic checks and verification tests
24. Complete inspection, maintenance, and repair checklists and documentation

Discussion Questions
1. Should broken equipment supports be fixed?
2. What are some different classes of leaks?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the equipment mounting systems, identify maintenance requirements, and recommend potential repairs.

CTS Guide Reference: CTS 3-3 / CTS 3-4 / CTS 3-5 / CTS 3-6

Topic 10-4: Cab Tilting Systems

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle (with a cab tilt system) and its assigned equipment, SOPs, manufacturer specifications, an inspection checklist (or assignment), a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the cab tilting systems and related components so that the operation and condition of the cab tilting systems and related components are verified, or preserved and restored, to be within manufacturer specifications; the condition of finishes, signs, labels, and paint is determined and documented; the tilt mechanism is readied safe; the structural integrity is assessed; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; warning system components function; all hoses are tight; leaks are stopped; latches are aligned and adjusted to operational condition; fluids are checked and filled; any electrical connections are clean and tight; worn pads are replaced; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; components are fabricated, adjusted, aligned, and lubricated; all checklist items are inspected; additional...
repair needs are reported; defective components are diagnosed; defects and deficiencies, including broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; diagnostic checks are conducted and performance is verified; hazardous conditions are avoided or resolved; and inspections, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

**Enabling Learning Objectives**

1. Identify types of defects, deficiencies, and potential problems associated with the cab tilting system and related components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction
3. Describe how to select test, calibration, and diagnostic equipment
4. Identify materials used in the cab tilting system and related components
5. Identify and describe types of fluids and lubricants
6. Identify failures and restoration of finishes, signs, labels, and paint
7. Identify leak classifications and methods to stop them
8. Describe troubleshooting procedures
9. Describe adjustment, calibration, and alignment methods and procedures
10. Identify personnel safety restraint systems that may present hazards during cab repair
11. Describe principles of pneumatic, hydraulic, and electric operation
12. Describe repair, rebuild, and replacement procedures
13. Identify required verification testing and diagnostic checks
14. Identify inspection, maintenance, and repair record-keeping requirements
15. Recognize and identify symptoms and conditions of the cab tilting system and related components
16. Use test, calibration, and diagnostic equipment
17. Determine defects, deficiencies, and potential problems
18. Recognize, identify, and evaluate reported conditions
19. Perform all required maintenance (including checklist items) to resolve deficiencies
20. Mitigate personnel safety restraint system hazards
21. Apply paint and finish materials
22. Perform all required repairs to resolve deficiencies
23. Perform operational, verification tests, and diagnostic checks
24. Complete inspection, maintenance, and repair checklists and documentation

**Discussion Questions**

1. How are an electric cab tilt system and a hydraulic cab tilt system different?
   - How are they similar?
2. Is a “locked” indicator required?

**Activities**

1. Determined by instructor

**Instructor Notes**

1. Throughout hands-on lecture in the shop, utilize students to inspect the cab tilting systems, identify maintenance requirements, and recommend potential repairs.
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CTS Guide Reference: CTS 3-7 / CTS 3-8

Topic 10-5: Body and Compartmentation

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle (with a cab tilt system) and its assigned equipment, SOPs, manufacturer specifications, an inspection checklist (or assignment), a maintenance checklist, a maintenance schedule (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform maintenance and repairs on the body and compartmentation and related components so that the operation and condition of the body and compartmentation and related components are verified, or preserved and restored, to be within manufacturer specifications; the condition of finishes, signs, labels, and paint is determined and documented; climate control systems are tested for proper operation; the tilt mechanism is readied safe; the structural integrity is assessed; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; warning system components function; all hoses are tight; leaks are stopped; latches are aligned and adjusted to operational condition; fluids are checked and filled; any electrical connections are clean and tight; worn pads are replaced; skid-resistant walking surfaces are intact; finishes and surfaces are clean and preserved; components are fabricated, adjusted, aligned, and lubricated; all checklist items are inspected; additional repair needs are reported; defective components are diagnosed; defects and deficiencies, including broken, loose, worn, or missing parts, are identified and reported and then repaired, rebuilt, or replaced to manufacturer specifications; operational tests are conducted and performance is verified; hazardous conditions are avoided or resolved; and inspections, checks, activities, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ)

Enabling Learning Objectives
1. Identify types of defects, deficiencies, and potential problems associated with the body and compartmentation and related components
2. Describe the inspection, diagnostic, maintenance, and repair procedures of the manufacturer and the authority having jurisdiction
3. Describe how to select test, calibration, and diagnostic equipment
4. Identify materials used in the body and compartmentation and related components
5. Identify and describe types of fluids and lubricants
6. Identify failures and restoration of finishes, signs, labels, and paint
7. Identify leak classifications and methods to stop them
8. Describe troubleshooting procedures
9. Describe adjustment, calibration, and alignment methods and procedures
10. Identify personnel safety restraint systems that may present hazards during cab repair
11. Describe principles of pneumatic, hydraulic, and electric operation
12. Describe repair, rebuild, and replacement procedures
13. Identify required verification testing
14. Identify inspection, maintenance, and repair record-keeping requirements
15. Recognize and identify symptoms and conditions of the body and compartmentation and related components
16. Use test, calibration, and diagnostic equipment
17. Determine defects, deficiencies, and potential problems
18. Recognize, identify, and evaluate reported conditions
19. Perform all required maintenance (including checklist items) to resolve deficiencies
20. Mitigate personnel safety restraint system hazards
21. Apply paint and finish materials
22. Perform all required repairs to resolve deficiencies
23. Perform operational checks and verification tests
24. Complete inspection, maintenance, and repair checklists and documentation

Discussion Questions
1. Are loose mountings a concern?
2. Will “cosmetic damage” put a unit out of service?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the body and compartmentation, identify maintenance requirements, and recommend potential repairs.

CTS Guide Reference: CTS 3-1 / CTS 3-2 / CTS 3-3 / CTS 3-9 / CTS 3-10 / CTS 3-11
Tank and Accessories Module

Unit 11: Tank and Accessories Overview

Topic 11-1: Tank and Accessories Terminology

Terminal Learning Objective
At the end of this topic, a student, given NFPA 1071 terminology, will be able to define inspection, maintenance, repair, and overhaul (rebuild) in accordance NFPA standards

Enabling Learning Objectives
1. Define “inspect(ion)
   • 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
2. Define “maintenance”
   • The act of servicing a fire apparatus or a component in order to keep the vehicle and its components in proper operating condition
3. Define “repair”
   • To restore to sound condition after failure or damage
4. Define “overhaul (rebuild)”
   • To make extensive repairs in order to restore a component to like-new condition in accordance with the original manufacturer’s specifications

Discussion Questions
1. Determined by instructor

Activities
1. Determined by instructor

CTS Guide Reference: None

Topic 11-2: The Inspection, Maintenance, Repair, and Testing Cycle

Terminal Learning Objective
At the end of this topic, a student, given circumstances that initiate the inspection process, safety requirements, and an overview of appropriate facilities and equipment, will be able to describe the cycle of inspecting, maintaining, repairing, and testing emergency vehicle pumps and tanks in accordance with NFPA standards

Enabling Learning Objectives
1. Identify circumstances that initiate the inspection process
   • Acceptance test of new vehicle
   • Meeting manufacturer and/or AHJ inspection cycle
   • Responding to a suspected or reported problem
   • Acceptance test of repaired vehicle
2. Identify safety requirements
Emergency Vehicle Technician 1A

- Vehicle safety
- Technician safety

3. Identify facilities and equipment
   - Proper location(s) for inspection, maintenance, repair/replace, testing
   - Required tools/equipment
     - Test, calibration, and diagnostic
     - Maintenance and repair

4. Describe the inspection process
   - Evaluate reported conditions (if applicable)
   - Perform operational tests
     - What if you can’t duplicate or validate the concern?
   - Identify and report defects and deficiencies, including broken, loose, worn, or missing parts
   - Complete checklist and document findings
   - Return vehicle to service or move to maintenance or repair

5. Describe the maintenance process
   - Evaluate reported conditions
   - Perform operational tests
   - Perform maintenance duties
   - Conduct performance tests
   - Complete checklist and document findings
   - Return vehicle to service or move to repair

6. Describe the repair and/or replacement process
   - Evaluate reported conditions
   - Perform operational tests
   - Repair or replace deformed, broken, loose, worn, or missing parts
   - Conduct performance tests and diagnostic checks
   - Complete checklist and document findings
   - Release to manufacturer or third-party shop for repair (if applicable)
     - Acceptance testing (inspection) on returned/repaired vehicle
     - Complete checklist and document findings
   - Return vehicle to service

Discussion Questions
   1. Determined by instructor

Activities
   1. Determined by instructor

CTS Guide Reference: None

Unit 12: Inspection and Repair Water/Foam/Agent Tanks

Topic 12-1: Function, Construction, Operation, and Mounting
Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle with a water, foam, or agent tank, SOPs, and manufacturer specifications, will be able to describe the function, construction, operation, and mounting of water, foam, and agent tanks and related components, diagnostic checks, and inspections in accordance with manufacturer specifications and the authority having jurisdiction (AHJ) requirements.

Enabling Learning Objectives
1. Describe the function, construction, operation, and mounting of water tanks
2. Describe the function, construction, operation, and mounting of foam tanks
3. Describe the function, construction, operation, and mounting of agent tanks

Discussion Questions
1. Is “foam” required on an apparatus?
2. What is the minimum foam tank size?

Activities
1. Determined by instructor

CTS Guide Reference: CTS 5-4 / CTS 5-5

Topic 12-2: Water and Foam Tanks

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle with a water, foam, or agent tank, manufacturer specifications, SOPs, an inspection checklist (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform repairs on water and foam tanks so that the mounting and condition of the tank is verified; all coated and non-coated interior and exterior surfaces are free of corrosion; sacrificial anodes are evaluated for life-cycle condition and replaced if necessary; the tank is flushed; all checklist items are inspected; leaks are repaired; coatings are renewed; and defects and deficiencies, including deformed, broken, loose, worn, or missing parts, are identified and reported, and repaired, replaced, or rebuilt to manufacturer specifications; service flow test of the tank(s) is conducted; and inspection, tests, and repairs are documented in accordance with the procedures of the manufacturer and the authority having jurisdiction (AHJ).

Enabling Learning Objectives
1. Describe types of materials used in water and foam tanks
2. Identify types of defects, deficiencies, and potential problems associated with water and foam tanks and related components
   - Corrosion
   - Rust, oxidation, electrolysis
   - Warping
   - Leaks
   - Cracks, fractures, breaks
   - Incompatible foam combinations
   - Loose, broken, worn, or missing components
3. Describe the inspection, diagnostic, and repair procedures of the manufacturer and the authority having jurisdiction
4. Describe how to select test, calibration, and diagnostic equipment
5. Describe testing procedures
   - Component must meet manufacturer, AHJ, and NFPA specifications (if applicable) to be considered operational
6. Describe specialized pressure systems
7. Identify flushing procedures
8. Describe sacrificial anode replacement procedures and schedules
9. Identify flow requirements
10. Describe cleaning and coating procedures
11. Describe principles of welding and fabrication
12. Describe troubleshooting procedures
13. Identify record-keeping requirements
14. Recognize and identify the effects of corrosion by different types of water and foam on selected tank materials
15. Determine defects and deficiencies
16. Recognize, evaluate, and identify reported conditions of water and foam tanks and related components
17. Use test, calibration, and diagnostic equipment
18. Perform required repairs to resolve deficiencies
19. Perform operational checks and service flow tests
20. Complete inspection and repair checklists and documentation

Discussion Questions
1. Do you have to have OEM (original equipment manufacturer) parts to warranty a tank?
2. Are tank baffles required?

Activities
1. Determined by instructor

Instructor Notes
1. Throughout hands-on lecture in the shop, utilize students to inspect the water or foam tank, identify maintenance requirements, and recommend potential repairs.

CTS Guide Reference: CTS 5-4 / CTS 5-5

Topic 12-3: Agent Tanks

Terminal Learning Objective
At the end of this topic, a student, given an emergency response vehicle with a water, foam, or agent tank, manufacturer specifications, SOPS, an inspection checklist (or assignment), an inspection report detailing a deficiency or deformation (or assignment), tools, and test, calibration, and diagnostic equipment, will be able to inspect and perform repairs on agent tanks so that the mounting and condition of the tank is verified; all coated and non-coated interior and exterior surfaces are free of corrosion; sacrificial anodes are evaluated for life-cycle condition and replaced if necessary; the tank is flushed; all checklist items are
inspected; leaks are repaired; coatings are renewed; and defects and deficiencies, including
deformed, broken, loose, worn, or missing parts, are identified and reported, and repaired,
replaced, or rebuilt to manufacturer specifications; service flow test of the tank(s) is
conducted; and inspection, tests, and repairs are documented in accordance with the
procedures of the manufacturer and the authority having jurisdiction (AHJ)

Enabling Learning Objectives
1. Describe types of materials used in water/foam/agent tanks
2. Identify types of defects, deficiencies, and potential problems associated with agent
tanks and related components
   • Corrosion
   • Rust, oxidation, electrolysis
   • Warping
   • Leaks
   • Cracks, fractures, breaks
   • Pressure vessel requirements
   • Loose, broken, worn, or missing components
3. Describe the inspection, diagnostic, and repair procedures of the manufacturer and the
   authority having jurisdiction
4. Describe how to select test, calibration, and diagnostic equipment
5. Describe performance testing procedures
   • Component must meet manufacturer, AHJ, and NFPA specifications (if applicable) to
     be considered operational
6. Describe specialized pressure systems
7. Identify flushing procedures
8. Identify flow requirements
9. Describe cleaning and coating procedures
10. Describe principles of welding and fabrication
11. Describe troubleshooting procedures
12. Identify record-keeping requirements
13. Recognize and identify the effects of corrosion by different types of agents on selected
tank materials
14. Determine defects and deficiencies
15. Recognize, evaluate, and identify reported conditions of agent tanks and related
    components
16. Use test, calibration, and diagnostic equipment
17. Perform required repairs to resolve deficiencies
18. Perform operational and service flow tests
19. Complete inspection and repair checklists and documentation

Discussion Questions
1. What are the requirements of a pressure vessel test?

Activities
1. Determined by instructor
Instructor Notes

1. Throughout hands-on lecture in the shop, utilize students to inspect the agent tank, identify maintenance requirements, and recommend potential repairs.

CTS Guide Reference: CTS 5-4 / CTS 5-5
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### Emergency Vehicle Technician 101 Module

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### Emergency Vehicle Technician 1A

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**Unit 7: Testing**

| Topic 7-1: Axle Weight Performance Testing | Lecture: 1:00 |
|                                           | Activity 7-1: Determined by instructor: 0:00 |
| Topic 7-2: Brake Performance Testing      | Lecture: 1:00 |
|                                           | Activity 7-2: Determined by instructor: 0:00 |
| Topic 7-3: Parking Brake Performance Testing | Lecture: 1:00 |
|                                           | Activity 7-3: Determined by instructor: 0:00 |

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**Cab and Body Systems and Components Module**

| Topic 8-1: Terminology | Lecture: 0:10 |
|                        | Activity 8-1: Determined by instructor: 0:00 |
| Topic 8-2: The Inspection, Maintenance, Repair, and Testing Cycle | Lecture: 0:20 |
|                        | Activity 8-2: Determined by instructor: 0:00 |

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**Unit 9: Cab and Body Systems and Components**
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**Unit 10: Inspection, Maintenance, and Repair**

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**Tank and Accessories Module**

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<td>Activity 12-1: Determined by instructor</td>
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<tr>
<td>Topic 12-2: Water and Foam Tanks</td>
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<td>Activity 12-2: Determined by instructor</td>
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<td>Topic 12-3: Agent Tanks</td>
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<td>Activity 12-3: Determined by instructor</td>
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**Course Totals**

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<tr>
<td>Total Activity Time (AT)</td>
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<tr>
<td>Total Testing Time (TT)</td>
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<td><strong>Total Course Time</strong></td>
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