



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

Course Plan

Course Details

Certification:	Emergency Vehicle Technician 1
CTS Guide:	Emergency Vehicle Technician 1 (2020)
Description:	<p><i>Chassis Systems and Components Module:</i> This course module provides an overview of the knowledge and skills needed to inspect, maintain, repair, and test emergency vehicle chassis systems and components.</p> <p><i>Cab and Body Module:</i> 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.</p> <p><i>Tanks and Accessories Module:</i> 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.</p>
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: 34:00 Activities: 0:00 (TBD) Testing: 2:00
Hours (Total):	36:00
Maximum Class Size:	40
Instructor Level:	Primary

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Instructor/Student Ratio: 1:40

SFT Designation: CFSTES

Required Resources

Instructor Resources

To teach this course, instructors need:

- NFPA 1071: Standard for Emergency Vehicle Technician Professional Qualifications (current edition / physical copy)
- 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)
- NFPA 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Emergency Vehicle (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/>:

- 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
- Lifts

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- 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

Emergency Vehicle Technician 1A

- EVT 1
 - EVT 2
 - EVT 3
2. Identify the SFT 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)
 3. Identify the SFT courses required for EVT 2
 - State Fire Training
 - Emergency Vehicle Technician 2A: Electrical Systems B (2020)
 4. Identify the SFT courses required for EVT 3
 - State Fire Training
 - Emergency Vehicle Technician 3A: Human Resource Management / Fleet Specifications and Records (2020)
 5. Identify additional requirements for Emergency Vehicle Technician 1
 - Experience (one of the following)
 - 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
 - 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
 - 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)
 - 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
 - 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
 - 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

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- 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
 - Successful completion of the CFMA Certification Exam or CFMA Recertification Exam for the respective SFT Level of Certification. This exam is administered by the California Fire Mechanics Academy (CFMA).
 - EVT 1 Requires the following ASE Certifications:
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]
 - EVT 2 and EVT 3 Requires the following ASE Certifications:
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)
- 9. Describe the task book process
 - Complete all prerequisites and course work
 - Complete all job performance requirements included in the task book
 - Must have identified evaluator verify individual task completion via signature
 - Submit application and fees
 - A candidate may apply for the EVT 1, EVT 2, and EVT 3 task books at the same time (three applications and three fees)
 - Shall not submit the EVT 2 task book until he or she receives EVT 1 certification (a prerequisite for EVT 2)
 - Shall not submit the EVT 3 task book until he or she receives EVT 2 certification (a prerequisite for EVT 3)

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- Must have Fire Chief or authorized representative verify task book completion via signature
- Must be employed by a California Fire Agency or be in a position as a volunteer or paid part-time, in a California fire department, or public agency, or private industry as a truck mechanic with primary duties performing as a truck mechanic as noted above for experience.
- This experience must be documented 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 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 expiration, greater than 18 months, the applicant will need to reapply for initial EVT 1 certification which includes successful completion of the EVT certification exam and 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.

Chassis Systems and Components Module

Unit 2: Systems Overview

Topic 2-1: 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 2-2: 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
 - Acceptance test of repaired vehicle

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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
 - What if you can't duplicate or validate the concern?

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- Identify and report defects and deficiencies, including broken, loose, worn, or missing parts
 - Complete checklist and document findings
 - Checklists vary by manufacturer and authority having jurisdiction (AHJ)
 - 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
 - Allocation
 - Cost reduction
 - 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
 - Review inspection report
 - Identify repairs (outside maintenance scope)
 - 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

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- 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 3: Chassis Systems and Components

Topic 3-1: 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

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- Leaf
 - Coil
 - Torsion bar
 - 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

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- Pump transmission
- Fuel
- Power steering
- Compressed air foam system (CAFS)
- Hydraulic
- Auxiliary
 - Direct cooling
 - 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 3-2: 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
 - 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 a chassis
 - Low voltage
 - Batteries
 - Starter
 - Alternator
 - Wiring
 - Line voltage
 - Power generation system
 - Shore power
 - Electronic

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- 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 1B : 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 4: Inspection, Maintenance, and Repair

Topic 4-1: 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 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

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- 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
 - Use recommended fluids
 - Adjust to appropriate fluid levels at operating temperature
 - Cracks, fractures, breaks
 - Send for repair
 - Loose, broken, worn, or missing components
 - Tighten

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- 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
 - Manufacturer
 - AHJ (vary)
 - Federal, state, and local government (vary)
 - Manufacturer
 - 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 4-2: 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
 - Clean
 - Correct cause (if possible)
 - Recoat or repaint (if necessary)
 - Rust, oxidation, electrolysis
 - Clean
 - Spectrochemical analysis of fluids (onsite or offsite)

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- 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 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.

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

Topic 4-3: 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)
 - Recoat or repaint (if necessary)
 - Rust, oxidation, electrolysis

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- 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 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.

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

Topic 4-4: 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
 - 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

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- 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. 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.

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

Topic 4-5: 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
 - 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

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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?

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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.

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

Topic 4-6: 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)

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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
 - 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. How do you read the tire date codes?
2. How do you check for worn rims?

Activities

1. Determined by instructor

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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.

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

Topic 4-7: 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
 - 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

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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 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.

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

Topic 4-8: 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

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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

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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.

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

Topic 4-9: 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)

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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

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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.

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

Unit 5: Testing

Topic 5-1: 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

Topic 5-2: 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 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 5-3: 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

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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
3. 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
 - California Vehicle Code (CVC) / Division 12. Equipment of Vehicles / Chapter 3. Brakes
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 5-4: 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

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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
 - US DOT Federal Motor Carrier Safety Administration / Part 393
 - California Vehicle Code (CVC) / Division 12. Equipment of Vehicles / Chapter 3. Brakes (26451 (a-c))
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

Cab and Body Systems and Components Module

Unit 6: Cab and Body Overview

Topic 6-1: 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 6-2: 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

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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
 - Inspection
 - 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
 - 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
 - Checklists vary by manufacturer and authority having jurisdiction (AHJ)
 - 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
 - Allocation
 - Cost reduction
 - 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

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- Evaluate reported conditions
 - Review inspection report
 - Identify repairs (outside maintenance scope)
 - 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)
 - Acceptance testing (inspection) on returned/repared 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 7: Cab and Body Systems and Components

Topic 7-1: 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

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

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- 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 striping
- 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 7-2: 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
 - Low voltage
 - Batteries
 - Starter
 - Alternator
 - Wiring

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- 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 7-3: 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

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 8: Inspection, Maintenance, and Repair

Topic 8-1: 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

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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 8-2: 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

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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 8-3: 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

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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 8-4: 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)

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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.

CTS Guide Reference: CTS 3-7 / CTS 3-8

Topic 8-5: 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

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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 9: Tank and Accessories Overview

Topic 9-1: 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 9-2: 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
 - Vehicle safety

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- 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 10: Inspection and Repair Water/Foam/Agent Tanks

Topic 10-1: 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 10-2: 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

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- 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 lectures 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 10-3: 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

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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?

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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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Time Table

Segment	Lecture Time	Activity Time	Total Unit Time
Unit 1: Introduction			
Topic 1-1: Orientation and Administration			
Lecture	0:30		
Activity 1-1: Determined by instructor		0:00	
Topic 1-2: Emergency Vehicle Technician Certification Process			
Lecture	0:30		
Activity 1-2: Determined by instructor		0:00	
Unit 1 Totals	1:00	0:00	1:00

Chassis Systems and Components Module

Segment	Lecture Time	Activity Time	Total Unit Time
Unit 2: Systems Overview			
Topic 2-1: Terminology			
Lecture	0:30		
Activity 2-1: Determined by instructor		0:00	
Topic 2-2: The Inspection, Maintenance, Repair, and Testing Cycle			
Lecture	0:30		
Activity 2-2: Determined by instructor		0:00	
Unit 2 Totals	1:00	0:00	1:00
Unit 3: Chassis Systems and Components			
Topic 3-1: Function, Construction, and Operation			
Lecture	0:30		
Activity 3-1: Determined by instructor		0:00	
Topic 3-2: Electricity and Electronics			
Lecture	1:00		
Activity 3-2: Determined by instructor		0:00	
Unit 3 Totals	1:30	0:00	1:30
Unit 4: Inspection, Maintenance, and Repair			
Topic 4-1: Frames and Cross Bars			
Lecture	1:00		
Activity 4-1: Determined by instructor		0:00	

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Topic 4-2: Steering System, Inspection, Maintenance, and Repair			
Lecture	1:30		
Activity 4-2: Determined by instructor		0:00	
Topic 4-3: Suspension System			
Lecture	1:00		
Activity 4-3: Determined by instructor		0:00	
Topic 4-4: Axles			
Lecture	0:30		
Activity 4-4: Determined by instructor		0:00	
Topic 4-5: Brake System			
Lecture	1:30		
Activity 4-5: Determined by instructor		0:00	
Topic 4-6: Wheels and Tires			
Lecture	1:00		
Activity 4-6: Determined by instructor		0:00	
Topic 4-7: Driveline			
Lecture	1:00		
Activity 4-7: See recommended activity		0:00	
Topic 4-8: Auxiliary Drive Systems			
Lecture	1:00		
Activity 4-8: Determined by instructor		0:00	
Topic 4-9: Cooling Systems			
Lecture	1:00		
Activity 4-9: Determined by instructor		0:00	
Unit 4 Totals	9:30	0:00	9:30
Unit 5: Testing			
Topic 5-1: Road and/or Performance Testing			
Lecture	1:00		
Activity 5-1: Determined by instructor		0:00	
Topic 5-2: Axle Weight Performance Testing			
Lecture	1:00		
Activity 5-1: Determined by instructor		0:00	
Topic 5-3: Brake Performance Testing			
Lecture	1:00		
Activity 5-3: Determined by instructor		0:00	
Topic 5-4: Parking Brake Performance Testing			
Lecture	1:00		
Activity 5-4: Determined by instructor		0:00	

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Unit 5 Totals	4:00	0:00	4:00
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Cab and Body Module

Segment	Lecture Time	Activity Time	Total Unit Time
Unit 6: Cab and Body Overview			
Topic 6-1: Terminology			
Lecture	0:30		
Activity 6-1: Determined by instructor		0:00	
Topic 6-2: The Inspection, Maintenance, Repair, and Testing Cycle			
Lecture	0:30		
Activity 6-2: Determined by instructor		0:00	
Unit 6 Totals	1:00	0:00	1:00
Unit 7: Cab and Body Systems and Components			
Topic 7-1: Function, Construction, and Operation			
Lecture	0:30		
Activity 7-1: Determined by instructor		0:00	
Topic 7-2: Electricity and Electronics			
Lecture	1:30		
Activity 7-2: Determined by instructor		0:00	
Topic 7-3: Welding and Fabrication			
Lecture	0:30		
Activity 7-3: Determined by instructor		0:00	
Unit 7 Totals	2:30	0:00	2:30
Unit 8: Inspection, Maintenance, and Repair			
Topic 8-1: Crew and Passenger Compartments			
Lecture	0:30		
Activity 8-1: Determined by instructor		0:00	
Topic 8-2: Cab Mounting System			
Lecture	2:30		
Activity 8-2: Determined by instructor		0:00	
Topic 8-3: Equipment Mounting Systems			
Lecture	0:30		
Activity 8-3: Determined by instructor		0:00	
Topic 8-4: Cab Tilting Systems			
Lecture	2:30		

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Activity 8-4: Determined by instructor		0:00	
Topic 8-5: Body and Compartmentation			
Lecture	1:00		
Activity 8-5: Determined by instructor		0:00	
Unit 8 Totals	7:00	0:00	7:00

Tank and Accessories Module

Segment	Lecture Time	Activity Time	Total Unit Time
Unit 9: Tank and Accessories Overview			
Topic 9-1: Tank and Accessories Terminology			
Lecture	0:30		
Activity 9-1: Determined by instructor		0:00	
Topic 9-2: The Inspection, Maintenance, Repair, and Testing Cycle			
Lecture	0:30		
Activity 9-2: Determined by instructor		0:00	
Unit 9 Totals	1:00	0:00	1:00
Unit 10: Inspection and Repair Water/Foam/Agent Tanks			
Topic 10-1: Function, Construction, Operation, and Mounting			
Lecture	2:00		
Activity 10-1: Determined by instructor		0:00	
Topic 10-2: Water and Foam Tanks			
Lecture	2:00		
Activity 10-2: Determined by instructor		0:00	
Topic 10-3: Agent Tanks			
Lecture	1:30		
Activity 10-3: Determined by instructor		0:00	
Unit 10 Totals	5:30	0:00	5:30
Total Lecture, Activity, and Unit Totals:	34:00	0:00	34:00

Course Totals

Segment Type	Time
Total Lecture Time (LT)	34:00
Total Activity Time (AT)	0:00
Total Testing Time (TT)	2:00
Total Course Time	36:00