

**Reference Materials:** Note: This exam may contain some "accepted practice" type questions not found in the reference material listed below.

**NFPA 1917, Standard for Automotive Ambulances**, including annexes

**NFPA 1911, Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus**

National Fire Protection Association, Quincy, MA. To order call (800) 344-3555 or [www.nfpa.org](http://www.nfpa.org)

**Ford Ambulance QVM Guide**, <https://www.fleet.ford.com/truckbbas/non-html/qpg/2004/ambulanceguidelines04.pdf>

General shop manuals, such as: Ford 1-ton chassis, Freightliner Medium Duty, International/Navistar Medium Duty,

Allison Transmission E books

Any service manual for OBD-2, Class 1 Diagnostic Service Codes

### LEARNING OBJECTIVES FOR THE E-4 EXAM

1. **Physical Characteristics of an ambulance** - Identify the design requirements as stated in NFPA 1917:
  - a. Height, width, wheel base & length
  - b. Ambulance types
  - c. Ambulance class & configurations
  - d. Weight distribution
  - e. Rearview mirrors
  
2. **Cab and Body** - Identify components and location. Describe maintenance and repair of the following:
  - a. Doors, latches & hardware
  - b. Oxygen Systems
    - (1) Maximum leakage
    - (2) Hose requirements
  - c. Dissimilar metals
  - d. Handrails
  - e. Warning light system
    - (1) Do not move light
    - (2) Low voltage
  - f. Patient compartment
    - (1) seat belts warning signal
  - g. Back up alarm
    - (1) Control
    - (2) Decibels
  
3. **Chassis** - Describe principles of operation, maintenance, and repair of the following:
  - a. Brakes
    - (1) Hydraulic brake systems & fluid types
      - (a) Fluid level
    - (2) Parking brakes and cables
    - (3) Anti-lock systems
      - (a) Wiring
      - (b) Bleeding
      - (c) Driveline retarder
    - (4) Brake assemblies
      - (a) Rotors
      - (b) Rotor measurements
      - (c) Rotor run out
    - (5) Brake retarder installation
  - b. Suspension
    - (1) Tires & wheels
      - (a) Tire balance
      - (b) Tire size
      - (c) Tire air pressure/monitoring system
    - (2) Wheel nuts/torque
    - (3) Air ride height adjustment
  - c. Frame
  - d. Steering
    - (i) Symptoms
    - (2) Alignment
  
4. **Powertrain** - describe principles of operation, maintenance and repair of the following
  - a. Power train control module
  - b. Engine
    - (1) Breakout box use
    - (2) Effects of water in fuel
    - (3) Coolant additives
    - (4) Common rail diesel fuel systems
    - (5) Diesel exhaust service
      - (a) After treatment
  - c. Automatic transmissions
    - (1) Torque convertor
      - (a) Components
      - (b) Function
      - (c) Installation
    - (2) Towing vehicle with automatic transmission
    - (3) Manual downshifting
    - (4) Rocking vehicle with automatic transmission
    - (5) Inspection
      - (a) Gauges and indicators
      - (b) Exterior
      - (c) Diagnostic codes
    - (6) Maintenance
      - (a) Service intervals
      - (b) Required procedures after overhaul or replacement
      - (c) Fluid change
  - (7) Fluid
    - (a) Purpose
    - (b) Level
    - (c) Types
    - (d) Change intervals
    - (e) Effects of coolant contamination
  - (8) Electronic controls
    - (a) Shift point after calibration
    - (b) Main ECU power and ground wiring
    - (c) Cleaning connectors
    - (d) Effects of electromagnetic interference (EMI)
    - (e) Effects of radio transmitter interference
  - d. Drive line
    - (1) Inspection
    - (2) Driveline angle
    - (3) Driveline phasing
    - (4) Slip joints & U-joints
    - (5) Vibration causes
    - (6) RPM test
  - e. Differentials
    - (1) Vibration
  - f. Road speed test

**5. Troubleshooting & Diagnostics** -Understand accepted practices of the following:

- a. Retrieving and interpreting diagnostic codes
  - (1) Breakout box
- b. Interpret diagnostic charts and service manuals
  - (1) Idle Validation Switch wiring
- c. Understanding schematic drawings
- d. Using diagnostic equipment
  - (1) Multi-meter uses
- e. Road testing for driveability problems
- f. Transmission
  - (1) Fluid
    - (a) Levels
    - (b) Contamination
    - (c) Effects of coolant contamination
    - (d) Fluid level too high
    - (e) Metal contaminated fluid
  - (2) Effects of a clogged breather
  - (3) Adjustments
    - (a) Linkage
    - (b) Shift points
  - (4)
  - (5) Electronic controls
    - (a) Multiple fault code
    - (b) Troubleshooting steps
    - (c) Cause of not shifting into gear
    - (d) Effect of poor battery connections
    - (e) Effects of water in connectors
    - (f) Historical code use
  - (6) Output shaft seal and yoke
  - (7) Stall test
  - (8) Troubleshooting procedure
    - (a) basic
    - (b) no code troubleshooting
  - (9) Leak diagnoses
  - (10) causes of overheating
- g. Welding precautions
- h. Driveline
  - (1) Vibration
  - (2) Driveline test
- i. Engine
  - (1) Leaks diagnoses
  - (2) Slow cranking
  - (3) Glow plug diagnostics
  - (4) Effects of clogged air filter
  - (5) Cause of pressure buildup in radiator
  - (6) Effect of incorrect muffler installation
- j. Differential
  - (1) Chattering noise
- k. Troubleshooting steps
- l. Brakes
  - (1) ABS braking systems
  - (2) Brake testing
  - (3) Boosters

**6. Safety** - Identify and describe the following:

- a. Safety procedures
  - (1) Use of wheel chocks
  - (2) Proper lifting & support equipment
  - (3) Right to know law
- b. Out of Service criteria
  - (1) Hydraulic brakes
  - (2) Engine oil leaks
  - (3) Automatic transmission
  - (4) Identifying out of service vehicle or component
  - (5) body mounts
  - (6) windshield wipers
- c. Equipment Storage and Mounting