AMBULANCE MANUFACTURERS DIVISION

STANDARDIZED TEST METHODS

A division of NTEA
THE WORK TRUCK ASSOCIATION

AMD Standardized Test Methods – 2024

Except where definitions are included in the individual standardized test methods contained herein ("Test Methods"), terms shall have the meaning ascribed to them in the applicable governing standard (e.g., Federal Specification for the Star-of-Life Ambulance, NFPA 1900 Standard for Aircraft Rescue and Firefighting Vehicles, Automotive Fire Apparatus, Wildland Fire Apparatus, and Automotive Ambulances, CAAS Ground Vehicle Standard for Ambulances, etc.) ("Governing Standards").

The Test Methods are a collection of test procedures to validate specific performance requirements of Governing Standards that incorporate the use of these test procedures by reference. When cited in a Governing Standard, these Test Methods provide a means to test to the performance levels/values specified by such standard. Some Test Methods also provide a performance level/value; if a Governing Standard does not specify a performance level/value, the Test Method performance level/value, at the discretion of a company, may be used. However, if the performance level/value in a Governing Standard differs from one provided in a Test Method, the level/value in the Governing Standard shall apply to the Test Method. Unless otherwise specified in the Governing Standard, or an individual test method, the temperature range for conducting these tests is 0 to 95 degrees Fahrenheit.

Type Test (see additional information in Annex):

Group 1: Testing conducted to validate system-based designs, affected by the OEM chassis, should be performed every five years unless a different duration is specified by the Governing Standard/governing body:

AMD 006 – Patient Compartment Sound Level Test
AMD 011 – Equipment Temperature Test
AMD 012 – Interior Climate Control Test
AMD 017 – Road Test
AMD 019 – Cabinet & Compartment Measurements
AMD 023 – Siren Performance Test

Group 2: Testing conducted to validate designs not part of a system(s) and unaffected by the OEM chassis should be repeated every five years unless a different duration is specified by the Governing Standard/governing body. Unless the Governing Standard/governing body provides otherwise, after the initial physical testing, the following tests may be validated through engineering judgment, at the discretion of the testing laboratory, based on various factors, including without limitation, the evaluation factors listed for each Test Method:

AMD 007 – Patient Compartment Carbon Monoxide Level Test: Design of door gasket(s), jamb, frame, and striker pin location.
AMD 008 – Patient Compartment Handrail Static Load Test: Grabrail design (gauge, stanchion spacing), hardware, and thickness of tapping substrate.
AMD 016 – Patient Compartment Lighting Level Test: Headroom, make/model of light, quantity and spacing of lights.
AMD 018 – Rear Stepping Surface Load Test: Material/design of bumper, brackets, and method of securement.
AMD 020 – Floor Distributed Load Test: Average density of floor substrate, moisture barrier thickness, structural box tube thickness, and distance between box tubes.
AMD 024 – Perimeter illumination Test: Headroom, make/model of light, number of lights and spacing of lights.
AMD 028 – Vertical Component Retention – Static Test: Hardware used, thickness of tapping substrate/ weldment information.

Introduction

The Ambulance Manufacturers Division (AMD), an operating division of NTEA – The Work Truck Association,[1] represents emergency medical services in the United States. NTEA is a trade association representing the nation's manufacturers and distributors of commercial trucks, truck bodies, truck equipment and accessories.[2]

AMD is dedicated to the production of safe, state-of-the-art ambulances. Currently composed of approximately 60 member companies, AMD has consistently maintained representation of the majority of ambulance production in North America. Since its founding in 1976, AMD has worked closely with state and federal regulatory agencies and has been directly involved in activities that benefit the general public as well as the industry. These activities include, without limitation:

- Working with National Institute of Occupational Safety and Health, other federal agencies and SAE International to research and develop new, dynamic test methods to evaluate and improve occupant safety of the patient compartment.
- Working with General Services Administration (GSA) in further development and revision of KKK-A-1822.
- Actively educating truck chassis manufacturers about ambulance service compatibility issues in connection with the development of new models and options.
- Supporting OEM quality programs, including the Ford Pro Upfitter Program, Ram Quality Professional (Q-Pro) and the eXpertUpfitter Program of Daimler Vans USA LLC.
- Continuing the development and improvement of the AMD Standardized Test Methods.

Development of the Test Methods began decades ago by AMD members, in conjunction with GSA. These Test Methods are currently cited by (1) Federal Specification for the Star-of-Life Ambulance (KKK-A-1822), (2) National Fire Protection Association 1900 Standard for Automotive Ambulances (NFPA 1900), (3) Commission on Accreditation of Ambulance Services/Ground Vehicle Standard for Ambulances (CAAS/GVS), and (4) BNQ 1013-110 (BNQ). To the extent cited in a standard of KKK-A-1822, NFPA 1900, CAAS/GVS, or BNQ, the applicable Test Method is intended to provide a verifiable means to test the relevant performance requirements in that standard.

Federal laws and regulations require that motor vehicles, including ambulances, comply with all applicable Federal Motor Vehicle Safety Standards (FMVSSs). The National Highway Traffic Safety Administration (NHTSA) of the U.S. Department of Transportation oversees these FMVSSs. **All Test Methods are in addition to, and in no way a substitute for, FMVSSs and other federal or state requirements that apply to motor vehicles and other regulated aspects of ambulances and their intended functions.**

From time to time, these Test Methods are revised. Please note, a Governing Standard (e.g., an NFPA 1900 standard) may refer to an older version of the Test Methods. In such a case, compliance with such Governing Standard may require use of the older Test Methods.

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1 Prior to 1986, AMD was a division of Truck Body and Equipment Association.

2 NTEA members include companies that produce highly specialized vehicles, such as ambulances, towing and recovery vehicles, small school buses and mid-size buses. The Association provides its 2,100+ member companies with in-depth technical information, education, and member programs and services. Headquartered in suburban Detroit, Michigan, NTEA also engages directly with major truck chassis manufacturers on product compatibility issues. In addition, through its government relations offices in Washington, DC, and Ottawa, Ontario, NTEA provides members with information on regulations affecting commercial trucks, and educates lawmakers with respect to industry issues.

STANDARDIZED TEST METHODS

Contents

S1. SCOPE.

This test method establishes a means to test ambulance electrical systems and certify test results.

S2. PURPOSE.

The purpose of this test method is to verify performance of an ambulance 12-volt DC electrical system. Each finished vehicle shall be tested.

S3. DEFINITION.

S3.1 "Common point" means a point in the ambulance 12-volt DC electrical system that is common for the electrical generating and storage system to the electrical consuming system of the vehicle, at which the current is to be measured.

S4. TEST PROCEDURE.

S4.1 The following steps shall be performed during the low voltage electrical system test.

S4.2 Tests shall be performed when the ambient air temperature is between 32°F and 95°F (0°C and 35°C).

S4.3 Before each test, the batteries should be fully charged.

S4.3.1 Failure of any of these tests shall require a repeat of the sequence.

S4.3.3 Alternator Performance Test at Idle.

S4.3.3.1 The minimum electrical load test conditions as stated in the governing standard shall be activated with the engine running at idle speed.

S4.3.3.2 The engine temperature shall be stabilized at normal operating temperature.

S4.3.3.3 The battery system shall be tested to detect the presence of battery discharge current.

S4.3.3.4 The detection of battery discharge current shall be considered a test failure.

S4.3.3.5 Activation of the load management system shall not be permitted during this test.

S4.3.3.6 The test shall run for a full 15-minutes and the voltages shall remain within 12.8 and 14.2 volts for the duration of the test, unless a higher threshold is necessary per individual chassis OEM system operations.

S4.3.3.7 At both the beginning and end of the 15-minute test period, the DC voltage and DC current draw shall be recorded.

S4.3.4 Alternator Performance Test at High Idle.

S4.3.4.1 The operational electrical load test conditions as stated in the governing standard shall be activated with the engine running at high idle.

S4.3.4.2 The test duration shall be a minimum of 15 minutes with engine at operating temperature.

S4.3.4.3 Engine speed shall not exceed 1600 RPM

S4.3.4.4 Activation of the load management system shall be permitted during this test.

S4.3.4.5 An alarm sounded by excessive battery discharge, as detected by the warning system, or a system voltage of less than 11.8 volts DC for a 12-volt nominal system, 23.6 volts DC for a 24-volt nominal system, or 35.4 volts DC for a 42-volt nominal system for more than 120 seconds shall be considered a test failure.

S4.3.4.6 At both the beginning and end of the 15-minute test period, the DC voltage and DC current draw shall be recorded.

S5. CERTIFICATION.

S5.1 The test results shall be certified by the ambulance manufacturer, and the certified test results shall be delivered with the ambulance. The lowest reading in S4.3.3.7 and S4.3.4.6 shall be recorded on the certification label (5.2) and attached to the ambulance for easy inspection, attesting to the worst case continuous current for the specific ambulance being tested.

S5.2 Certification label. The following data and statement shall appear on the certification label:

This vehicle has been tested in accordance with AMD Low Voltage Electrical System Test, Standardized Test Method 005 – 2024.

a. *The data furnished herein is based upon simultaneously turning on the following electrical equipment and electrical load(s):
   1) Engine and Transmission control systems (key on).
   2) Headlights (low beams).
   3) All FMVSS running lights.
   4) Windshield wipers (low speed).
   5) Cab air conditioning (at coldest setting with highest blower speed).
   6) Wireless communication equipment in receiving mode (or equivalent load, if not equipped).
   7) Patient module dome lighting (in the high intensity setting).
   8) Patient module air conditioning (at coldest setting with highest blower speed).
   9) Emergency warning lighting system (in the daytime “primary” mode).
   10) 20-amp medical load or equivalent.
   11) Optional 12-volt DC equipment and lights.

This vehicle is ___/is not___ equipped with a load management system.

NOTE: IF EQUIPPED WITH A LOAD MANAGEMENT SYSTEM, CERTAIN LOADS/FUNCTIONS (ITEM 11) LISTED ABOVE MAY HAVE AUTOMATICALLY BEEN INHIBITED FROM OPERATING BY THE LOAD MANAGEMENT SYSTEM DURING TESTING. IF EQUIPPED WITH AN ACCESSIBLE ELECTRICAL LOAD MANAGEMENT OVERRIDE SWITCH, THE SWITCH WAS ACTIVATED DURING TESTING TO PROVIDE MAXIMUM ELECTRICAL LOAD ATTAINABLE.

b. Name of ambulance manufacturer: _____
c. Ambulance type/model: _____
d. Chassis manufacturer: _____
e. Vehicle Identification Number (VIN): _____
f. Electrical generating system data:
   1) Alternator or generator make/model: _____
   2) Maximum 12-Volt DC manufacturer’s current rating at 200°F at 14-volt DC: ____ amps.
g. Test Data:
   1) Lowest DC voltage at common point during testing with loads 1-10: _____ volts.
   2) Lowest DC voltage at common point during testing with loads 1-11: _____ volts.
   3) Engine speed control setting: ____ rpm.
   4) DC current draw at common point during test with loads 1-10: ____ amps.
   5) DC current draw at common point during test with loads 1-11 without load management system: ____ amps.
h. Generating reserve:
   1) Generating reserve (+)/overload (-) with loads 1-10: ___ amps. (difference between f.2 and g.4).
   2) Generating reserve (+)/overload (-) with loads 1-11 without load management system: ___ amps. (difference between f.2 and g.5).
i. Date of test: _____.

Note 1: “ * ” denotes reference to explanatory material available in the Annex to this document.

AMD 006 | Patient Compartment Sound Level Test – 2024

S1. PURPOSE AND SCOPE.

This test method provides a means for measuring the maximum sound level for ambulance patient compartments. This is a type test.

S2. APPLICABILITY.

This test method applies to all ambulances.

S3. REQUIREMENTS.

The interior sound level in the patient compartment shall not exceed 80 decibels.

S4. TEST PROCEDURE.

S4.1 This test shall be performed during the following environmental conditions:

1. Humidity not to exceed 75 percent relative humidity
2. Wind velocity not to exceed 12 mph (19 km/hr)
3. Barometric pressure 29 in. Hg to 31 in. Hg (98.2 kPa to 104.9 kPa)

S4.2 The following steps shall be performed during the patient compartment sound level test:

1. Measure sound level using a meter that meets the requirements of ANSI S1.4, Specification for Sound Level Meters, for Type II meters with the meter set to A for a weighting network, “fast” meter response.
2. Suspend the microphone 23 in. (584 mm) above the vehicle floor, centered laterally and longitudinally on the expected center of the patient cot as it will be secured in the patient compartment.
3. Park the ambulance on a concrete or asphalt surface, at a location so that no large reflecting surfaces, such as other vehicles, signboards, buildings, or hills, are within 50 ft (15.2 m) of the vehicle being tested.
4. Close all ambulance doors, windows, and exterior compartment vents.
5. Run air conditioner and heater blower fans in patient compartment at the highest speed with outlet louvers fully opened.
6. Set vehicle transmission in neutral gear and set the engine speed to the rpm obtained by the ambulance when operating on level ground at 55 mph (88 km/hr).
7. Turn on all warning lights.
8. Operate siren in the loudest mode.
9. Measure and record the highest sound level.
10. Decrease the engine speed to idle and then back to the 55 mph (88 km/hr) rpm.
11. Measure and record the highest sound level.
12. Repeat until two maximum sound levels within 2 decibels (dB) of each other are recorded.
13. Numerically average these two maximum sound level readings.

AMD 007 | Patient Compartment Carbon Monoxide Level Test – 2024

S1. PURPOSE AND SCOPE

This test method provides a means for testing for the presence of carbon monoxide (CO) gas in ambulances. This test is type test.

S2. TEST CONDITIONS.

a. Open vehicle doors and ventilate with fresh air for 10 minutes.

b. Do not conduct testing during high wind periods (above 15 mph) or during any type of precipitation.

c. Calibrate equipment at start of test.

S3. TEST EQUIPMENT.

a. CO meter capable of calibration to 10 parts per million (ppm).

b. Canister of 10 ppm CO.

S4. TEST PROCEDURE.

Using a CO meter calibrated to 10 ppm, perform the following:

S4.1 Sample ambient air around the outside of the vehicle and record.

S4.2 Close all doors and windows of vehicle, assuring that heating, air conditioning and ventilating systems are off.

S4.3 Start and idle engine in parked position for 10 minutes.

S4.4 Monitor CO at head of primary cot for the first five minutes and record results.

S4.5 Monitor CO around doors, windows and floor for the remaining five minutes and record results.

S4.6 With environmental systems remaining off, drive the vehicle for 10 minutes on traffic laden city streets (15–30 mph). Exception: windshield defrost may be run to operate the vehicle in a safe manner.

S4.7 Repeat S4.4.

S4.8 Repeat S4.5.

S4.9 With environmental systems remaining off, drive vehicle for 10 minutes on limited access (interstate) highway (45–65 mph). Exception: windshield defrost may be run to operate the vehicle in a safe manner.

S4.10 Repeat S4.4

S4.11 Repeat S4.5

S4.12 Stop vehicle and repeat S4.1

S5. CALCULATION OF RESULTS.

S5.1 Determine the average reading taken in S4.1 and S4.12.

S5.2 Deduct result of S4.1 from the highest reading taken in each of the three tests. The resultant levels of CO shall not exceed 10 ppm.

S5.3 Record all results noting time, date, location and route of tests. Record temperature, barometric pressure and humidity at the time of the test

AMD 008 | Patient Compartment Handrail Static Load Test – 2024

S1. PURPOSE AND SCOPE.

This test method provides a means for testing an ambulance grab rail. This test is type test.

S2. APPLICABILITY.

This test method applies to all ambulances.

S3. REQUIREMENTS.

Handrails shall withstand a force of 300 lbs. (136 kg) applied in the directions specified in S4 without detaching.

S4. TEST PROCEDURE.

The following steps shall be performed during the handrail static load test.

1. Apply force to handrail at the midpoint between every location where the handrail fastens to the vehicle body structure and as near as possible to the ends of the handrail, as shown in Figure 1.
2. Apply the force perpendicular to the mounting surface.
3. Apply the force parallel to the mounting surface.
4. Apply the force diagonal to the mounting surface at an angle midway between the perpendicular and the parallel pulls, as shown in Figure 2.
5. Maintain each force application for 2 minutes.

Figure 1 | Location of Force Application on Handrail

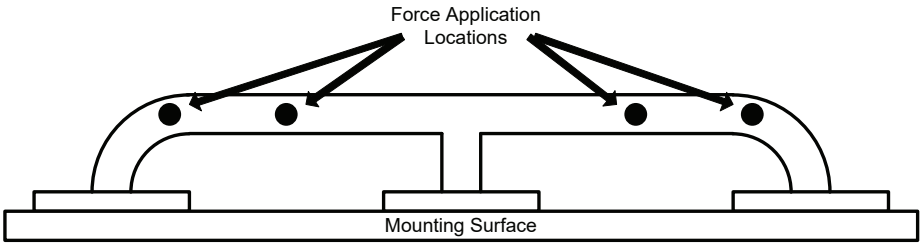
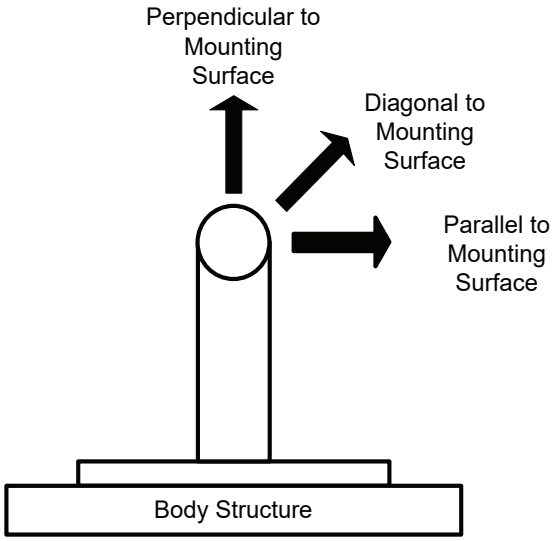


Figure 2 | Direction of Force Application on Handrail



AMD 009 | 125V AC Electrical Systems Test – 2024

S1. SCOPE AND PURPOSE.

This test method establishes a means for testing the conductors that connect ambulances to 125-volt, nominal, AC electrical supply system(s). Each finished vehicle shall be tested.

S2. APPLICABILTY.

This test method applies to all ambulances.

S3. DEFINITIONS.

S3.1 "Dielectric Test (withstanding)", a test of the insulation between normal current carrying conductors (line and neutral) and the ground (ambulance shoreline ground or ambulance chassis ground). This is accomplished by applying higher than normal voltage across the insulation for a given period of time. The purpose of this test is to detect any 'weak spots' in the insulation of the "current carrying conductor/s.

S3.2 "Continuity Test" means the testing to ensure all metallic parts that may become energized are properly bonded and that the bonding path is complete.

S3.3 "Operational Test" means testing all added 125-volt equipment or outlets for function.

S3.4 "Polarity Test" means using a polarity or circuit tester with built-in GFCI tester to test all outlets for proper polarity and GFCI protection.

S4. REQUIREMENTS.

S4.1 FACTORY ELECTRICAL TESTS.

Each ambulance shall be subjected to the following tests, and the results shall be documented:

a. Dielectric Test (withstanding). This test is accomplished by introducing a higher voltage (AC or DC), for the specified period of time per Table 1, to assure the wire insulation will perform as designed and installed.

Table 1 | Common Dielectric Test Parameters Used for Testing 125-Volt Circuits

Test Voltage	Time	Trip Current
900 - 1079 volts AC	60 seconds	10 – 50 mA
1273 -1526 volts DC	≥ 2- 5 s	≥ 1 – 3 mA

The dielectric withstanding test is to be performed between ungrounded and grounded conductors of the ambulance on all 125-volt circuits.

Note 1: This test is to be conducted after all production activities that may damage conductors, such as cabinet set, trim/upholstery installation and any final assembly.

Note 2: All wiring installed by the ambulance manufacturer that supplies current from a generator or inverter to the ambulance branch circuits must be dielectric tested. Generators and inverters need to be disconnected to reduce possible test voltage damage.

Note 3: When testing 125-volt system with load transfer switch (shoreline power), the test must be performed on both sides of the switch to assure total circuit testing.

b. Continuity Test. A continuity test is to be performed to ensure that all metallic parts are properly bonded using a volt/ohm meter or other suitable continuity tester.

c. Polarity Test. A polarity test is to be performed using a polarity or circuit tester to ensure that all electrical connections (neutral, hot and ground) have been properly made and that all GFCI devices function as required.

d. Operational Test. Operational tests are to be performed to demonstrate that all equipment is properly connected and in working order. This should be done through shoreline connections, inverters and generators (based on ambulance configuration/equipment) by use of volt/ohm meters, circuit tester, or by using test loads.

AMD 010 | Water Leak Test – 2024

S1. SCOPE.

This test method establishes a means for testing ambulances for water leakage. Each finished vehicle shall be tested.

S2. PURPOSE.

The purpose of this test method is to minimize the possibility of water leakage in ambulances.

S3. APPLICABILITY.

This test method applies to all ambulances.

S4. REQUIREMENTS.

There shall be no water leakage into the cab, any exterior compartment, or the patient compartment.

S5. TEST PROCEDURES.

The water leak test shall be performed during the following environmental conditions.

1. Ambient temperature above 40°F (4°C).
2. Wind velocity not to exceed 10 mph (16 km/hr).

S5.1 The following steps shall be performed during the water leak test:

1. Close all windows and doors.
2. Turn off heating, ventilating, and air conditioning (HVAC) systems.
3. Drench the entire roof, sides, front, and back of the vehicle evenly with water spray from a nozzle or combination of nozzles.
4. Continue spraying until a minimum of 40 gal (151 L) of water has been used.
5. Start engine and operate the cab and patient compartment ventilation systems at maximum ventilation rates.
6. Continue spraying until an additional minimum of 40 gal (151 L) of water has been used.
7. Inspect the interior of the cab and patient compartment for water leaks during the duration of the test.
8. At the conclusion of the test, examine all exterior compartments for leakage.

AMD 011 | Equipment Temperature Test – 2024

S1. PURPOSE AND SCOPE.

This test method establishes a means to test the ambulance and ambulance equipment over a specified ambient temperature range. This is a type test.

S2. APPLICABILITY.

This test method applies to all ambulances.

S3. REQUIREMENTS.

All interior systems, components, and permanently attached equipment shall function satisfactorily over a temperature range of 32°F to 95°F (0°C to 35°C).

S4. TEST PROCEDURES.

The following steps shall be performed during the equipment temperature test.

1. Locate the test vehicle in an environmental chamber capable of maintaining a temperature within ±4°F (2°C.)
2. Turn off all vehicle power.
3. Open all patient compartment entry doors, cabinet doors, cab door windows, and exterior compartment doors.
4. Maintain an air velocity over the vehicle of at least 5 mph (8 km/hr) throughout the entire test.
5. Cool the chamber to 32°F (0°C) and soak the vehicle at this temperature for a minimum of 3 hours.
6. Start the engine.
7. Operate all vehicle systems for 1 hour while maintaining 32°F (0°C) chamber temperature.
8. Shut off the engine.
9. Heat the chamber to 95°F (35°C) and soak the vehicle at this temperature for a minimum of 3 hours.
10. Start the engine.
11. Operate all vehicle systems for 1 hour while maintaining 95°F (35°C) chamber temperature.
12. Shut off the engine.

AMD 012 | Interior Climate Control Test – 2024

S1. SCOPE.

This test method provides a means to verify the performance of the primary heater/air conditioning system of an ambulance. This is a type test.

S2. PURPOSE.

The purpose of this test method is to measure the performance of the heater/air conditioning system in an ambulance.

S3. APPLICABILITY.

This test method applies to all ambulances.

S4. REQUIREMENTS.

The heating system shall be capable of raising the interior temperature from 32°F to 68°F (0°C to 20°C) within 30 minutes when tested in accordance with S5. The air-conditioning system shall be capable of lowering the interior temperature from 95°F to 78°F (35°C to 25°C) at a minimum of 40 percent relative humidity within 30 minutes when tested in accordance with S5.

S5. TEST PROCEDURES.

*The following steps shall be performed during the interior climate control test:

1. Locate the test vehicle in an environmental chamber capable of maintaining a temperature within ±4°F (2°C).
2. Locate three thermocouples 7 in. (178 mm) off the floor along the patient compartment centerline and equally spaced from front to back.
3. Locate three thermocouples 7 in. (178 mm) below the ceiling along the patient compartment centerline and equally spaced from front to back.
4. Locate three thermocouples midway between the floor and the ceiling along the patient compartment centerline and equally spaced from front to back.
5. Locate three thermocouples in the cab horizontally positioned 24 in. (600 mm) above the seat cushion and located 12 in. (300 mm) in front of the headrest.
6. Locate the first and third thermocouples along the centerline of the driver's and passenger's seats and center the second between the first and third.
7. Turn off all vehicle power.
8. Open all patient compartment entry doors, cabinet doors, cab door windows, and exterior compartment doors.
9. Open engine hood.
10. Maintain an air velocity over the vehicle of at least 5 mph (8 km/hr) throughout the entire test.
11. Cool the chamber to 32°F ±4°F (0° C ± 2°C) and soak the vehicle at this temperature for a minimum of 3 hours.
12. Close all exterior doors, hood and interior cabinet doors. If equipped with an interior partition door or window it shall be closed.
13. Set heaters in cab and patient compartment to maximum heating setting (maximum temperature, maximum blower speed, recirculating air).
14. Record the thermocouple temperatures.
15. Shut off patient compartment dome lights.
16. Start engine and maintain transmission in neutral or park and engine high idle on with a maximum engine speed not to exceed 1600 rpm for the duration of the test.
17. Record thermocouple temperatures at 5-minute intervals up to 30 minutes.
18. Shut off the engine.
19. Open all patient compartment entry doors, cabinet doors, cab door windows, and exterior compartment doors.
20. Open the engine hood.
21. Heat the chamber to 95°F (35°C) with a minimum of 40 percent relative humidity and soak the vehicle at this temperature for a minimum of 3 hours.

22. Close the hood; all doors, with the exception of partition doors (if present); and all windows, with the exception of the patient compartment/cab partition window (if present).
23. Set the air conditioners in the cab and the patient compartment to maximum cooling setting (maximum blower speed, coldest temperature setting, recirculating air).
24. Record the thermocouple temperatures.
25. Shut off the patient compartment dome lights.
26. Start the engine and maintain the transmission in neutral or park and engine high idle on with a maximum engine speed not to exceed 1600 rpm for the duration of the test.
27. Record thermocouple temperatures at 5-minute intervals up to 30 minutes.
28. Shut off the engine.

Note 1: " * " denotes reference to explanatory material available in the Annex to this document.

AMD 015 | Ambulance Main Medical Gas System Test – 2024

S1. SCOPE.

This test method establishes a means for testing the on-board medical gas system. Each finished vehicle shall be tested.

S2. PURPOSE.

The purpose of this test method is to minimize the possibility of a medical gas system leak and to demonstrate adequate flow through the medical gas outlets.

S3. APPLICABILITY.

This test method applies to all ambulances.

S4. REQUIREMENTS.

S4.1 The medical gas system shall lose no more than 5 psi (34.5 kPa) of pressure in a 2-hour period.

S4.2 *Each outlet shall be capable of delivering at least 3.53 ft3/min (100 L/min) of medical gas.

S4.3 *A label shall be provided near the medical gas tank stating the following: “The integrity of this medical gas system was tested in accordance with AMD 015 and meets the requirements thereof.”

S4.4 The label shall be signed and dated by an authorized representative of the ambulance manufacturer or test agency.

S5 TEST PROCEDURE.

S5.1 Pressure Test. The following steps shall be performed for the pressure test.

1. If equipped, bypass must be open.
2. Charge the system with approximately 80 psi (552 kPa) of test gas.
3. *Close system valves to trap pressure in the lines that contain the vent valve.
4. Record the system pressure with an accuracy of ±1 psi (7 kPa).
5. Allow the system to rest without disturbance for 2 hours.
6. Record the system pressure.

S5.2 Flow Test. The following steps shall be performed for the flow test.

1. Charge the system with test gas regulated to 50 psi ± 2 psi (345 kPa ± 14 kPa).
2. Plug all outlets other than the one being tested.
3. Measure and record the flow of gas from each outlet using a flowmeter with an accuracy of ±0.18 ft3/min (±5 L/min).
4. Check the electrical continuity between the medical gas system piping and the vehicle to verify that it is grounded

Note 1: “ * ” denotes reference to explanatory material available in the Annex to this document.

AMD 016 | Patient Compartment Lighting Level Test – 2024

S1. SCOPE AND PURPOSE.

This test method verifies performance of ambulance interior lighting. This is a type test.

S2. APPLICABILITY.

This test method applies to all ambulances.

S3. REQUIREMENTS.

S3.1 The patient compartment lighting shall have the two levels of lighting, high and low, at a minimum.

S3.2 In the high setting, the patient compartment floor shall have a minimum of 15 fc of illumination, measured along the centerline of the clear floor.

S3.3 In the high setting, the primary cot shall be provided with a minimum of 35 fc of illumination, measured on at least 90 percent of the cot's surface area.

S3.4 In the low setting, the patient compartment floor shall have a minimum of 3.5 fc of illumination, measured along at least 85 percent of the centerline length.

S3.5 In the low setting, the side entry step shall have a minimum of 2.0 fc of illumination, measured in the center of the step area.

S3.6 Compliance of the requirements in S3.2 through S3.5 shall be validated by testing a substantially similar ambulance in accordance with S4.

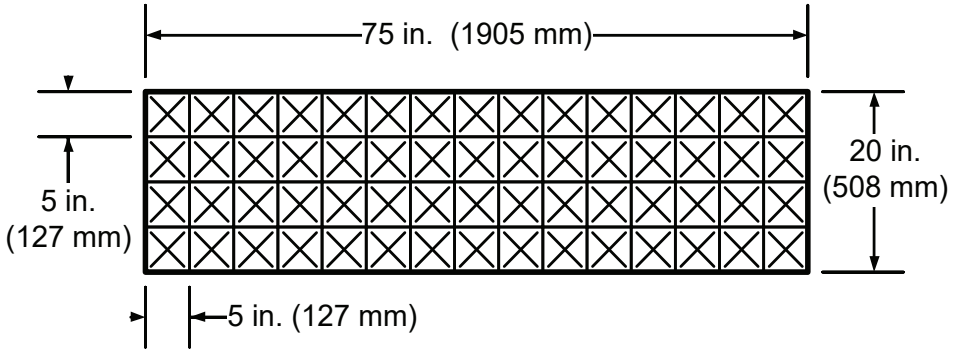
S4. TEST PROCEDURE.

The following steps shall be performed for the patient compartment lighting level test:

1. Prepare the ambulance or locate it in an environment to prevent light from penetrating into the patient compartment.
2. Remove the patient cot.
3. Turn on dome lights to highest setting.
4. Measure and record the light intensity along the longitudinal centerline of the patient compartment floor every 10 in. (254 mm).
5. Turn on the lights that come on with the side entry door or rear entry door.
6. *Measure and record the light intensity along the longitudinal centerline of the patient compartment floor every 10 in. (254 mm).
7. Measure and record the light intensity in the center of the side entry step well and record the reading.
8. Install the patient cot test grid shown in Figure 1, 17 in. (432 mm) above the patient compartment floor, centered laterally and longitudinally on the expected center of the patient cot as it will be secured in the patient compartment.
9. Measure and record the light intensity in the center of each 5 in.2 (322 mm2) area on the test grid.

Note 1: " * " denotes reference to explanatory material available in the Annex to this document.

Figure 1 | Patient Cot Test Grid, Top View



S1. PURPOSE AND SCOPE.

This test method verifies ambulance road performance. This is a type test.

S2. APPLICABILITY.

This test method applies to all ambulances.

S3. DEFINITIONS.

S3.1 "Curb Weight" is the total weight of the complete ambulance and is defined as chassis (including batteries and any other permanently attached or dedicated equipment); cab; body and a full complement of fuel, lubricants and coolant.

S3.2 "Payload Allowance" is the minimum payload for the vehicle as specified in the governing standard.

S3.3 "Cross-Country Operation" is defined as travel over open fields, rolling hills, rough and muddy terrain.

S4. REQUIREMENTS.

The ambulance shall be capable of meeting the requirements set forth under this test method when tested in accordance with test procedures outlined in S6. under the conditions set forth in S5.

S4.1 Speed. The vehicles shall be capable of a sustained speed of not less than 65 mph over dry, hard-surfaced, level roads, at sea level, and passing speeds of 70 mph.

S4.2 Acceleration. Vehicle shall have a minimum average acceleration at sea level of 0–55 mph within 25 seconds.

S4.3 Gradeability. The vehicle shall be capable of meeting the following requirements. The determination shall be made by actual test or chassis manufacturer's certified computer prediction or chassis manufacturer's certification.

a. Minimum gradeability at speed shall be 55 mph on a 3% (1.72 degrees) grade.
b. The minimum low speed gradeability of 5 mph on a 35% (19.3 degrees) grade is required for 4x2 vehicles.
c. The minimum low-speed gradeability of 5 mph on a 45% (24.2 degrees) grade for 4x4 vehicle in the low 4x4 range.

S4.4 Fuel Range. The ambulance shall be capable of being driven for at least 250 miles without refueling.

S4.5 Fording. The vehicle shall be capable of three fordings, without water entering patient and equipment compartments while being driven through a minimum of 8" of water, at speeds of 5 mph, for a distance of at least 100'.

S5. TEST CONDITIONS.

The following conditions apply.

S5.1 Road test may be performed at any ambient temperature.

S5.2 Vehicle must be loaded to curb weight plus total usable payload (i.e., GVWR), or if specified by the customer, to the prescribed curb weight plus the minimum payload allowance for the type of vehicle being tested as listed in S3.2.

S6. TEST PROCEDURE.

S6.1 The vehicle shall be subjected to a minimum 150-mile road test.

a. Seventy-five (75) miles shall be continuous miles on paved highways at speeds up to 70 mph.
b. Thirty (30) miles on city streets.
c. Fifteen (15) miles on gravel or dirt roads at speeds up to at least 35 mph.
d. Not less than five miles in simulated or actual cross-country operation at speeds applicable to the terrain.
e. 4x4 vehicles shall demonstrate cross-country operation in four-wheel drive for an additional 20 miles.
f. Balance of the 150-mile road test may be accumulated during other tests and checks requiring vehicle movements.
g. After completion of the road test, vehicle shall be subjected to the water leak test (AMD Test Method 010).

AMD 018 | Rear Stepping Surface Load Test – 2024

S1. SCOPE AND PURPOSE.

This test method establishes a means to test an ambulance rear step while the ambulance is not in motion. This is a type test.

S2. APPLICABILITY.

This test method applies to all ambulances.

S3. REQUIREMENTS.

S3.1 The rear stepping surface shall withstand a load of 500 lbs. (227 kg) with no more than 1.0 in. (25.4 mm) of deflection or 0.25 in. (6.4 mm) of permanent deformation.

S3.2 Compliance of the rear step surface shall be validated by testing a substantially similar ambulance or bumper and step structure in accordance with S4.

S4. TEST PROCEDURE.

The following steps shall be performed during the rear stepping surface load test.

1. Support the ambulance or substantially similar structure to negate the effect of the vehicle suspension.
2. Apply a vertical load on the stepping surface using a fixture that distributes the load over a circular area 5 in. (127 mm) in diameter.
3. Apply 500 lbs. (227 kg) of load to the lateral and longitudinal center of the stepping surface.
4. Record deflection during the load application.
5. Release the load.
6. Measure and record any permanent deformation after the load is released.
7. Apply 500 lbs. (227 kg) of load to the longitudinal center of the stepping surface as close to each of the lateral extremes as the test fixture will allow.
8. Record deflection during the load application.
9. Release the load.
10. Measure and record any permanent deformation after the load is released.

AMD 019 | Cabinet & Compartment Measurements – 2024

S1. SCOPE AND PURPOSE.

This test method establishes a means to test the volume of interior cabinets and exterior compartments of an ambulance.

S2. APPLICABILITY.

This test method applies to all ambulances.

S3. DEFINITIONS.

S3.1 "Cabinet depth" is the measured depth from the cabinet inside back wall to the outside cabinet face.

S3.2 "Compartment depth" is the measured depth from the compartment inside back wall to the outside compartment face.

S3.3 "Door OD" is the door overall outside thickness (dimension).

S3.4 "Depth ID" is the actual interior depth ether measured or figured by subtracting the Door OD from the cabinet or compartment measured depth.

S3.5 "Height ID" is determined by measuring from interior bottom surface to the interior surface of the cabinet or compartment top.

S3.6 "Width ID" is determined by measuring from one interior surface to the next interior surface of the cabinet or compartment.

S3.7 "Sliding window track" is the track used for sliding cabinet windows. S3.8 "Sliding cabinet windows" is the sliding doors used on interior cabinets.

S4. TEST CONDITIONS.

S4.1 Remove any loose or mounted removal able equipment from interior cabinets or exterior compartments. Examples would be fire extinguishers, portable oxygen mounts, spare tires and tools.

S5. TEST PROCEDURE.

S5.1 Interior cabinet with sliding doors or roll-up doors (Figure 1).

a. Measuring from the back of the rear wall to the back of the sliding window track, record that dimension for Depth ID.
b. Measuring from cabinet interior wall to wall, record that dimension for Width ID.
c. Measuring from the interior top to bottom, record dimension. This is the Height ID.
d. Multiply Height ID x Width ID x Depth ID = then divide by 1,728 to get cubic feet.

S5.2 Interior cabinets with hinged doors (Figure 2).

a. Measure from the back of the door to the face of the door and record that dimension for Door OD.
b. Measure from the back of the rear wall to the cabinet face and record that dimension for cabinet depth.
c. Subtract the Door OD from the cabinet depth to get Depth ID.
d. Measure from cabinet interior wall to wall and record that dimension for Width ID.
e. Measure from the interior top to bottom and record dimension. This is the Height ID.
f. Multiply Height ID x Width ID x Depth ID = then divide by 1,728 to get cubic feet.

S5.3 Exterior Compartments with hinged doors (Figure 3).

a. Measure from the back of the door to the face of the door and record that dimension for Door OD.
b. Measure from the back of the rear wall to the cabinet face and record that dimension for cabinet depth.
c. Subtract the Door OD from the cabinet depth to get Depth ID.
d. Measure from cabinet interior wall to wall and record that dimension for Width ID.
e. Measure from the interior top to bottom and record dimension this is the Height ID.
f. Multiply Height ID x Width ID x Depth ID = then divide by 1,728 to get cubic feet.

Note: Subtract any notches for spring shackles or fuel systems from the total to get the correct total cubic feet.

Figure 1

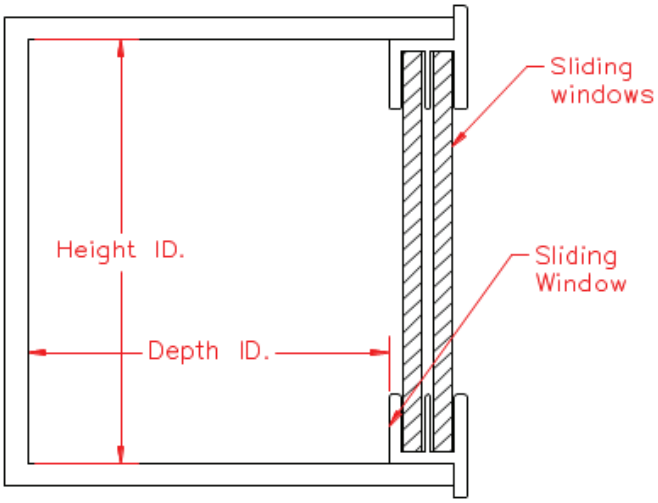


Figure 2

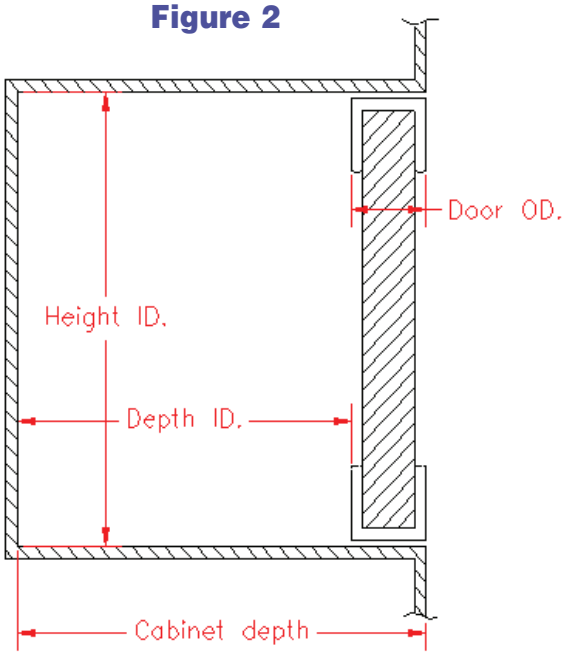
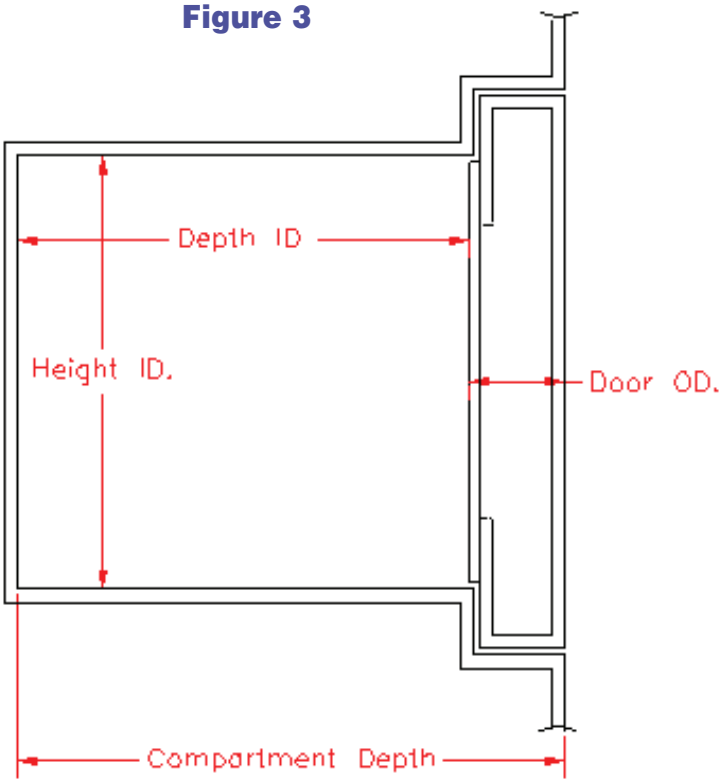


Figure 3



AMD 020 | Floor Distributed Load Test – 2024

S1. SCOPE.

This test method establishes a means for verifying patient compartment floor weight bearing capacity. This is a type test.

S2. PURPOSE.

The purpose of this test method is to validate that the weight bearing capacity of the ambulance floor can support the weight of the laden cot.

S3. APPLICABILITY.

This test method applies to all ambulances.

S4. DEFINITIONS.

S4.1 "Distributed loads." Medium footprint of existing cots loaded to required test load of 400 lbs. for a standard cot or 800 lbs. for a bariatric cot.

S4.2 "Standard cot load" is designed to handle a cot load of 400 lbs.

S4.3 "Bariatric cot load" is designed to handle a cot load of 800 lbs.

S4.4 "Load Cell," as shown in Figure 1 on page 23, is loaded to either a standard cot load of 400 lbs. or a bariatric cot load of 800 lbs.

S4.5 "Deflection Indicator," as shown in Figure 2 on page 23, used to measure floor deflection as close to centerline of the load cell and wheels as possible.

S5. REQUIREMENTS.

With a load for either a standard cot or bariatric cot applied to the floor structure as specified in S7, the allowable maximum deflection is 1/16-inch for standard cot and 1/8-inch for a bariatric cot. If flooring material has a raised pattern, measure the pattern and subtract from any deflection.

S6. TEST CONDITIONS.

S6.1 The test may be conducted at any temperature with the vehicle parked on a level surface.

S7. TEST PROCEDURE.

Each vehicle tested shall be capable of meeting the requirements of S5 when tested in accordance with the procedures set forth below.

a. Locate load cell on centerline of floor (measured from left wall to squad bench) and flush with inside of rear doors (see Figure 3 on page 23).
b. Load cell to required load (400 lbs. or 800 lbs.).
c. Using Deflection Indicator, measure floor deflection at centerline of each wheel along load cell axis (four points B, C, E and F).
d. Using Deflection Indicator, measure floor deflection across (22") the front and rear of the load cell at centerline of floor (two points A and D).
e. Move load cell forward 12" and repeat procedures C and D.
f. Continue moving load cell forward and recording deflection at six points until 12" from front seat cushion.

Figure 1 | Load Cell

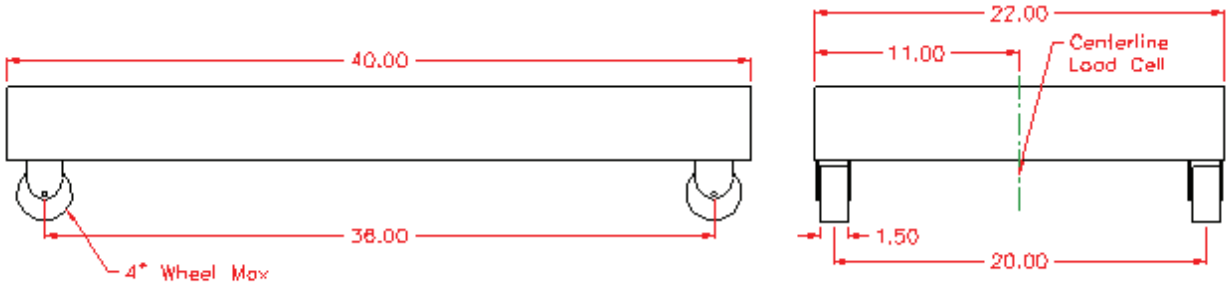


Figure 2 | Deflection Indicator

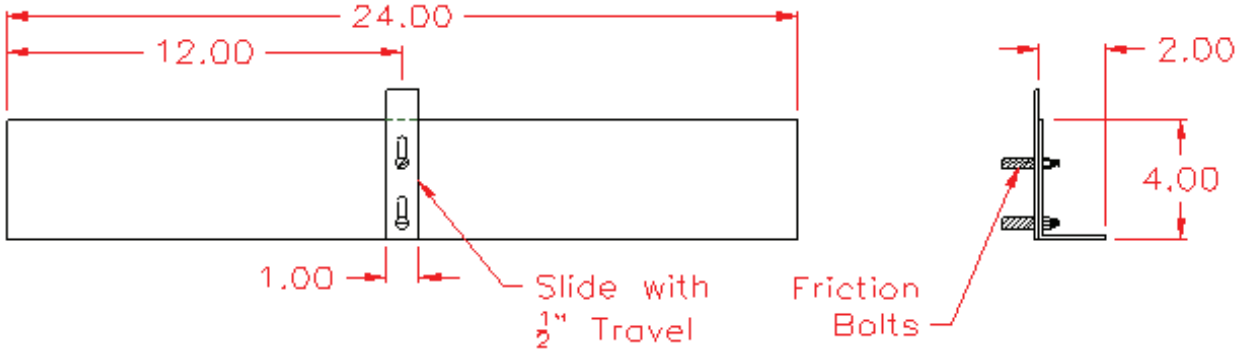
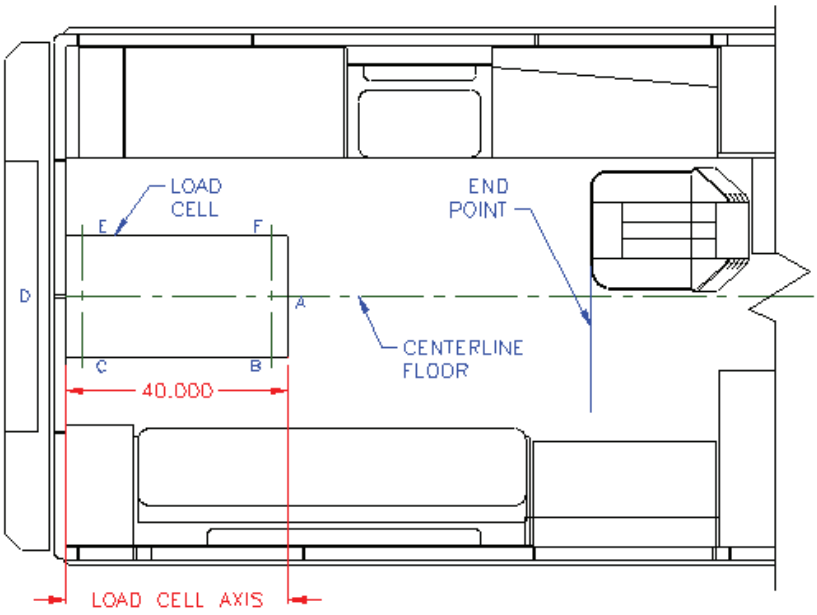


Figure 3



AMD 021 | Aspirator System Test – 2024

S1. SCOPE.

This test method provides a means to verify performance of an ambulance aspirator system when installed per the manufacturer's directions. Each finished vehicle shall be tested.

S2. PURPOSE.

The purpose of this test method is to ensure that minimum performance levels are attained that will permit collection of aspirate and semi-solid gastric stomach contents.

S3. REQUIREMENTS.

S3.1 The aspirator system shall provide a free airflow of at least 30 L/min.

S3.2 The aspirator system shall achieve a minimum of 300 mm Hg vacuum within 4 seconds after the suction tube is closed.

S3.3 Compliance of the aspirator system shall be validated by the manufacturer by testing each individual aspirator system installed in accordance with S4.

S4 TEST PROCEDURE.

The following steps shall be performed during the aspirator system test.

1. Run the vehicle engine at high idle speed for duration of the test.

S4.1 Vacuum Test.

The following steps shall be performed during the vacuum test.

1. Attach a 120 in. (3 m) length of transparent or translucent, non-kinking suction tubing to the collection bottle.
2. Install a vacuum-measuring instrument capable of an accuracy of ±10 mm Hg (+1.3 kPa) to measure the vacuum in the collection bottle.
3. Adjust the vacuum control valve to its maximum vacuum position.
4. Turn on the vacuum pump.
5. Clamp or plug the end of the suction tubing.
6. Measure and record the vacuum 4 seconds after plugging the tubing.

S4.2 Flow Test.

The following steps shall be performed during the flow test.

1. Install a flow-measuring instrument capable of an accuracy of ±0.18 ft3/min (5 L/min) to measure the flow in the suction tubing.
2. Adjust the vacuum control valve to its maximum vacuum position.
3. Turn on vacuum pump.
4. Measure and record the flow.

AMD 023 | Siren Performance Test – 2024

S1. SCOPE.

This test method provides a means to verify performance of an ambulance siren. This is a type test.

S2. PURPOSE.

To provide a testing method that validates the performance, installation, and speaker location of the siren system.

S3. TEST PROCEDURE.

The following steps shall be performed during the siren performance test:

S3.1 The following information should be recorded:

a. Date and time;
b. Location of test performed (address.;
c. Model, type, and serial number of the vehicle tested;
d. Pictures of the testing setup, including the front of the vehicle;
e. Direction vehicle is facing versus wind;
f. Temperature;
g. Humidity;
h. Wind speed; and
i. Ambient decibel level at the recording point in front of the vehicle.

S3.2 Park the vehicle on a concrete or asphalt surface at a location that has no large reflecting surfaces, such as other vehicles, signboards, buildings, or hills, within 50 ft (15 m) in any direction of the vehicle being tested.

S3.3 Start the vehicle and set the high idle speed (RPM shall not exceed the OEM recommended high idle speed).

S3.4 Close the vehicle doors, windows, and vents.

S3.5 Using a sound level meter that meets the requirements of S1.4 of the American National Standards Institute (ANSI), Specification for Sound Level Meters, for Type II meters (operating on the A-weighting network with a slow meter response), record decibels levels as specified in S3.6, below, of the siren speaker system 10ft (3m) forward, along the centerline of the vehicle's forward most point 3ft (1m) above the ground.

S3.6 Operate the siren through all modes while recording the maximum decibel level for each mode. For each mode, repeat until two maximum sound levels within 2 decibels (dB) of each other are recorded. Numerically average these two maximum sound level readings.

S4. TEST ACCEPTANCE CRITERIA.

S4.1 The siren shall be capable of producing a warning sound at a minimum level/mode as determined by the governing standard.

AMD 024 | Perimeter Illumination Test – 2024

S1. SCOPE.

This test method provides a means to verify performance of ambulance perimeter lighting intensity. This is a type test.

S2. PURPOSE.

The purpose of this test method is to measure and verify the exterior lighting provided for the sides and rear of ambulances.

S3 REQUIREMENTS.

S3.1 The perimeter area shall be illuminated to a level of at least 1 footcandle (fc) at each measuring point.

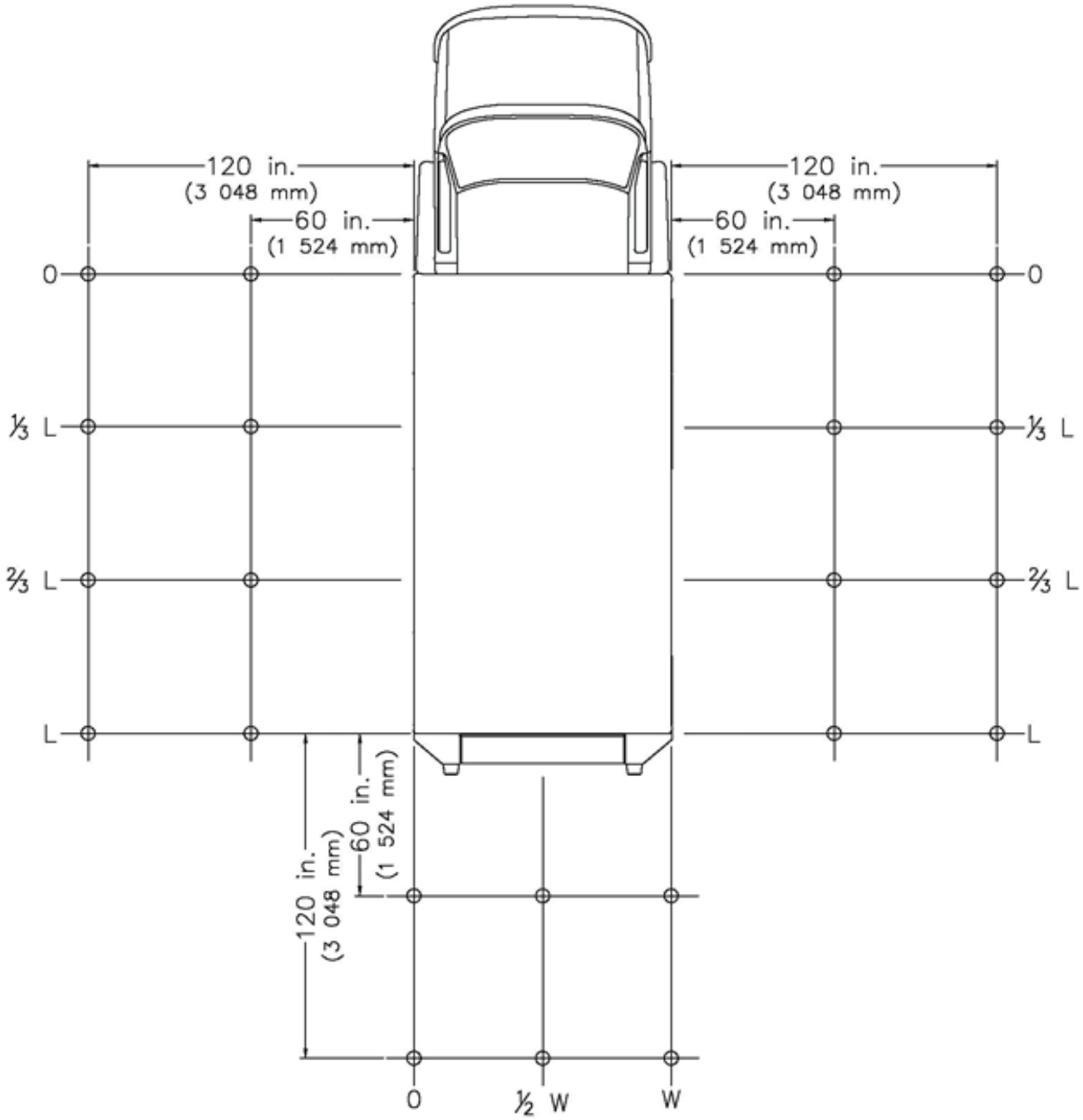
S3.2 Compliance of the lighting illumination shall be validated by testing a substantially similar ambulance in accordance with S4.

S4 TEST PROCEDURE.

The following steps shall be performed during the perimeter illumination test.

1. Place the ambulance in a dark environment.
2. Record the light intensity with a meter capable of measuring to an accuracy of ±0.01 fc with the meter sensor perpendicular to the ground
3. Construct a grid of test points off the sides and rear of the test ambulance, as shown in Figure 1 (page 27).
   a. Locate lines parallel with the exterior walls of the patient compartment 60 in. (1 524mm) and 120 in. (3 048 mm) from the test unit.
   b. Intersect these lines with lines perpendicular to the exterior walls emanating from each corner and with equally spaced lines, one at the midpoint of the patient compartment for the back of module, and two (2) equally spaced lines for the sides, as shown in Figure 1 (page 27).
5. Measure and record the light intensity at each point 3 in. (76 mm) above the grid.
6. Turn on all exterior scene lights.
7. Measure and record the light intensity at each point 3 in. (76 mm) above the grid.
8. Subtract the ambient light readings from the scene light readings.

Figure 1 | Perimeter Illumination Test Grid



AMD 025 | Occupant Head Clearance Zones Test – 2024

S1. SCOPE.

This test method provides a means for measuring the minimum acceptable dimension for an occupant workspace based on static considerations. Each finished vehicle shall be tested.

S2. PURPOSE.

The purpose of this test method is to measure the occupant workspace.

S3. REQUIREMENTS.

S3.1 The minimum seat-to-ceiling dimension from the top surface of the seat bottom cushion to the nearest overhead obstruction for each designated seating position shall be 43 in. (1092 mm).

S3.2 The measurement shall be in accordance with the procedures in S4.

S4 TEST PROCEDURES.

S4.1 The following steps shall be performed during the occupant head clearance zones test:

1. Construct a rigid rectangular test box 43 in. (1092 mm) high, 24 in. (457 mm) wide, and 15 in. (381 mm) deep.
2. Place the test box in each seating position, centered laterally on the seat cushion, with the bottom edge resting against the seat back.
3. Align the test box so that the sides of the box are perpendicular to the patient compartment floor.

S4.2 The maximum weight for the test fixture shall not exceed 60 lbs. (27 kg).

S4.3 No permanent objects shall protrude into the test box zone.

AMD 027 | Line Voltage Electrical Systems Test – 2024

S1. SCOPE AND PURPOSE.

This test method establishes a means for testing the conductors that connect ambulances to 125-volt, nominal, AC electrical supply system(s). Each finished vehicle shall be tested.

S2. APPLICABILTY.

This test method applies to all ambulances

S3 REQUIREMENTS.

S3.1 The wiring and associated equipment shall be tested by the ambulance manufacturer or the installer of the line voltage system.

S3.2 The electrical polarity of all permanently wired equipment, cord reels, and receptacles shall be tested to verify that wiring connections have been properly made.

S3.3 Electrical continuity shall be verified from the chassis or the body to all line voltage electrical enclosures, light housings, motor housings, light poles, switch boxes, and receptacle ground connections that are accessible to personnel in normal operations.

S3.4 If the ambulance is equipped with a transfer switch, it shall be tested to verify operation and that all non-grounded conductors are switched.

S3.5 Electrical light towers, floodlights, motors, fixed appliances, and portable generators shall be operated at their full rating or capacity for 30 minutes to ensure proper operation.

S3.6 CERTIFICATION TEST OF POWER SOURCE.

S3.6.1 The ambulance manufacturer or installer of the power source shall perform a certification test on each power source.

S3.6.2 The testing of any power source greater than 8 kW shall be witnessed, and the results of the tests of the power source shall be certified by an independent third-party certification organization.

S4 TEST PROCEDURE.

S4.1 The prime mover shall be started from a cold start condition, and the unloaded voltage and frequency shall be recorded.

S4.2 The line voltage electrical system shall be loaded to at least 100 percent of the continuous rated wattage stated on the power source specification label.

S4.3 Testing with a resistive load bank shall be permitted.

S4.4 The power source shall be operated in the manner specified by the ambulance manufacturer as documented on instruction plates or in operation manuals.

S4.5 The power source shall be operated at a minimum of 100 percent of the continuous rated wattage as stated on the power source specification label for a minimum of 2 hours.

S4.5.1 The load shall be adjusted to maintain the output wattage at or above the continuous rated wattage during the entire 2-hour test.

S4.5.2 The following conditions shall be recorded at least every 30 minutes during the test.

1. The power source output voltage, frequency, and amperage
2. The prime mover's oil pressure, water temperature, and transmission temperature, if applicable
3. The power source hydraulic fluid temperature, if applicable
4. The ambient temperature and power source air inlet temperature

S4.5.3 The following conditions shall be recorded once during the test for power sources driven by dedicated auxiliary internal combustion engines.

1. Altitude
2. Barometric pressure
3. Relative humidity

S4.6 If the generator is driven by the chassis engine and the generator allows for operation at variable speeds, the chassis engine speed shall be reduced to the lowest rpm allowed for generator operation, and the voltage and frequency shall be recorded.

S4.7 The load shall be removed, and the unloaded voltage and frequency shall be recorded.

S4.8 Voltage shall be maintained within ±10 percent of the voltage stated on the power source specification label during the entire test.

S4.9 Frequency shall be maintained within ±3 Hz of the frequency stated on the power source specification label during the entire test.

S4.10 Inverter Test. If the ambulance has an inverter, then the ambulance inverter shall be tested as follows:

1. The ambulance engine shall be running during the inverter test.
2. The inverter shall be subjected to a load equal to the manufacturer's nominal listed power output for a minimum of 1 hour.
3. If the manufacturer has a specific full power output test, that test shall be performed.
4. A load bank shall be permitted to be used.
5. The test shall be considered a failure if the output of the inverter drops below the manufacturer's specifications or more than 10 percent of nominal listed output.

S4.11 On-Board Battery Charger Test.

The ambulance on-board battery charger shall be tested for 2 hours as follows:

1. Batteries shall be fully charged to at least 12.66 volts before starting test.
2. Engine off and shoreline power cord attached.
3. Apply a load of at least 80% of nominal charger output.
4. Inverter/battery charger compartment closed.
5. Record battery voltage at beginning of test.
6. Remove the load and record battery voltage at end of test.
7. The battery charger test shall be considered a failure if charger does not maintain battery voltage at 12.54 volts or higher.

S5. Suggestions and Explanations.

The purchaser should consider the range of temperatures in which the power source is to be operated. If extreme conditions are anticipated, the purchaser should specify the test conditions that are desired.

The purchaser should check the polarity of the wiring in a building prior to interconnecting the ambulance-mounted electrical system to the electrical system in a building.

It is important that the power source meets the purchaser's requirements for output. Power sources may be advertised with power ratings for operating conditions that are more favorable than the conditions that might be encountered in ambulance use. Some power sources are advertised at peak output or intermittent duty ratings and not the continuous duty output required for ambulances. The power source manufacturer and ambulance manufacturer might need to establish a reduced rating that is appropriate for ambulances.

This standard calls for two steps. First the power source manufacturer provides a declared rating for 120°F (49°C) air inlet temperature and 2000 ft (600 m) altitude for the minimum clearance and ventilation indicated on the declaration. Then the ambulance manufacturer verifies that the rating printed on the power source specification label can be attained during the line voltage load test.

Generator Set Rating.

Auxiliary engine-powered generator sets are the type of power source most likely to require a reduction from advertised ratings, and generator set literature usually provides rating correction factors for altitude and temperature. These factors could be based on standards for engines, such as ISO 3046-1, Reciprocating internal combustion engines — Performance — Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods —Additional requirements for engines for general use, and SAE J1349, Engine Power Test Code — Spark Ignition and Compression Ignition — Net Power Rating; standards for generators, such as NEMAMG 1, Motors and Generators; or manufacturer testing. As an example of how altitude and temperature affect output capability, consider a typical 10 kW generator set with 0.8 generator efficiency and naturally aspirated diesel engine that is rated at 500 ft (150 m) and 85°F (30°C) for continuous operation without overload or reserve capacity. ISO 3046-1 indicates a factor of –2.1 percent output per 10°F (5.5°C) ambient increase, and a –2.6 percent per 1000 ft (300 m) altitude increase. Generator output is also affected by temperature [about –0.5 percent per 10°F (5.5°C)] and altitude (small and ignored in this example).

There is also an effect from combining engine and generator into a generator set due to each heating the other. This may require an additional factor of –1 to –4+ percent per 10°F (5.5°C), depending on the effectiveness of the cooling system and temperature (the factor increases with increasing temperature). Altogether, these factors suggest the 10 kW generator set in this example is capable of about 8.8 kW at the maximum temperature of 110°F (43°C) and altitude of 2000 ft (600 m) specified in the standard. Another way to view this result is that an 11.4 kW generator set would be required to provide

10 kW at 110°F (43°C) and 2000 ft (600 m).

Where there is concern that installation or operational circumstances could cause power source intake air to heat above 120°F (49°C) or where the flow of cooling, induction, or exhaust air is more restricted than what is allowed by the manufacturer's literature, advance consultation with the power source manufacturer(s) could help in the selection of a power source that will pass the ambulance test with an output that meets the purchaser's needs. Also, weather, like

altitude, also can affect air density and thus engine and generator set output. The combined effect of altitude and weather is reported as barometric pressure on local weather reports. Low barometric pressure will reduce engine and generator set output capability. High barometric pressure (usually clear cold days) will increase engine and generator set output capacity.

Other Power Source Types.

Some output correction factors described in the generator set example apply to other types of power sources, depending on circumstances. For example, PTO and hydraulically driven generators also rely on engine power, but the engine

will usually have substantial reserve power, so increased altitude or temperature will not affect their power supply rating. Regardless, best practice for longest life and lowest maintenance is to provide unrestricted airflow at the lowest temperature.

AMD 028 | Vertical Component Retention — Static Test – 2024

S1. SCOPE.

This test method provides a means for verifying vertical retention. This is a type test.

S2. PURPOSE.

The objective of the test method is to verify that the Equipment Mounting Device or System retains the Test Analog/Device and remains attached to its test surface when the Test Analog/Device and the Equipment Mounting Device or System are subject to a vertical 25G acceleration. The vertical load shall be upward if the item is floor-mounted, upward and downward if wall-mounted, and downward if ceiling-mounted. Items mounted adjacent to a floor or ceiling are considered floor-mounted or ceiling-mounted, respectively. Items mounted to a counter top are considered to be floor-mounted.

S3. APPLICABILITY.

*This test standard applies to all ambulances.

S4. DEFINITIONS.

S4.1 "Equipment" means the device affixed by way of a separate mount or holder. This includes any permanently attached brackets or hardware that may be required for attachment to the Equipment Mounting Device or System.

S4.2 "Equipment Mounting Device or System" means a retention system that utilizes a temporary or permanent means of fixation, which may have fixed or adjustable positions, for a specific piece of Equipment. Also includes all hardware provided for securing the Equipment.

S4.3 "Test Surface" means the surface to which the Equipment Mounting Device or System is attached for testing.

S4.4 "Test Analog/Device" means a rigid inert structure that represents the physical dimensions of the Equipment for which the Equipment Mounting Device or System was designed to restrain. It provides connection points to attach to the Equipment Mounting Device or System that match those found on the actual Equipment to be mounted in the Equipment Mounting Device or System.

S5. REQUIREMENTS.

S5.1 The Test Surface and means of attaching the Equipment Mounting Device or System used for the test must replicate what is used in actual service conditions.

S5.2 The attachment of the Test Analog/Device to the Equipment Mounting Device or System must withstand a force equal to 25 times the weight of the Equipment.

S5.3 The attachment of the Equipment Mounting Device or System to its test surface must withstand a force equal to 25 times the combined weight of the Equipment and the Equipment Mounting Device or System.

S5.4 The elements listed in S5.2 and S5.3 may be tested independently or as a single assembly.

S6. TEST PROCEDURES.

Perform the test as described in sections S6.1 and S6.2 or as described in section S6.3.

S6.1 ANALOG/DEVICE RETENTION WHEN INSTALLED IN THE EQUIPMENT MOUNTING DEVICE OR SYSTEM.

S6.1.1 Install the Equipment Mounting Device or System on the Test Surface and the Test Analog/Device into the Equipment Mounting Device or System as described in the manufacturer's instructions.

S6.1.2 Attach a cable or chain with a calibrated in-line gauge to the Test Analog/Device at a point representing the center of gravity of the Equipment.

S6.1.3 Apply the load to the Test Analog/Device to achieve the required force stated in S5.2. When the required force has been attained, hold that load for a minimum of 5 seconds.

S6.1.4 Release applied load to achieve zero pounds.

S6.1.5 Record the maximum load applied and any deformation or fracture of the Equipment Mounting Device or System.

S6.2 EQUIPMENT MOUNTING DEVICE OR SYSTEM ATTACHMENT TO MODULE STRUCTURE.

S6.2.1 Install the Equipment Mounting Device or System as described in the manufacturer's instructions.

S6.2.2 Attach a cable or chain with a calibrated in-line gauge to the Equipment Mounting Device or System at a point representing the composite center of gravity of the Equipment Mounting Device and the Equipment.

S6.2.3 Apply the load to the Equipment Mounting Device or System to achieve the required force stated in S5.3. When the required force has been attained, hold that load for a minimum of 5 seconds.

S6.2.4 Release applied load to achieve zero pounds.

S6.2.5 Record the maximum load applied and any deformation or fracture of the Equipment Mounting Device or System.

S6.3 TEST ANALOG/DEVICE AND EQUIPMENT MOUNTING DEVICE OR SYSTEM ATTACHMENT TO MODULE STRUCTURE.

S6.3.1 Install the Equipment Mounting Device or System and Test Analog/Device into the mount as described in the manufacturer's instructions.

S6.3.2 Attach a cable or chain with a calibrated in-line gauge to the Test Analog/Device at a point representing the center of gravity of the Equipment.

S6.3.3 Apply the load to the Test Analog/Device to achieve the required force stated in S5.3. When the required force has been attained, hold that load for a minimum of 5 seconds.

S6.3.4 Release applied load to achieve zero pounds.

S6.3.5 Record the maximum load applied and any deformation or fracture of the equipment mounting device or system.

S7. TEST ACCEPTANCE CRITERIA.

S7.1 Deformation and displacement of the Equipment Mounting Device or System or the Test Analog/Device is acceptable.

S7.2 Fracture is acceptable as long as load bearing components are not completely detached or fully severed.

S7.3 The Equipment Mounting Device or System shall retain the Test Analog/Device for the duration of the test.

S7.4 The Equipment Mounting Device or System shall remain attached to the Test Surface.

Note 1: " * " denotes reference to explanatory material available in the Annex to this document.

Annex to AMD Standardized Test Methods

Type testing:

When performing type testing in conjunction with, but not limited to, the Federal Specification for the Star-of-Life Ambulance (KKK-A-1822) as the governing standard, tests listed under Group 1 in the Introduction section of this document are conducted to validate system-based designs and deemed to be affected by the OEM chassis. Repetition of the physical type tests in this group are required every five years unless a different duration is specified in the governing standard.

For example, AMD 023 - Siren Performance Test would be required to be performed at least every five years, or possibly sooner if the system components or other design factors (e.g., OEM front bumper contour) change which could affect the outcome of the AMD 023 test.

When performing type testing in conjunction with, but not limited to, the Federal Specification for the Star-of-Life Ambulance (KKK-A-1822) as the governing standard, tests listed under Group 2 in the Introduction section of this document are conducted to validate designs not part of a system(s) and unaffected by the OEM chassis. These tests shall be repeated every five years unless a different duration is specified in the governing standard. However, after the initial testing, the following tests may be validated through engineering judgment at the discretion of the testing laboratory, based on the evaluation of various factors, including but not limited to, the evaluation factors listed for each test method (unless the governing standard/governing body provides otherwise).

For example, AMD 008 - Patient Compartment Handrail Static Load Test would require an initial type test and repetitive testing every five years, or possibly sooner if the system components or other design factors change which could affect the outcome of the AMD 008 test. However, after successful, initial type testing of the handrail, engineering judgement may be considered for validation at the discretion of the testing laboratory if the design, fastening and any other relevant specifications remain the same, including the test procedure. Consistency of factors from the initial type test, such as grabrail design (gauge, stanchion spacing), hardware, and thickness of tapping substrate should be documented for comparison to the current design along with any other materials requested for evaluation by the testing laboratory.

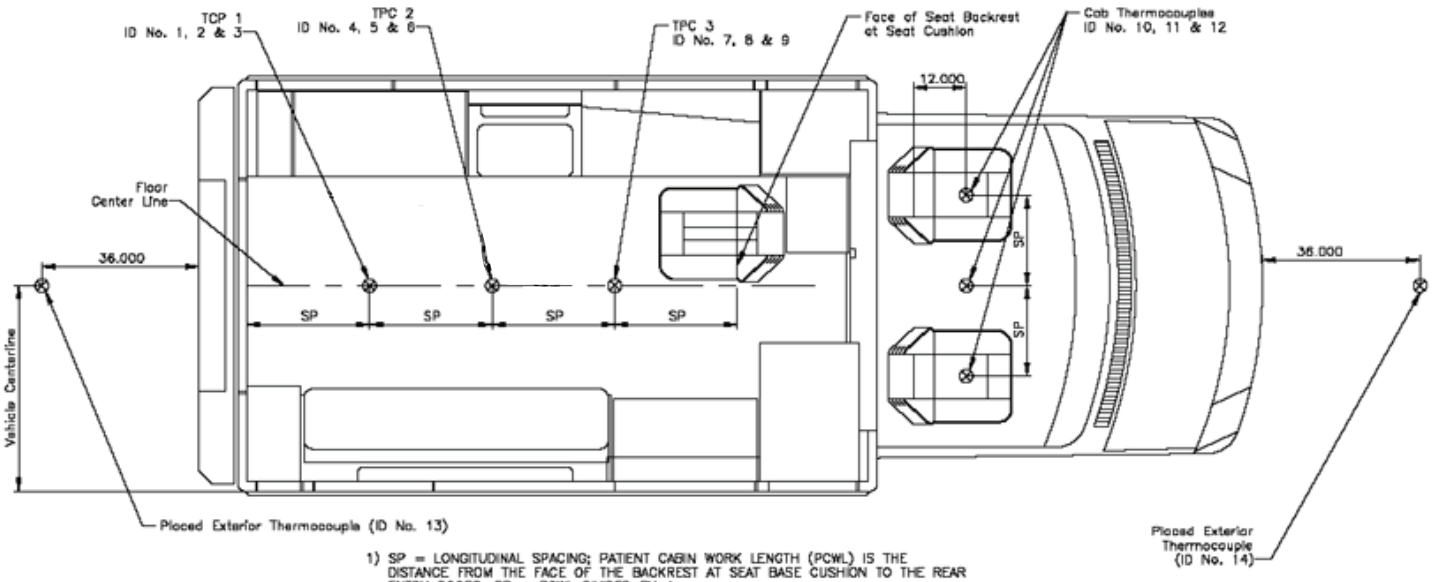
AMD 005 Low Voltage Electrical System Test – 2024

When performing the AMD 005 test in conjunction with the Federal Specification for the Star-of-Life Ambulance (KKK-A-1822) as the governing standard, the test shall be limited to the following minimum electrical loads consisting of the following electrical equipment and systems.

1. Engine/transmission control system.
2. Headlights (low beam).
3. All FMVSS 108 lights.
4. Windshield wipers (low speed).
5. Cab air conditioning (at coldest setting with highest blower speed).
6. Radio in receiving mode (or equivalent load, if not equipped).
7. Patient module dome lighting (in the high intensity setting).
8. Patient module air conditioning (at coldest setting with highest blower speed).
9. Emergency warning lighting system (in the daytime “primary” mode).
10. 20-amp medical load or equivalent.

AMD 012 Interior Climate Control Test – 2024

When performing the AMD 012 test in conjunction with the Federal Specification for the Star-of-Life Ambulance (KKK-A-1822) as the governing standard, the following figure may be used for guidance for the placement of thermocouples.



1) SP = LONGITUDINAL SPACING; PATIENT CABIN WORK LENGTH (PCWL) IS THE DISTANCE FROM THE FACE OF THE BACKREST AT SEAT BASE CUSHION TO THE REAR ENTRY DOORS. SP = PCWL DIVIDED BY 4.
2) TPC = THERMOCOUPLE PROBE COLUMN;
   1 AT 7-INCHES ABOVE FLOOR LEVEL
   1 AT MID-HEIGHT BETWEEN FLOOR AND CEILING
   1 AT 7-INCHES BELOW CEILING
3) PLACED EXTERIOR THERMOCOUPLES (ID No. 13 & 14) SHALL BE HEIGHT SET AT 1/2 OF THE OVERALL VEHICLE HEIGHT.

AMD 015 Ambulance Main Medical Gas System Test – 2024

When performing the AMD 015 test in conjunction with the Federal Specification for the Star-of-Life Ambulance (KKK-A-1822) as the governing standard, the following provides an example form of the label required to represent compliance of the main medical gas delivery system, as well as a figure depicting system pressure testing.

Example documentation

The integrity of this medical gas system was tested in accordance with AMD 015 and meets the requirements of the Federal Specification for the Star-of-Life Ambulance (KKK-A-1822) .

Stage 1 Testing – Flow rate at each outlet:

Gas used for flow test (check one):

_____ Dry Nitrogen (110 LPM min. required)

_____ Breathing Air (110 LPM min. required)

_____ Oxygen (100 LPM min. required)

Note: For purposes of this test, 110 LPM of dry Nitrogen or Breathing Air is considered equivalent to 100 LPM of Oxygen.

Outlet # Flow Rate (LPM)

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Stage 2 Testing – Pressure:

Initial Conditions for Stage 2 Testing:

Temperature: _____ °F

Pressure: _____ psi

Final Conditions for Stage 2 Testing:

Temperature: _____ °F

Pressure: _____ psi

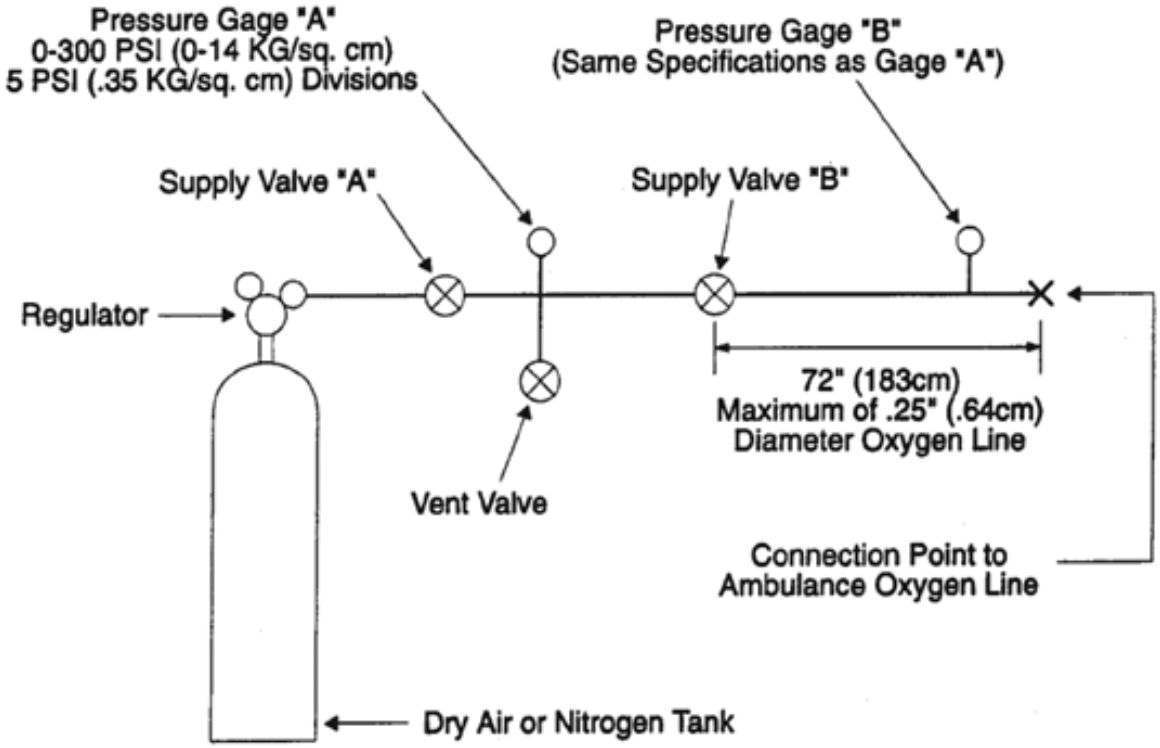
Pressure Loss:_____ psi

Maximum Allowable Pressure Loss: 5psi

Signature of operator performing test: _____

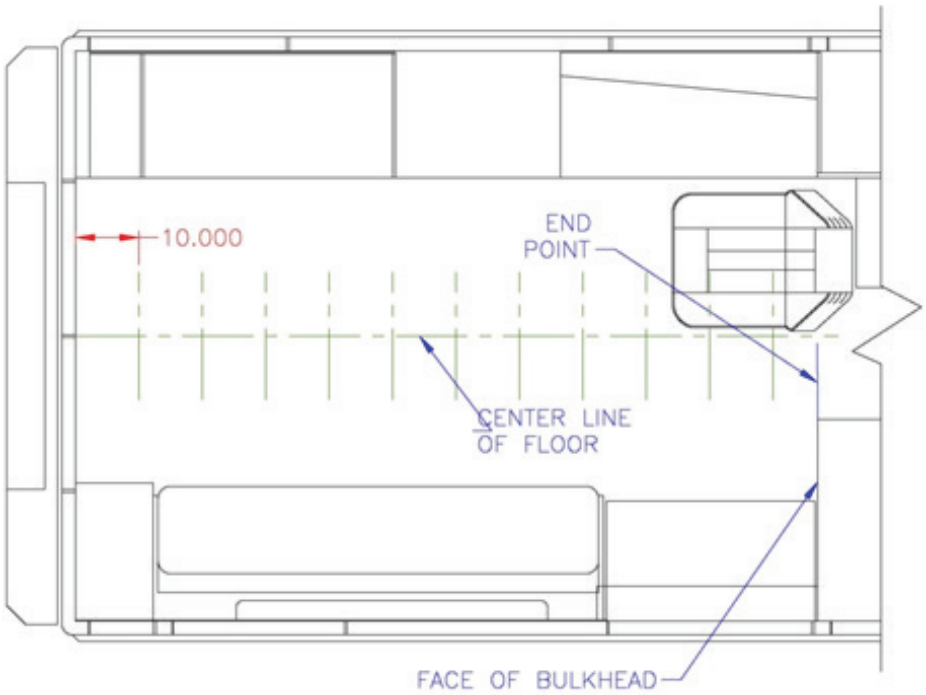
Printed name of operator performing test: _____

Date of test: _____



AMD 016 Patient Compartment Lighting Level Test – 2024

When performing the AMD016 test in conjunction with Federal Specification for the Star-of-Life Ambulance (KKK-A-1822) as the governing standard, the following provides a depiction of the locations for measuring floor or lighting intensity along the centerline of the patient compartment.



AMD 028 Vertical Component Retention Test – Static Test – 2024

This test method is complementary with SAE J3043 – Ambulance Equipment Mount Device or Systems, which does not have a vertical component. If a governing standard requires an equipment mount to be tested in all directions, it needs to incorporate both SAE J3043 and AMD 028 by reference.

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