

**Global change:** Anywhere in the document the word “oxygen” is used, replace it with “medical gas”.

**Substantiation:** Critical care ambulance services carry medical gasses in addition to oxygen. As worded the current language suggests it would be prohibited for those other gasses to be stored in the oxygen compartment when that is not the case. The term oxygen is limiting. The replacement of the tem oxygen with medical gas will allow EMS operations to function in the manner they are authorized to by applicable State laws and regulations.

**Add new 2.3.7** and renumber accordingly to where the NEW 2.3.7 will list in order the AMD 1-25 standards. (This will also result in the deletion of chapter 9 since the AMD testing standards will be part of the requirements of this standard through their reference in this chapter.)

**Substantiation:** The technical committee on ambulances should incorporate by reference all AMD testing standards into NFPA 1917. By doing so, the technical committee will not need to update this standard in response to any revisions to testing standards at AMD. AMD is the appropriate body to develop and disseminate those testing standards. The AMD standards have served for many years as a solid basis for testing requirements for the KKK standard upon which much of the NFPA 1917 standard is based. The bylaws and semi-annual meetings of the AMD allow for more nimble adaptation to changes appropriate for the testing standards.

**3.3.3 Ambulance.** A vehicle used for out of hospital medical care and patient transport, which provides a driver’s compartment; a patient compartment to accommodate an emergency medical services provider (EMSP) and at least one patient, located on the primary cot, so positioned that the primary patient can be given emergency care during transit; equipment and supplies for emergency care at the scene as well as during transport; safety, comfort, and avoidance of aggravation of the patient’s injury or illness; two-way radio communication; and audible and visual traffic warning devices.

**Substantiation:** This allows for the definition of ambulance to contemplate the potential for more than one patient to be transported in the back of the ambulance, and the addition of the phrase precludes an erroneous interpretation that the ambulance can be constructed to transport only one patient. The commas are editorial in nature and to ensure that there is not more than one patient on the primary cot.

~~4.2.3 — After acceptance of the ambulance, the purchaser shall be responsible for ongoing training of personnel to develop and maintain proficiency regarding the proper and safe use of the ambulance and the associated equipment.~~

**Substantiation:** This is an unenforceable construction requirement and should be deleted or moved to the annex. A design/construction standard should not include operational parameters. The requirement for driver training is the responsibility of the ambulance operator and if deemed necessary by the regulating body can be required by State law or regulation.

~~4.3.1.2~~ The contractor's detailed description shall include a statement specifically describing each aspect of the delivered ambulance that will not be fully compliant with the requirements of this standard.

**Substantiation:** This is redundant with 4.17 and the language in 4.17 is superior.

**4.6 Third-Party Certification of Test Results.** ~~Where~~ This standard requires the witnessing or performing of tests by an independent third-party organization, that organization shall meet the requirements of this section.

~~4.6.1~~ Testing shall be witnessed or performed by an organization that is accredited for inspection of ambulances in accordance with ISO/IEC 17020, *General Criteria for the Operation of Various Types of Bodies Performing Inspection*, or accredited for testing ambulances to this standard in accordance with ISO/IEC 17025, *General Requirements for the Competence of Testing and Calibration Laboratories*.

~~4.6.2~~ The certification organization shall not be owned or controlled by the final stage ambulance manufacturer.

~~4.6.3~~ The certification organization shall witness all tests and shall refuse to certify any test results for a system if all components of that system requiring testing do not pass the testing required by this standard. [1901: 4.7.4]

~~4.6.4~~ Conditional, temporary, or partial certification of test results shall not be permitted.

~~4.6.5~~ Appropriate forms or data sheets shall be provided and used during the testing. [1901: 4.7.6]

~~4.6.6~~ Programs shall be in place for training, proficiency testing, and performance verification of any staff involved with certification. [1901: 4.7.7]

~~4.6.7 Appeal Process.~~

~~4.6.7.1~~ The certification organization's operating procedures shall provide a mechanism for the manufacturer to appeal decisions.

~~4.6.7.2~~ The procedures shall include provisions for the presentation of information from representatives of both sides of a controversy to a designated appeals panel.

~~4.6.8~~— The third party that certifies any test results shall supply the following information on the certification organization letterhead:

- ~~(1) — Company or business for which the results are certified~~
- ~~(2) — Date of certification~~
- ~~(3) — Ambulance model, components, or equipment being certified~~
- ~~(4) — Certification organization and address~~
- ~~(5) — Date product tested~~
- ~~(6) — Model number and specification data~~
- ~~(7) — Applicable specification references and test requirement~~
- ~~(8) — Summary of the test report~~
- ~~(9) — A certifying statement with official signature~~

~~4.6.9\*~~ The testing facility for each certification shall supply the following supportive verification data and information on letterhead stationery in electronic format:

- ~~(1) — Name of company or business for whom ambulance product was tested~~
- ~~(2) — Report date~~
- ~~(3) — Name of sample product or device~~
- ~~(4) — Contractor's address~~
- ~~(5) — Serial and model number(s)~~
- ~~(6) — Specification referral and amendment number(s), and test requirement(s)~~
- ~~(7) — Test facilities used and location~~
- ~~(8) — Test equipment used~~
- ~~(9) — Test procedure~~
- ~~(10) — Test results~~
- ~~(11) — Verifying test data~~
- ~~(12) — Photographs~~
- ~~(13) — Drawings~~

~~(14) Test conclusion(s)~~

~~(15) Witness(es)~~

~~(16) Authorized signature~~

**4.6.1** The initial testing and inspections required for certification shall be performed by one of the following:

**(1)** A Nationally recognized testing laboratory, recognized by OSHA under Appendix A to 29 CFR 1910.7

**(2)** An ISO/IEC 17025 accredited laboratory by an accreditation body that is recognized by the National Cooperation for Laboratory Accreditation (NACLA) or is a signatory to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA).

**(a)** The scope of accreditation shall include AMD tests 1-25.

**(b)** The individual certifications will remain valid for 5 years as long as the type of ambulance tested remains in production.

**(c)** Design changes during the 5 year certification period must be tested at the time of production release.

**(d)** Certifications that appear on the ambulance need not be re-submitted (i.e.; DOT, EPA, etc.).

**(e)** Certification(s) will be acceptable in lieu of actual verification test during inspections providing supporting verifying data complying with 4.6.1 is on file for examination.

**(f)** Certification from OEM and individual equipment manufacturers are acceptable providing they are not part of a system(s) or altered and in accordance with 4.7.

**4.6.1.1** Type certifications of individual components and equipment products shall be acceptable.

**4.6.1.2** Each ambulance constructed shall be tested by the FSAM to demonstrate compliance with AMD STDs 5, 9, 10, 15, 21 & 25 in addition to the initial type testing certification required.

~~**4.7 Certification of Test Results by Manufacturer.** Where this standard requires the results of tests or the performance of a component to be certified by the manufacturer, the manufacturer shall meet the requirements of this section. [1901: 4.8]~~

~~4.7.1— A representative of the manufacturer shall witness all tests and shall refuse to certify any test results for a system unless all components of that system requiring testing pass the testing required by this standard. [1901: 4.8.1]~~

~~4.7.2— Conditional, temporary, or partial certification of test results shall not be permitted.~~

~~4.7.3— The manufacturer shall have the facilities and equipment necessary to conduct the required testing, a program for the calibration of all instruments, and procedures to ensure the proper control of all testing. [1901: 4.8.3]~~

~~4.7.4— Appropriate forms or data sheets shall be provided and used during the testing. [1901: 4.8.4]~~

~~4.7.5— Programs shall be in place for training, proficiency testing, and performance verification of any personnel involved with certification. [1901: 4.8.5]~~

~~4.7.6— An official of the company that manufactures or installs the product shall designate in writing who is qualified to witness tests and certify results. [1901: 4.8.6]~~

#### **4.7 CERTIFICATION LETTER FORMAT**

**4.7.1 Certification letters submitted for the ambulance model, components, and equipment being certified shall contain the following information on FSAM's letterhead stationery in electronic format (pdf files):**

1. To whom certifying.

2. Date.

3. Units or items.

4. FSAM and address.

5. Date product tested.

6. Model number and specification data.

7. Applicable specification references and test requirement.

8. Summary of the test report.

9. A certifying statement w/ official signature.

**4.7.27** Certification documentation shall be delivered with the ambulance, including results of the certification tests. [1901: 4.8.7]

**4.7.38** Certification tests performed on a substantially similar ambulance shall be valid for up to 7 years or until such time as the production product changes are so significant that they no longer meet the definition of a substantially similar ambulance.

**Substantiation:** This is text from the KKK specification that should be maintained. The NFPA 1917, *Standard for Automotive Ambulances* significantly weakened this requirement, which compromises safety. The current KKK standard requires independent third party certification and testing. The use of an independent third party for certification and testing removes any possibility of undue influence in this process or the ability to make any modifications to the test. The inconsistency in construct of boxes for patient care compartments has been widely noted in reports of ambulance collisions where boxes have been torn apart. The NFPA technical committee on ambulances should not condone any opportunity to allow undue influence or a degradation of the current standard.

#### **4.11\* Ambulance Performance.**

~~4.11.1 The ambulance shall meet the requirements of this standard at elevations up to 2000 ft (600 m) above sea level.~~

**Substantiation:** Because the vast majority of ambulances in the US operate at elevations well below 2000 ft above sea level, the requirement to test at that elevation creates an unjustifiable additional expense. The number of tests affected by elevation is small. For those tests that are affected by elevation, it is more reasonable for customers that operate at high elevation to add requirements for high elevation testing to the extent they are warranted by their operating requirements.

~~4.11.2\* The ambulance shall meet all the requirements of this standard while stationary on a grade of 6 percent in any direction.~~

**Substantiation:** While we fully expect the ambulance to perform to this standard while parked on a 6 percent grade in any direction, there is no feasible way to validate that performance. The platforms for performing such tests are not available. But even if they were, there is no justification for multiplying the testing cost by a factor of five on account of performing all tests at four orientations other than horizontal.

**4.11.3\*** Where temperature requirements are not otherwise specified, the ambulance shall be designed to function in ambient temperature conditions between ~~-20°F and 110°F (-29°C and 43°C)~~ 0°F to 95°F (-18°C to 35°C).

**Substantiation:** Chassis manufacturers only provide pass through certification for cold start at 0°F. Expanding the range of degrees requires additional costs and testing that are unnecessary in most areas of the country. States that experience extremes of

temperature can impose regulations that conform to their environment, and/or local EMS agencies can spec to that. It is virtually impossible for the OEM or ambulance manufacturer to produce vehicles that comply with the NFPA 1917 requirements. There are specific areas of the United States with extremes of temperature that can and do establish specifications for temperature ranges for those variables. There is no need for the NFPA technical committee on ambulances to establish a one size fits all range of temperatures.

~~4.12.3 The maximum top speed of the ambulance shall not exceed 77 mph (124 km/hr) or the manufacturer's maximum service speed rating for the tires installed on the ambulance, whichever is lower.~~

**Substantiation:** This provision was previously deleted from NFPA 1917 through a Temporary Interim Amendment. It is time to make that a permanent change. States are afforded the primary responsibility to establish speed for roadways and any exceptions for emergency vehicles. It is not within the purview of an ambulance design standard to supersede or subvert State rights. If there is scientific research or other information that the NFPA technical committee on ambulances desires to communicate to the ambulance community, it may be included or referenced in the annex. The requirement of a speed limiting device that places a maximum speed limit of 77 mph creates a safety hazard for operators and occupants of ambulances, especially in states that have posted speed limits above 77 mph. In some states, For example, Texas, there is a posted speed limit of 85 mph and an NFPA 1917 compliant ambulance would not be able to meet the posted speed limit, thus creating a safety hazard. This is also true in states where emergency vehicles are allowed to exceed the posted speed limit by 10 mph; with 77 mph being the maximum, in a standard that comprises minimum requirements, the posted speed limit would have to be as low as 67 mph which is not common in some states. This requirement places a restriction upon some states that would prohibit them from purchasing an NFPA 1917 compliant ambulance.

**4.16.1 Ambulance Documentation.** The contractor shall deliver with the ambulance at least one copy of the following documents:

- (1) The manufacturer's record of ambulance construction details, including the following information:
  - (a) Owner's name and address
  - (b) Ambulance manufacturer, model, and serial number
  - (c) Chassis make, model, and vehicle identification number (VIN)
  - (d) GAWR of front and rear axles and GVWR
  - (e) Front tire size and total rated capacity in pounds (kilograms)

- (f) Rear tire size and total rated capacity in pounds (kilograms)
  - (g) Type of fuel and fuel tank capacity
  - (h) Electrical system voltage and alternator output in amps
  - (i) Paint manufacturer and paint number(s)
  - (j) Company name and signature of responsible company representative
  - (k) Documents from a certified scale showing curb weight on the front axle and rear axle(s) (without personnel and equipment)
  - (l) Documentation of each test performed as required by NFPA 1917 or AMD Standards 5, 9, 10, 15, 21, and 25 and the initial type testing required.
- ~~(5) — Certification of slip resistance of all exterior stepping, standing, and walking surfaces (see Section 6.12)~~

**Substantiation:** With the utilization of AMD testing standards, Ambulance Manufacturers will need to represent that all necessary testing in accord with those standards has been completed successfully to a purchaser. The AMD standards listed in (l) prescribe testing to be done on each ambulance. The documentation should be included with the ambulance as a record of the performance of each ambulance in each area of required testing. The proposed change to 6.11.4 eliminates item (5).

**4.16.2.3\*** The contractor shall also deliver with the ambulance the following documentation for the entire ambulance and each major operating system or major component of the ambulance:

- (1) Manufacturer's name and address
- (2) Country of manufacture
- (3) Source for service and technical information
- (4) Parts replacement information
- (5) Descriptions, specifications, and ratings of the chassis
- (6) Wiring diagrams for low voltage and line voltage ambulance-specific systems to include the following information:
  - (a) Circuit logic for all electrical components and wiring
  - (b) Circuit identification
  - (c) Connector pin identification
  - (d) Zone location of electrical components
  - (e) Safety interlocks



- (f) Alternator battery power distribution circuits
  - (g) Input/output assignment sheets or equivalent circuit logic implemented in multiplexing systems
- (7) Lubrication charts
  - (8) Operating instructions for the chassis and any major components
  - (9) Instructions regarding the frequency and procedure for recommended maintenance
  - (10) Overall ambulance operating instructions
  - (11) Safety considerations
  - (12) Limitations of use
  - (13) Inspection procedures
  - (14) Recommended service procedures
  - (15) Troubleshooting guide
  - (16) Ambulance body, chassis, and other component manufacturer's warranties
  - (17) Special data required by this standard
  - (18) ~~Material safety~~ Safety data sheet (MSDS) for any fluid that is specified for use on the ambulance module

**Substantiation:** OSHA has amended the Hazard Communication standard to bring it into concert with the worldwide Global Harmonization Standard. As a result, the term "Material Safety Data Sheet" has been replaced with "Safety Data Sheet".

~~5.3.4 Idle reduction engine shutdown device shall be disabled if provided in accordance with federal and state exemptions.~~

**Substantiation:** This should be locally determined if not regulated by the state. There may be cases where statute prohibits disabling the idle reduction shutdown device. In any case, there is no reason to stipulate disabling of the shutdown device as the ambulance manufacturers will do this automatically in order to sustain the required alternator output. The exception will be on ambulances with anti-idling systems with a voltage-monitoring, auto re-start feature, in which case the requirement to disable the shutdown device would be inappropriate.

~~5.14.4 Each side view mirror's reflective surface outboard edge shall extend at least 1 in. (25.4 mm) beyond the outside of the modular body.~~

**Substantiation:** This change is being suggested as the current text is in conflict with FMVSS.

**6.1.2** The compartment shall provide a ~~minimum of 12 in. (300 mm)~~ of clear aisle walkway on at least one side of the patient cot.

**Substantiation:** This change is being suggested as there is no rationale to the 12 inches and it could possibly be design restrictive. If a minimum width is ever specified, it should be driven by anthropomorphic/ergonomic studies such as those being conducted by NIOSH. There remains no specific reasoning for a minimum space for a clear aisle walkway in the patient compartment. With the increasing demand for ergonomics design criteria in the patient compartment, the current provision may be unnecessarily restrictive. The standard should be silent on this issue. The inside track dimension of the rear tires plus the required tire chain clearance pursuant to SAE J683 creates an absolute limit on the maximum aisle width between the wheel wells. Depending upon the cot dimensions—especially in the case of a bariatric cot—it may not be possible to provide a 12" clear aisle.

**6.1.3\* Floor Height.** The finished floor (loading) height shall be a maximum of 34 in (864 mm).

**A.6.1.3** It should also be noted that 4X4 ambulances are note subject to this requirement and most 4X4 ambulances wouldn't meet the requirement as the 4X4 option raises the chassis.

**Substantiation:** It is noted that 34" is the maximum load height most cots are designed to and to go any higher than 34" could potentially create an unsafe lifting situation for those providers who are not physically able to lift that high.

## **6.8 Access Handrails or Handholds.**

**6.8.1** ~~Interior or exterior access~~ handrails or handholds shall be provided at each entrance to a driving or crew compartment and at each position where steps or ladders for climbing are located and on the ceiling of the patient compartment.

**Substantiation:** The specification for interior or exterior is superfluous; there is no way they cannot be interior or exterior. Grab bars on the ceiling of the patient compartment are generally accepted as a standard in the industry.

**6.8.2\*** ~~Exterior access~~ handrails shall be constructed of or covered with a slip-resistant (e.g., ~~cross-hatched stainless steel, rubberized~~), nonporous, noncorrosive material.

**A.6.8.2** Some examples could be cross-hatched stainless steel or rubberized.

**Substantiation:** The key requirements are: slip-resistant, nonporous, and noncorrosive. Examples of compliant options belong in the annex.

**6.8.4** ~~All exterior access~~ handrails shall be designed and mounted to reduce the possibility of hand slippage and to avoid snagging of equipment or clothing.

**Substantiation:** These requirements are desired features of both interior and exterior handrails.

**6.8.5** ~~Access~~ handrails supplied by the chassis manufacturer on a commercial chassis shall be deemed sufficient for purposes ~~permitted to be used to meet the requirements~~ of this section.

**Substantiation:** These changes clean up this section and delete non value added words. There is no need for requiring cross hatched stainless steel and or rubberized handrails, particularly inside the patient compartment. As revised, the provision provides an adequate base level of safety for an ambulance operation.

**6.9.11** ~~Doors shall, in addition to meeting applicable FMVSS standards, withstand the loads on the latches and hinges listed in Table 6.9.11 when tested in accordance with Section 9.2.~~

**Table 6.9.11 Loads Withstood on Ambulance Door Latches and Hinges**

Latch or Hinge	Side Door				Rear Door			
	Transverse Load		Longitudinal Load		Transverse Load		Longitudinal Load	
	lbf	N	lbf	N	lbf	N	lbf	N
Fully latched position	2,500	11,120	2,500	11,120	2,500	11,120	2,500	11,120
Secondary latched position	1,500	6,672	1,500	6,672	1,500	6,672	1,500	6,672
Hinge	2,500	11,120	2,500	11,120	2,500	11,120	2,500	11,120

**6.9.11.1** ~~Compliance of the door shall be validated by testing on a patient compartment sample of a substantially similar design.~~

**6.9.11.2** ~~During the tests, the door(s) or its retention components shall not do either of the following:~~

- ~~(1) Open at any time during the test procedure~~
- ~~(2) Fail at the latch, striker(s), hinge, or their points of attachment to the door or the body framework~~

**Substantiation:** Currently, FMVSS 206 covers these requirements. There is no need to specify anything in addition to or different from FMVSS 206 which could create conflict and confusion.

## **6.10 Means of Egress Escape.**

**6.10.1** The patient compartment area shall have a minimum of two means of egress sized and positioned to allow for the removal of a patient on a backboard. Any interior area to be occupied by personnel shall have a minimum of two means of escape.

~~**6.10.2** Each means of escape opening shall be a minimum of 24 in. x 24 in. (610 mm x 610 mm).~~

**Substantiation:** The existing provision is a standard similar to that found in busing operations. In an ambulance environment, it is imperative that a patient may be removed while on a backboard. The task group suggests making a clear statement about what is needed, and allows the manufacturer and purchaser determine how to accomplish that requirement.

~~**6.11.4** The contractor shall deliver with the ambulance a certification that all materials used for exterior surfaces designated as stepping, standing, and walking areas meet the requirements of Section 6.11.~~

**Substantiation:** This section duplicates the requirements of section 4.17. To the extent the standard requires a feature (such as slip resistance) and stipulates that all exceptions must be documented, it logically follows that all requirements other than those documented as an exception are compliant.

**6.13.2** With the exception of cot, equipment retention hardware, and equipment mounted in its hardware, the floor shall be unencumbered in the door(s) access and work area.

**Substantiation:** This addition is to allow for the inclusion of retention hardware for specialty equipment, such as balloon pumps, and the presence of such equipment on the floor when mounted. In addition, tracking materials may be built into the flooring for securement of NICU equipment.

~~**6.13.7.1** If the subfloor is constructed of plywood, the plywood shall have an American Plywood Association (APA) floor rating of 16 in. (406 mm) on center or better.~~

~~**6.13.7.2** If the subfloor is constructed of other than plywood, it shall be tested using a 3 in. (76 mm) disk and have a maximum of 0.125 in. (3 mm) deflection at 200 lb (91 kg) force and a minimum ultimate load of 400 lb (181 kg) for a 16 in. (406 mm) on center load.~~

**Substantiation:** AMD testing standards, specifically AMD 20, Floor distributed load test provides the necessary specifications for flooring material.

**6.16.1** The interior of the patient compartment shall provide enclosed storage cabinetry, ~~compartment space, and shelf space.~~

**Substantiation:** Evolving design considerations may not include cabinets or compartment space. As written, the language suggests cabinets and compartments are required. The designation of separate types of space is unnecessary. There is also no apparent justification for specifying or restricting the type of storage space provided.

6.16.7 Each patient compartment cabinet shall be permanently labeled with its maximum load capacity.

6.16.8 Patient compartment cabinets shall be tested dynamically using SAE J2917 and/or SAE J2956 as appropriate for the intended orientation and weight rating proposed by the manufacturer.

6.16.8.1 The cabinet shall be mounted on a rigid test fixture using the hardware provided by the cabinet manufacturer.

6.16.8.2 An analog device of a weight matching the proposed weight limit of the cabinet shall be placed at the center of the cabinet.

6.16.8.3 Post-test inspection shall confirm the analog device remained in the cabinet and the cabinet remained attached to the test fixture.

**Substantiation:** These added sections provide testing parameters in support of 6.16.7. Cabinets and equipment mounts previously showed a requirement for a 10g load requirement with no discussion of method to valid compliance. The 10g value was also an arbitrary number. Ambulance, seat, and cot manufacturers are all moving to a dynamic loading test based on actual crash testing of ambulances. The results from those crash tests are covered by SAE J2917 (frontal impact) and SAE J2956 (side impact). It would be an obvious extension to test cabinet mounts to those same dynamic loads.

~~6.18.2 Equipment weighing 3 lb (1.36 kg) or more mounted or stored in a driving or patient area shall be contained in an enclosed compartment capable of containing the contents when a 10G force is applied in the longitudinal, lateral, or vertical axis of the vehicle, if the equipment is secured in a bracket(s) or mount that can contain the equipment when the equipment is subjected to those same forces.~~

6.18.2 Equipment weighing 3 lbs. (1.36 kg) or more that is to be mounted or secured in the patient compartment but not in an enclosed, labeled cabinet shall be dynamically tested using SAE J2917 and/or SAE J2956, as appropriate for the expected location and orientation of the equipment in the patient compartment.

6.18.2.1 The test shall include the equipment mount and the piece of equipment or a representative analog device to be mounted or secured.

6.18.2.2 The equipment mount or securing device shall be mounted to the test fixture using the manufacturer's suggested mounting hardware.

6.18.2.3 Post-test inspection shall confirm the equipment or analog remained in the equipment mount or securing device and that the mount or securing device remained attached to the test fixture.

**Substantiation:** These added sections provide testing parameters in support of 6.18. Equipment mounts previously showed a requirement for a 10g load requirement with no discussion of method to valid compliance. The 10g value was also an arbitrary number. Ambulance, seat, and cot manufacturers are all moving to a dynamic loading test based on actual crash testing of ambulances. The results from those crash tests are covered by SAE J2917 (frontal impact) and SAE J2956 (side impact). It would be an obvious extension to test equipment mounts to those same dynamic loads.

~~6.18.3~~ Each patient compartment cabinet shall be permanently labeled with its maximum load capacity.

**Substantiation:** This change is being suggested as this is being moved to 6.16.7.

**6.21.1 Seat Integrity.** Any seat and occupant restraint system mounted on a fixed or an adjustable seat device shall be dynamically tested ~~along the direction of the adjustment~~ using the crash pulse in SAE J2917, ~~Occupant Restraint and Equipment Mounting Integrity—Frontal Impact System-Level Ambulance Patient Compartment.~~ and SAE J2956 as appropriate for the proposed orientation of the seat and occupant restraint system in the vehicle.

**6.21.1.1** If adjustable, ~~the~~ test shall be conducted with the seat oriented in the direction of adjustment for both the forward-facing and rear-facing directions.

**6.21.1.2** The test shall include a 50<sup>th</sup> percentile male anthropometric test device (ATD) as appropriate for the seating orientation and in accordance with the requirement of 49 CFR 572.

**6.21.1.23** During and after the test, the seat shall remain securely attached to mounting fixture ~~the adjustment device~~.

**6.21.1.4** During, and after the test, the ATD shall remain securely attached to the seating system.

**6.21.1.35** Seat belt anchorages on ~~side-facing~~ wall mounted seats shall be tested in accordance with the strength requirements of FMVSS 210.

**Substantiation:** The original language required a frontal impact test only, with an empty seat and limited acceptance criteria. NIOSH has now published a side impact test load input. The side impact should be included in the seat test requirement regardless of seat orientation. Also, loading of the structure is substantially increased with a 175 lb. crash test dummy installed. This will substantially increase the loading to the seat and seat attachment hardware. Seating manufacturers are already working with NIOSH and testing using this philosophy.

~~6.21.3.3~~ Signs that read “Occupants Must Be Seated and Belted When Ambulance Is in Motion” shall be visible from each seated position.

**Substantiation:** This should be removed from the document and/or moved to an appropriate place in the annex as this should be an option for the AHJ. A design/construction standard should not include operational parameters, which the sign language is indicative of.

**6.21.8.2** If the primary patient care ~~position~~seat is at the patient torso position, the fore-aft position of the seat shall be capable of lining up within 6 in. (152 mm) of the midpoint between the head end of the cot and the backrest hinge.

**Substantiation:** This change was made for the purposes of clarifying that the requirement is pertaining to the primary patient care seat rather than position.

#### ~~6.21.10~~ **Seatbelt Warning System.**

~~6.21.10.1~~ An occupant restraint warning system shall be provided for each designated seating position in the patient compartment.

~~6.21.10.2~~ The warning system shall indicate if an occupant in the patient compartment is not belted or restrained.

~~6.21.10.3~~ The warning system shall consist of an audible and visual warning device that can be heard and seen by the driver and seen by the occupants of the patient compartment.

~~6.21.10.4~~ The warning shall be activated when the parking brake is released and the transmission is not in neutral or park.

~~6.21.10.5~~ The warning system shall not show an affirmative indication unless it has determined that the seat was occupied before the seat belt or restraint was buckled.

**Substantiation:** This change is being suggested as it is believed that this distracts the driver, does not alarm if provider departs the seat, there may be clinical demands warranting seat departure, it does not correspond to the need to stop the vehicle. This could be moved to the annex and expand to include policy issues as well as other crew monitoring mechanisms. A design/construction standard should not include operational parameters. It was previously added to the standard as a good idea. The visual and audible alarm will add distraction to a driver. The system may be defeated if the unbelted and seated Caregiver simply stands in the Patient Compartment – which has been documented as a unsafe position for an occupant in the Patient Compartment. It is well established that there may be clinical demands warranting seat departure for patient care. As a good idea, this could be moved to the annex and expand to include policy issues as well as other crew monitoring mechanisms.

#### **6.22 Patient Cot Retention.**

~~6.22.1 Each patient cot retention system shall not fail or release when subjected to the greater of the cot manufacturer's recommended retention force or a minimum retention force of 2200 lb (998 kg) applied in the longitudinal, lateral, and vertical directions. Each patient cot, patient restraint, and cot retention system shall be dynamically tested as a system using SAE J2917 and SAE J2956, as appropriate.~~

~~6.22.1.1 Pre-test, a 50<sup>th</sup> percentile male ATD with pedestrian pelvis shall be properly positioned on the cot per manufacturer's instructions.~~

~~6.22.1.2 During and after the test the cot shall remain securely attached to cot mounting system.~~

~~6.22.1.3 During and after the test the cot mounting system shall remain securely attached to the test fixture.~~

~~6.22.1.4 During and after the test, the ATD shall remain securely attached to the cot.~~

~~6.22.2 Compliance of the cot retention system shall be validated by testing a sample retention device using a substantially similar ambulance or body structure in accordance with Section 9.4.~~

**Substantiation:** Cot testing previously showed a requirement for a 2200 lb. static loading of cot retention device in multiple directions based on the AMD 004 test. The 2200 lb. value was an arbitrary number. Ambulance, seat, and cot manufacturers are all moving to a dynamic loading test based on actual crash testing of ambulances. The results from those crash tests are covered by SAE J2917 (frontal impact) and SAE J2956 (side impact). Cot manufacturers are also working with NIOSH to test cots installed into the cot retention and loaded with a 50<sup>th</sup> percentile crash test dummy (175 lb.) The loading experienced by the cot and cot retention device in such a crash is far greater than was found in the 2200 lb. pull test.

~~6.25.1\* A retroreflective stripe or combination of stripes shall be affixed to the ambulance in the following proportions:~~

- ~~(1) 25 percent of the width length of each of the front cab side surfaces of the ambulance visible when approached from the front each side.~~
- ~~(2) 5075 percent of the overall ambulance length patient compartment side surfaces visible when approached from each side.~~

~~6.25.2 The stripe or combination of stripes shall be a minimum of 46 in. (152 mm) in total vertical width.~~

~~6.25.3 The 46 in. (152 mm) wide stripe or combination of stripes shall be permitted to be interrupted by objects (e.g., receptacles, cracks between slats in roll up doors), provided the full stripe is conspicuous as the ambulance is approached.~~



**Substantiation:** The task group strongly recommends maximizing conspicuity and improved specificity of the proposed language. The revised provision contains requirements that may be met and provide an adequate level of safety.

**6.25.6\*** At least 50 percent of the rear-facing, painted vertical surfaces, visible from the rear of the ambulance, shall be equipped with retroreflective ~~material striping in a chevron pattern sloping downward and away from the centerline of the vehicle at an angle of 45 degrees.~~

**A.6.25.6** Retroreflective material included in the calculation includes any combination of graphics, lettering, a chevron pattern sloping downward and away from the centerline of the vehicle at an angle of 45 degrees or Battenburg markings.

**6.25.6.1** When chevrons are used, each stripe in the chevron shall be a single color alternating between two high contrast colors. ~~Each stripe in the chevron shall be a single color alternating between red and either yellow, fluorescent yellow, or fluorescent yellow-green.~~

**6.25.6.3** When Battenburg markings are used, each box in the Battenburg markings shall be XX in<sup>2</sup> (XX mm<sup>2</sup>).

**Substantiation:** The task group is suggesting these changes as the back of an ambulance is configured differently than a fire truck. The AHJ has the authority to determine the design of all safety markings on the vehicle. Science has established that chevrons are not the only design that provides conspicuity. The intended desire in the existing standard to be consistent between fire & EMS may actually conflict with local culture and preferences. Scientific research and the FEMA study on conspicuity does not dictate one design or color pair, and the color red is highly inconspicuous during daylight and nighttime hours.

**6.28.11.2** ~~A label shall be provided near the oxygen tank stating the following: “The integrity of this oxygen system was tested in accordance with NFPA 1917 and meets the requirements thereof.”~~

**6.28.11.3** ~~The label shall be signed and dated by an authorized representative of the ambulance manufacturer or test agency.~~

**Substantiation:** The labeling requirements are prescribed by AMD Standard 015 Ambulance Main Oxygen System Test which are proposed for incorporation by reference pursuant to recommendations for section 2.3.7.

**7.1.1.2** Printed circuit assemblies ~~provided~~ installed by the ambulance manufacturer shall qualify under IPC A-610D, “Acceptability of Electronic Assemblies,” Classification 1.4.1 as Class 2 ~~“For Commercial and Industrial Assemblies”~~ “Life Support or other critical assemblies” or better.

**Substantiation:** This revision is necessary as Class 3 High Performance Electronic Products includes products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required such as life support or other critical systems. The proposed language restores the caliber of the circuit assemblies as it has been established by the KKK specifications. A higher rate of failure is not acceptable in an ambulance.

~~7.2.1.3 The use of star washers for circuit ground connections shall not be permitted. [1901:13.2.1.2]~~

Substantiation: The task group is suggesting this change as this type of lock washer is specifically required by some chassis manufacturers and QVM.

**7.2.2.1** All insulated wire and cable shall conform to SAE J1127, *Low Voltage Battery Cable*, or SAE J1128, *Low Voltage Primary Cable*, type SXL, or GXL, ~~or~~ TXL.  
[1901:13.2.2.1]

**Substantiation:** TXL is an inferior wire compared to the current requirements in the KKK standard which is SXL or GXL. The insulation thickness on SXL is .037, GXL is .023 and TXL is .016.

~~7.2.2.1.2 Conductor materials and stranding, other than copper, shall be permitted if all applicable requirements for physical, electrical, and environmental conditions are met as dictated by the end application. [1901:13.2.2.1.2]~~ All wiring provided by the FSAM shall be copper.

**Substantiation:** This change is being made as copper conductors are more reliable and efficient than aluminum, etc (that is why they quit wiring houses with aluminum) and the connections don't require special methods that aluminum does. This is also to address concerns of safety and that copper wire is the safest.

**7.2.2.2** The overall covering of conductors shall be moisture-resistant loom or braid that has a minimum continuous rating of 194300°F (90149°C) ~~except where good engineering practice dictates special consideration for loom installations exposed to higher temperatures. [1901:13.2.2.2]~~

**7.2.2.3** The overall covering of jacketed cables shall be moisture resistant and have a minimum continuous temperature rating of 194300°F (90149°C) ~~except where good engineering practice dictates special consideration for cable installations exposed to higher temperatures. [1901:13.2.3]~~

**Substantiation:** The current KKK standard requires a 300 degree insulation covering and reducing that to 194 degrees increases the chance of high heat related issues with various harnesses within the ambulance upfit especially those in the engine compartment.

**7.2.2.7** Exterior Connections at exterior for lights and fixtures shall utilize sealed connectors or sealed splices.

**Substantiation:** There is no reason for the increased expense of exterior sealed connectors on devices where the connector is inside the patient compartment. The logical intent is to ensure that all connections that are potentially exposed to moisture are properly protected against moisture. Many exterior light connections are interior connections that are not exposed to moisture and therefore do not need such protection. Conversely, there are connections for devices other than exterior lights and fixtures that are exterior connections that do need to utilize sealed connectors or sealed splices.

### **7.3.2\* Low Idle Alternator Output.**

~~7.3.2.1~~ The alternator shall have a minimum output at low idle to meet the minimum electrical load test conditions of the ambulance between 60°F and 110°F (15°C and 43°C) ambient temperature.

~~7.3.2.1.1~~ Minimum electrical load test conditions, which are tested under low-idle conditions, shall consist of the following:

- ~~(1) The propulsion engine and transmission~~
- ~~(2) All legally required clearance and marker lights, headlights, and other electrical devices except windshield wipers and four-way hazard flashers~~
- ~~(3) The radio(s) at a duty cycle of 10-percent transmit and 90-percent receive (for calculation and testing purposes, a default value of 5 amperes continuous)~~
- ~~(4) Cab air conditioning (at coldest setting with highest blower speed)~~
- ~~(5) Patient compartment air conditioning (at coldest setting with highest blower speed)~~
- ~~(6) The lighting necessary to illuminate walking surfaces at entry points~~

~~7.3.2.2~~ Compliance of the minimum electrical load test conditions shall be validated by testing a substantially similar ambulance in accordance with 9.5.3.3.

**Substantiation:** This change is being suggested as current and next year commercial ambulance chassis cannot meet this requirement and upgrading the alternator is infeasible. The requirement in sections 5.4 and 7.5.3 for a high idle function both acknowledges and accommodates this reality.

### **7.11.5 Ground Lighting.**

~~7.11.5.1~~ The ambulance shall be equipped with lighting that is capable of providing illumination at a minimum level of 0.3 fc on ground areas within 30 in. (800 mm) of the edge of the ambulance in areas designed for personnel to climb into or onto the ambulance or descend from the ambulance to the ground level.

~~7.11.5.2~~ Lighting designed to provide illumination on areas under the driver and crew riding area exits shall be switchable but activated automatically when the exit doors are opened.

~~7.11.5.3~~ All other ground area lighting shall be switchable.

**Substantiation:** It is believed that this should either be moved to the annex or deleted as they believe that existing exterior and scene lighting provides sufficient illumination for the vast majority of ambulance applications. If desired, annex information could prompt consideration of ground lighting for ambulances that regularly operate in areas with little or no ambient illumination. Given the option, most customers elect not to add ground lighting.

**7.11.6.1\*** If not equipped with an OEM dome light, ~~the ambulance~~FSAM shall ~~have~~install sufficient lighting to provide an average level of 1 fc at each seating surface in the driving compartments.

**Substantiation:** The majority of all ambulance chassis are equipped with OEM door activated dome lights. Any additional driver compartment lighting requirements should be the purchaser's decision.

**7.12.1\*** A red flashing or rotating light or electronic display within the forward view of the driver shall be illuminated automatically whenever the ambulance's ignition switch is in the run position, the parking brake is not fully engaged, and any of the following conditions exist:

- (1) Any passenger, patient entry, or equipment compartment door is not closed.
- (2) Any external equipment rack is not in the stowed position.
- (3) Any other device permanently attached to the ambulance is open, extended, or deployed in a manner that is likely to cause damage to the ambulance if the ambulance is moved.

**Substantiation:** Internal equipment may or may not be stowed while the ambulance is being driven based on patient care demands and AHJ policies. An electronic display in the view of the driver in these cases is an unnecessary distraction.

8.5.3.1 When the FSAM furnishes a generator below 8 kW they shall follow generator manufacturer's installation and operation instructions, over 8 kW follow NFPA 1901.

#### **8.5.4 Power Source Rating.**

8.5.4.1\* For power sources of 8 kW or larger, the power source manufacturer shall declare the continuous duty rating that the power source can provide when installed on the ambulance according to the manufacturer's instructions and run at 120°F (49°C) air intake temperature at 2000 ft (600 m) above sea level.

8.5.4.2 The rating on the power source specification label shall not exceed the declared rating from the power source manufacturer. [1901:22.4.3.2]

8.5.5 Access shall be provided to permit both routine maintenance and removal of the power source for major servicing. [1901:22.4.4]

8.5.6 The power source shall be located such that neither it nor its mounting brackets interfere with the routine maintenance of the ambulance.

#### **8.5.7 Instrumentation.**

8.5.7.1 If the power source is rated at less than 3 kW, a "Power On" indicator shall be provided. [1901:22.4.6.1]

8.5.7.2 If the power source is rated at 3 kW or more but less than 8 kW, a voltmeter shall be provided. [1901:22.4.6.2]

8.5.7.3\* If the power source is rated at 8 kW or more, the following instrumentation shall be provided at an operator's panel:

- (1) Voltmeter
- (2) Current meters for each ungrounded leg
- (3) Frequency (Hz) meter
- (4) Power source hourmeter

[1901:22.4.6.3]

8.5.7.4 The instrumentation shall be permanently mounted at an operator's panel. [1901:22.4.6.4]

8.5.7.4.1 The instruments shall be located in a plane facing the operator. [1901:22.4.6.4.1]

8.5.7.4.2 Gauges, switches, or other instruments on this panel shall each have a label to indicate their function. [1901:22.4.6.4.2]

~~8.5.7.4.3~~—The instruments and other line voltage equipment and controls shall be protected from mechanical damage and not obstructed by tool mounting or equipment storage. [~~1901:22.4.6.4.3~~]

~~8.5.8~~—An instruction plate(s) that provides the operator with the essential power source operating instructions, including the power-up and power-down sequence, shall be permanently attached to the ambulance at any point where such operations can take place. [~~1901:22.4.7~~]

### ~~8.5.9 Operation.~~

~~8.5.9.1~~—Provisions shall be made for placing the generator drive system in operation using controls and switches that are identified and within reach of the operator while seated in the driver's seat or standing upright on the ground.

~~8.5.9.2~~—Where the generator is driven by the chassis engine and engine compression brakes or engine exhaust brakes are furnished, they shall be automatically disengaged for generator operations. [~~1901:22.4.8.2~~]

~~8.5.9.3\*~~ Any control device used in the generator system power train between the engine and the generator shall be equipped with a means to prevent unintentional movement of the control device from its set position in the power generation mode. [~~1901:22.4.8.3~~]

~~8.5.10~~—If there is permanent wiring on the ambulance that is designed to be connected to the power source, a power source specification label that is permanently attached to the ambulance at the operator's control station shall provide the operator with the information detailed in Figure 8.5.10.

~~\*\*\*\*INSERT FIGURE HERE\*\*\*\*~~

### ~~FIGURE 8.5.10 Power Source Specification Label. [1901:Figure 22.4.9]~~

~~8.5.11~~—The power source, at any load, shall not produce a noise level that exceeds 90 dBA in any driving compartment, crew compartment, or onboard command area with windows and doors closed or at any operator's station on the ambulance.

### ~~8.6 Power Source-Type Specific Requirements.~~

~~8.6.1\* Direct Drive (PTO) Generators.~~ If the generator is driven by any type of PTO, it shall meet the requirements of 8.6.1.1 through 8.6.1.3.

~~8.6.1.1~~—The transmission's PTO port and PTO, or the split shaft PTO, and all associated driveshaft components shall be rated to support the continuous duty torque requirements of the generator's continuous duty rating as stated on the power source nameplate. [~~1901:22.5.1.1~~]

~~8.6.1.2~~—The direct drive generator shall be mounted so that it does not change the ramp breakover angle, angle of departure, or angle of approach as defined by other components, and it shall not extend into the ground clearance area. [~~1901:22.5.1.4~~]

~~8.6.1.3~~—The direct drive generator shall be mounted away from exhaust and muffler areas or provided with a heat shield to reduce operating temperatures in the generator area. [~~1901:22.5.1.5~~]

~~8.6.2\* Hydraulically Driven Generators.~~ If the generator is driven using hydraulic components, it shall meet the requirements of ~~8.6.2.1~~ through ~~8.6.2.3.4~~.

~~8.6.2.1\*~~ A means shall be provided to activate the hydraulic generator system. [~~1901:22.5.2.1~~]

~~8.6.2.2~~—If the hydraulic generator system is not capable of output as stated on the power source specification label at all engine speeds, an automatic engine speed control system shall be provided. [~~1901:22.5.2.2~~]

### ~~8.6.2.3 Hydraulic Components.~~

~~8.6.2.3.1~~—A hydraulic system filter and strainer shall be provided and shall be located in a readily accessible area. [~~1901:22.5.2.4.1~~]

~~8.6.2.3.2~~—Hydraulic hose shall meet the hydraulic pump manufacturer's recommendations for pressure, size, vacuum, and abrasion resistance. [~~1901:22.5.2.4.2~~]

~~8.6.2.3.3~~—Hydraulic fittings shall meet the hydraulic pump manufacturer's recommendations for pressure, size, and the type of hose used. [~~1901:22.5.2.4.3~~]

~~8.6.2.3.4~~—Where the hydraulic hose comes into contact with other surfaces, the hose shall be protected from chafing. [~~1901:22.5.2.5~~]

~~8.6.3\* Fixed Auxiliary Engine-Driven Generators.~~ If the generator is driven by a fixed auxiliary engine, it shall meet the requirements of ~~8.6.3.1~~ through ~~8.6.3.9.4~~.

~~8.6.3.1~~—The generator shall be installed so that fumes, vapors, heat, and vibrations do not enter the driving or patient compartment.

~~8.6.3.2\*~~ Generators rated at 8 kW or more shall be equipped with a high temperature automatic shutdown system and a low oil (pressure or level) automatic shutdown system. [~~1901:22.5.3.2~~]

~~8.6.3.3~~—The generator shall be installed in accordance with the generator manufacturer's requirements for ventilation and service accessibility. [~~1901:22.5.3.3~~]

~~8.6.3.4~~—If the generator is installed in a compartment and the compartment doors need to be open during its operation, the generator shall be equipped with an interlock system to prevent its operation if the doors are not open, or the compartment shall be equipped with a high temperature alarm. [~~1901:22.5.3.4~~]

~~8.6.3.5~~—If the generator is installed in a compartment on a slide tray and the slide tray must be in the extended or out position during operation, an interlock shall be provided to prevent operation unless the tray is in the correct position, or the compartment shall be equipped with a high temperature alarm. [~~1901:22.5.3.5~~]

~~8.6.3.6~~— Permanently installed generators shall have readily accessible engine oil drain provisions or piping to a remote location for oil changing. [~~1901:22.5.3.6~~]

~~8.6.3.7~~— If the generator is located in a position on the ambulance where the operator cannot see the instrumentation and operate the controls while standing at ground level or positioned at a specifically designated operator station, an operating panel with the required instrumentation, start and stop controls, and other controls necessary for safe operation shall be provided at a remote operator's panel.

~~8.6.3.7.1~~— A visual and audible warning shall be provided in the ambulance cab, visible from the operator's seat to do the following:

(1) ~~Visually indicate that the generator engine is operating~~

(2) ~~Visually and audibly indicate that the generator engine is in operation when the ambulance ignition is off~~

~~8.6.3.7.2~~— The audible warning shall be permitted to be equipped with an override function that resets automatically when the ignition is cycled on.

~~8.6.3.7.3~~— The generator engine shall shut down and be prevented from restarting automatically when connection to an external source of electrical power ("shore power") is established.

#### ~~8.6.3.8 Fuel System.~~

~~8.6.3.8.1~~— Fuel lines shall be protected from chafing at all wear points. [~~1901:22.5.3.8.1~~]

~~8.6.3.8.2~~— If the fuel source is shared with the ambulance engine, a separate fuel pickup system shall be provided that is arranged to ensure that the generator cannot utilize more than 75 percent of the fuel tank's capacity.

#### ~~8.6.3.9 Exhaust System.~~

~~8.6.3.9.1\*~~— The exhaust piping and discharge shall be located or shielded to prevent thermal damage to the ambulance or equipment.

~~8.6.3.9.2~~— The exhaust shall be piped to the exterior of the vehicle and discharged at a location away from any operator's position. [~~1901:22.5.3.9.2~~]

~~8.6.3.9.2.1~~— The exhaust system for the generator shall comply with Section ~~5.6~~.

~~8.6.3.9.3~~— Where parts of the exhaust system are exposed so that they can cause injury to operating personnel, protective guards shall be provided. [~~1901:22.5.3.9.3~~]

~~8.6.3.9.4~~— Silencing devices shall be provided and shall not create exhaust backpressure that exceeds the limits specified by the engine manufacturer. [~~1901:22.5.3.9.4~~]



**~~8.6.4\* Line Voltage Power Derived from the Ambulance Low Voltage Power Supply Systems.~~** If the power source derives its input energy from the ambulance low voltage electrical system, it shall meet the requirements of ~~8.6.4.1 and 8.6.4.2.~~

~~8.6.4.1~~—The low voltage power supply system shall be installed in compliance with the requirements of Chapter ~~7.~~

~~8.6.4.2\*~~ The alternator and/or battery system shall be adequate to provide power for continuous operation for a minimum of 2 hours at full output. [~~1901:22.5.5.2~~]

**~~8.6.5 Power Sources Requiring Elevated Engine Speed.~~** If the power source requires the chassis engine to be operating at a specific fixed speed or a specific speed range, it shall meet the requirements of ~~8.6.5.1 through 8.6.5.3.~~

~~8.6.5.1~~—The main propulsion engine shall have a governor capable of maintaining the engine speed within the limits required by the power source to meet the frequency control, voltage control, and power output specifications. [~~1901:22.5.6.1~~]

~~8.6.5.2~~—An interlock shall prevent engagement of the generator unless the parking brake is engaged and the transmission is in neutral or not connected to the drive wheels. [~~1901:22.5.6.2~~]

~~8.6.5.3\*~~ Where the chassis engine drives the generator and electronic engine throttle controls are provided, an interlock shall prevent engine speed control from any other source that would interfere with the generator while the generator is operating. [~~1901:22.5.6.3~~]

**~~8.6.6\* Waveform Created Electronically.~~** If the power output waveform is electronically created (as with invertors and some generators), the purchaser shall specify whether modified sine wave or pure sine wave output is required.

**~~8.7\* Portable Generator Installations.~~** The generator shall comply with Article 445, "Generators," of *NFPA 70*. [~~1901:22.6~~]

~~8.7.1~~—Any portable generator that can be operated while mounted on the ambulance shall be as follows:

- ~~(1)~~ Installed so that fumes, vapors, heat, excessive noise, and vibrations do not enter interior driving or crew compartments or damage the generator during operation
- ~~(2)~~ Have the exhaust outlet located so that exhaust is directed away from any operator station located on the ambulance and guarded to protect the operator
- ~~(3)~~ Installed in a location that directs the exhaust and heat at least 12 in. (300 mm) away from the fuel fill, oxygen system, entry doors, and ventilation inlets

~~8.7.2~~—If the portable generator is remotely mounted, it shall have a remote operator's control station that shall provide a means for starting and stopping the generator and monitoring the same instrumentation as is required for fixed power sources. [~~1901:22.6.2~~]

~~**8.7.3 Wiring for Portable Generator Installations.** Wiring installed for the purpose of facilitating the distribution of power from a portable generator installation to fixed wiring on the ambulance shall conform to the additional requirements of 8.7.3.1 through 8.7.3.5.~~

~~**8.7.3.1**—Circuit conductors shall be sized in relation to the power source specification label rating and shall be protected by an overcurrent device commensurate with their amperage capacities. [1901:22.6.3.1]~~

~~**8.7.3.2**—There shall be a single output connector cord with all of the conductors in the cord sized to carry a minimum of 115 percent of the nameplate amperage. [1901:22.6.3.2]~~

~~**8.7.3.3**—If there is not an overcurrent protection device at the power source, the output connector cord shall not exceed 72 in. (1830 mm) in length and shall be connected to an overcurrent protection device. [1901:22.6.3.3]~~

~~**8.7.3.4**—The rating of an external main overcurrent protection device shall equal the rated amperage on the power source specification label or the next larger available size overcurrent protection device where so recommended by the power source manufacturer. [1901:22.6.3.4]~~

~~**8.7.3.5**—If a connecting plug is required, it shall be sized in relation to the system and conform to NEMA configurations for plugs. [1901:22.6.3.5]~~

## ~~**8.8 Transfer Switch Applications.**~~

~~**8.8.1**—A transfer switch shall be required to isolate one power source from the other where a circuit(s) is intended to be supplied from more than one power source. [1901:22.7.2.1]~~

~~**8.8.2**—Transfer equipment, including transfer switches, shall operate such that all ungrounded conductors of one power source are disconnected before any ungrounded conductors of the second power source are connected. [1901:22.7.2.2]~~

~~**8.8.3**—The neutral conductor shall be switched through the transfer switch. [1901:22.7.2.3]~~

## ~~**8.9 Power Supply Assembly.**~~

~~**8.9.1**—The conductors used in the power supply assembly between the output terminals of the power source and the main overcurrent protection device shall not exceed 12 ft (4 m) in length. [1901:22.8.1]~~

~~**8.9.2**—All power supply assembly conductors, including neutral and grounding conductors, shall have an equivalent amperage rating and shall be sized to carry not less than 115 percent of the amperage of the nameplate current rating of the power source. [1901:22.8.2]~~

~~**8.9.3\*** If the power supply assembly connects to the vibrating part of a generator (not a connection on the base), the conductors shall be flexible cord or other fine-stranded~~

conductors enclosed in metallic or nonmetallic liquidtight flexible conduit rated for wet locations and temperatures not less than 194°F (90°C). [1901:22.8.3]

**8.10 Overcurrent Protection.** Manually resettable overcurrent devices shall be installed to protect the line voltage electrical system components. [1901:22.9]

**8.10.1 Power Source Protection.** A main overcurrent protection device shall be provided that is either incorporated in the power source or connected to the power source by a power supply assembly. [1901:22.9.1]

**8.10.1.1**—The size of the main overcurrent protection device shall not exceed 100 percent of the rated amperage stated on the power source specification label or the rating of the next larger available size overcurrent protection device, where so recommended by the power source manufacturer. [1901:22.9.1.1]

**8.10.1.2**—If the main overcurrent protection device is subject to road spray, the unit shall be housed in a Type 4-rated enclosure. [1901:22.9.1.2]

**8.10.2 Branch Circuit Overcurrent Protection.** Overcurrent protection devices shall be provided for each individual circuit and shall be sized at not less than 15 amperes in accordance with 240.4, “Protection of Conductors,” of *NFPA 70*. [1901:22.9.2]

**8.10.2.1**—Any panelboard shall have a main breaker where the panel has six or more individual branch circuits or the power source is rated 8 kW or larger. [1901:22.9.2.1]

**8.10.2.2**—Each overcurrent protection device shall be marked with a label to identify the function of the circuit it protects. [1901:22.9.2.2]

**8.10.2.3**—Dedicated circuits shall be provided for any large appliance or device that requires 60 percent or more of the rated capacity of the circuit to which it is connected, and that circuit shall serve no other purpose. [1901:22.9.2.3]

**8.10.3 Panelboards.** All fixed power sources shall be hardwired to a permanently mounted panelboard unless one of the following conditions exists:

- (1) All line voltage power connections are made through receptacles on the power source, and the receptacles are protected by integrated overcurrent devices.
- (2) Only one circuit is hardwired to the power source, which is protected by an integrated overcurrent device.

[1901:22.9.3]

**8.10.3.1**—The panel shall be visible and located so that there is unimpeded access to the panelboard controls. [1901:22.9.3.1]

**8.10.3.2**—All panelboards shall be designed for use in their intended location. [1901:22.9.3.2]

**8.10.3.3**—The panel(s) shall be protected from mechanical damage, tool mounting, and equipment storage. [1901:22.9.3.3]

~~**8.10.3.4\*** Where the power source is 120/240 volts, and 120-volt loads are connected, the ambulance manufacturer or line voltage system installer shall consider load balancing to the extent that it is possible.~~

**Substantiation:** It is extremely rare for an ambulance to be equipped with a generator larger than 8kW. Inclusion of this large section of text for an application that is inapplicable to ambulances cannot be justified as part of an ambulance standard.