

# Ambulance Vehicle Standards Code January 2010

Alberta Health and Wellness

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of Alberta 

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# Ambulance Vehicle Standards Code January 2010

## Alberta Health and Wellness

### PART 1

Part 1 of this Code contains the minimum ambulance vehicle standards and is intended to be used in conjunction with the Testing Standards in Part 2.

#### **1 Definitions**

- 1.1 "CMVSS" means Canadian Motor Vehicle Safety Standards
- 1.2 "CSA" means the Canadian Standards Association
- 1.3 "C-UL" means a certification provided by the Underwriters' Laboratories of Canada
- 1.4 "HVAC" means Heat, Ventilation and Air Conditioning
- 1.5 "OEM" means Original Equipment Manufacturer, that is the manufacturer of the ambulance chassis
- 1.6 "SAE Standard" means a standard set out by the Society of Automotive Engineers for the construction and testing of automotive components
- 1.7 "Testing Standard" means a Testing Standard as set out in section 17 of this Code.
- 1.8 "Type I ambulance" means a conventional truck cab and chassis with a remountable modular body that contains the patient compartment
- 1.9 "Type II ambulance" means a standard van with integral cab and body with the patient compartment contained within the body and a raised roof over the patient compartment
- 1.10 "Type III ambulance" means a cutaway van cab and chassis with a remountable modular body that contains the patient compartment.

#### **2 General Requirements**

##### **2.1 Compliance**

- 2.1.1 An ambulance shall comply with the following, listed in order of precedence:
  - (a) Canadian Motor Vehicle Safety Standards (CMVSS);
  - (b) Ambulance Vehicle Standards Code January 2010 as published by Alberta Health and Wellness;
  - (c) any criteria established by the OEM for the conversion of chassis to ambulances or emergency vehicles; and
  - (d) any relevant standards and recommended practices of technical agencies and bodies referred to in this Code.

##### **2.2 Versioning**

- 2.2.1 The documents referenced in 2.1.1 shall be the version of those documents that was in effect no earlier than when the motor vehicle chassis was manufactured and no later than when the vehicle was completed as an ambulance.

#### **3 Construction and Design Details**

##### **3.1 Interior Safety**

- 3.1.1 To the greatest extent possible, the interior walls and ceiling of the ambulance shall present a simple plane surface.
- 3.1.2 The interior of the patient and driver compartments shall be free of all sharp projections.
- 3.1.3 All hangers or supports for equipment, lighting, controls and other devices shall be mounted as flush as possible with the surrounding surface.

3.1.4 All exposed edges and corners without padding shall be rounded with the largest possible radius or chamfer. At minimum, there shall be a 15 mm radius or a 3 mm chamfer.

### **3.2 Bolsters**

3.2.1 Bolsters (padded cushions) shall be provided at all locations which may prove dangerous to persons moving about or seated within the ambulance, or entering and leaving the ambulance.

3.2.2 At minimum, bolsters will be installed as follows:

- (a) across the full width of the interior top sill of each door opening in the patient compartment;
- (b) adjacent to each seating position;
- (c) on the bulkhead immediately above and behind the driver and front passenger seats; and
- (d) as required to protect the elbow, shoulder and head of an attendant in the rear-facing attendant seat next to the action wall.

### **3.3 Polycarbonate Window Glazing**

3.3.1 Windows in medical supply cabinet doors and the bulkhead door (see 5.5.5) or communication window (see 5.5.6) shall be made of transparent polycarbonate and bear a permanent identifying mark that certifies compliance with Transport Canada Regulations for motor vehicle glazing.

### **3.4 Equipment Retention**

3.4.1 The interior of an ambulance shall have readily accessible space for the storing and securing of all equipment and supplies.

3.4.2 Medical supply cabinets that are equipped with hinged door frames, and all other spaces where equipment and supplies may be stored, must be fitted with restraint devices that meet the requirements in Testing Standard 17.12.

### **3.5 Cabinet Construction and Fastenings**

3.5.1 All interior cabinets shall be constructed of metal or lightweight materials with a metal framework, and be attached to the body of the ambulance in compliance with 3.5.2.

3.5.2 Using machine screws or bolts, all cabinets, benches, bulkheads and partitions shall be securely attached to metal tapping plates and/or framing that is welded to the body structure.

3.5.3 All cabinetry structures shall meet the requirements in Testing Standard 17.11.

### **3.6 Interior Finishes**

3.6.1 The finish of all interior surfaces, other than those installed by the OEM, shall be impervious to soap and water, disinfectants and mildew.

3.6.2 All surfaces, edges, corners and joints that can be exposed to any fluid shall be sealed by a waterproof bonding material.

3.6.3 All entry steps shall be covered with heavy-duty ribbed rubber matting or other anti-skid material.

3.6.4 The patient compartment floor covering shall provide a static friction coefficient equal to or greater than 0.8 under dry conditions.

### **3.7 Pressure Vessel Retention**

- 3.7.1 Mounts and brackets that restrain pressure vessels, including all oxygen tank holders, fire extinguisher brackets and mounts for tanks containing other pressurized gasses, must meet the requirements in Testing Standard 17.4.
- 3.7.2 In addition, a holder that is used to restrain a pressure vessel in a horizontal position must:
- (a) prevent the cylinder from moving;
  - (b) put the bottom of the cylinder in direct contact with the holder;
  - (c) be strong enough to prevent the cylinder from passing through it in case of an uncontrolled venting of the cylinder contents; and
  - (d) protect the cylinder against scoring during insertion into and removal from the holder.

### **3.8 Vehicle Weight**

- 3.8.1 An ambulance shall be weighed in accordance with the requirements in Testing Standards 17.18 and 17.19 and be certified as meeting the weight distribution, payload allowance and centre of gravity standards.
- 3.8.2 When applying for a Unit Number for an ambulance, the ambulance operator shall supply the Registrar with documentation, provided by the manufacturer, certifying compliance with 3.8.1.

### **3.9 Loading Height**

- 3.9.1 The maximum height from the ground to the rear door sill shall be:
- (a) on a 2-wheel drive ambulance, 840 mm, or
  - (b) on a 4-wheel drive ambulance, 970 mm.
- 3.9.2 The use of an automotive “dump valve” on air suspension vehicles may be used to achieve the loading height requirement. The system shall include an interlock that only permits vehicle lowering when the transmission is in ‘NEUTRAL’ or ‘PARK’ and the parking brake is set.

### **3.10 Bumper and Steps**

- 3.10.1 Patient Compartment Side Door Step
- (a) The side entrance to the patient compartment shall include a stepping surface that is at least 200 mm deep from edge to riser.
  - (b) The step shall be positioned approximately halfway between the ground and the finished floor of the ambulance, or a second fixed or retractable step must be provided.
- 3.10.2 Rear Step Bumper
- (a) A step bumper shall be located at the rear doors of the ambulance.
  - (b) The rear step shall be positioned so that the stepping surface is approximately halfway between the ground and the finished floor of the ambulance.
  - (c) The position of the rear step shall not reduce the angle of departure to less than 10 degrees, or from that provided by an OEM bumper, as measured in accordance with SAE Standard J689.
  - (d) A safety grating step shall run the width of the rear door opening, be at least 240 mm deep and pivot to permit ambulance attendants to move closer when loading and unloading a cot.
- 3.10.3 The rear bumper, rear step and any step at the curbside or cab entrances, whether fixed or retractable, must meet the requirements in Testing Standard 17.14.



## **4 Chassis Requirements**

### **4.1 Chassis Modifications**

4.1.1 Any modifications or additions to the OEM chassis must be completed using approved OEM practices and all modified equipment must meet or exceed OEM performance characteristics.

### **4.2 Metric Speedometer and Odometer**

4.2.1 An ambulance shall have a speedometer and odometer that indicate speed and distance in kilometres.

### **4.3 Automatic Engine High-Idle Speed Control**

4.3.1 An ambulance shall have an engine high-idle speed control that increases the engine speed to sustain the ambulance's total continuous electrical load, and maximum heating/air conditioning output.

4.3.2 The device shall normally be 'ON' and have safety controls built in so that it may not be activated unless the transmission is in 'PARK' and the parking brake is engaged.

4.3.3 The device shall be preset so that it engages automatically whenever the safety controls are operational and the voltage of the OEM battery or the conversion battery falls below 12.5 volts.

4.3.4 The device shall disengage automatically when the operator depresses the service brake pedal, moves the transmission from 'PARK' or releases the parking brake.

### **4.4 Backup Alarm**

4.4.1 An ambulance shall be equipped with an alarm that sounds whenever the vehicle is in 'REVERSE' gear.

4.4.2 The backup alarm shall be sufficiently loud so as to be audible over the sound of the engine when the engine high-idle speed control is engaged.

4.4.3 Despite 4.4.1, the alarm may be overridden by means of a momentary switch on the driver's switch console provided that the alarm has an automatic reset feature that is activated each time the gearshift is moved from 'REVERSE'.

### **4.5 Curb Clearance**

4.5.1 Curb clearance, approach, departure and breakover angles shall meet or exceed the standards set out in SAE Standard J689.

4.5.2 For a Type II ambulance, replacing the OEM bumper with a step bumper shall not cause a reduction in the rear curb clearance or departure angle from the original condition as measured under SAE Standard J689.

4.5.3 For a Type I or Type III ambulance, the rear curb clearance shall be a minimum of 250 mm as measured under SAE Standard J689.

### **4.6 Tailpipe Termination**

4.6.1 The tailpipe on an ambulance shall terminate at, or no more than, 100 mm beyond the body perimeter and behind the rear wheels on the right side.

4.6.2 Despite 4.6.1, if an ambulance is equipped with an aftermarket rear suspension, the tailpipe may be rerouted to terminate ahead of the right rear wheel provided that:

- (a) the vehicle is powered by a diesel engine,
- (b) the aftermarket suspension has been installed in accordance with the manufacturer's instructions and any OEM guidelines,
- (c) there is insufficient room between the suspension components to maintain required clearances for the tailpipe, and

- (d) installation of heat shields is not advisable due to movement of the body relative to the rear axle when air in an air suspension system is exhausted to lower the loading height.

## **5 Driver's Cab**

### **5.1 General**

- 5.1.1 In the construction of the ambulance conversion, the seat travel of each of the driver and passenger seats shall not be reduced from that provided by the OEM.
- 5.1.2 In order to prevent any engine emissions from entering the interior of the ambulance, no equipment or fixtures are to be mounted on the engine cowl, unless fasteners and methods of securing that are specifically designed to prevent this problem are used. Any mounting on the cowl shall be done without damaging the integrity of the cowl insulation or heat shield.
- 5.1.3 Floor covering in the cab shall be rubber matting as supplied by the OEM, or equivalent.

### **5.2 Equipment Installation**

- 5.2.1 Equipment installed in the cab shall be located and mounted in such a way that it shall not interfere with the operation of the driver side and/or passenger side air bag(s), if the vehicle is so equipped.
- 5.2.2 Nothing mounted in the cab by the ambulance conversion manufacturer or any other person may be positioned so it blocks, or may block, the driver's full view of the windshield or passenger-side rear-view mirror or window.

### **5.3 Driver's Console**

- 5.3.1 Switches to control the emergency warning lights, siren, scene lights and other ambulance functions shall be mounted in a central switch console located in the cab.
- 5.3.2 Design and location of the console and the placement of the switches shall favor the driver as primary user but allow access to control functions from the passenger seat.
- 5.3.3 An illuminated voltmeter that monitors the condition of both the OEM and conversion batteries shall be provided. The gauge function shall be clearly labeled.
- 5.3.4 An illuminated ammeter that indicates the charge being supplied by the generating system shall be provided. The gauge function shall be clearly labeled.
- 5.3.5 The top of the switch panel shall not be positioned more than 30 mm above the top of the dashboard.

### **5.4 Door Open Warning**

- 5.4.1 One or more red 'DOOR OPEN' warning lights shall be located in a location clearly visible to the driver.
- 5.4.2 The warning light(s) shall flash whenever a door to the patient compartment or an exterior storage compartment is open and may only be overridden by the ambulance conversion master power switch or the ignition switch.
- 5.4.3 If a 'DOOR OPEN' warning light is located on the driver's switch console, the lens shall be at least 15 mm in diameter.
- 5.4.4 If a 'DOOR OPEN' warning light is located in the headliner above the rear-view mirror, the lens shall be at least 50 mm in diameter.
- 5.4.5 Electronic displays that are visible in all ambient light, and that project narrative information, may be used in lieu of discrete, coloured indicator/warning lights, provided the projected message is at least as visible as the basic required warning light and complies with CMVSS 101 for displays.

## **5.5 Bulkhead Partition**

- 5.5.1 The cab and patient compartment shall be separated by bulkhead partitions, secured to tapping plates by welding or bolting, in compliance with 3.5.2.
- 5.5.2 The bulkheads shall incorporate a passageway to allow movement between the cab and the passenger compartment.
- 5.5.3 The floor of the passageway shall include a sealed fluid barrier, not less than 12 mm high.
- 5.5.4 A hinged or sliding door that is lockable from the driver's side shall separate the cab from the patient compartment.
- 5.5.5 The door shall have a transparent, polycarbonate window of at least 250 mm x 250 mm.
- 5.5.6 Despite 5.5.2, a Type I ambulance may be constructed without a passageway so long as it has a sliding communication window of at least 900 cm<sup>2</sup>. The transparent, polycarbonate window shall be latchable from the driver's side.

## **6 Modular Body**

### **6.1 Construction**

- 6.1.1 Modular bodies shall be constructed of aluminum and shall be of all-welded construction.
- 6.1.2 Construction methods shall prevent electrolytic action between dissimilar metals and materials.
- 6.1.3 Despite 6.1.1, the Registrar may approve other construction materials and methods.
- 6.1.4 The body shall be mounted to the chassis with high-strength fasteners and vibration-isolating rubber body mounts designed and installed in accordance with the chassis manufacturer's guidelines.
- 6.1.5 Modular bodies shall not be welded to the frame at any point.

### **6.2 Certifications**

- 6.2.1 A modular body structure must meet the requirements in Testing Standard 17.2.
- 6.2.2 Door hardware must meet the requirements in Testing Standard 17.3.

## **7 Patient Compartment**

### **7.1 Patient Compartment Dimensions**

- 7.1.1 The patient compartment of an ambulance must have the following:
  - (a) at least 1600 mm between the finished floor and the ceiling;
  - (b) not less than 3000 mm between the bulkhead partition immediately behind the driver's seat and the inside of the rear doors;
  - (c) not less than 680 mm between the backrest of the rear-facing attendant's seat and the forward edge of the main cot;
  - (d) not less than 250 mm between the rear edge of the main cot mattress and the inside of the rear doors; and
  - (e) a clear aisle of not less than 250 mm in width between the main cot and the face of the squad bench or the second cot. The aisle shall not be reduced by more than 40 mm by any cantilever of a squad bench seat.
- 7.1.2 If a side-facing CPR seat is installed in the street side cabinetry, there must be a clear aisle of not less than 200 mm from the face of the cabinet wall to the main cot, and it shall not reduce the distance required in 7.1.1(e).

## **7.2 Patient Transport Configuration**

- 7.2.1 Type I and III ambulances may have accommodation and storage arrangements for either one or two patients on multi-level cots.
- 7.2.2 Type II ambulances shall have accommodation and storage arrangements for one patient on a multi-level cot.

## **7.3 Patient Compartment Doors**

- 7.3.1 Entry doors to the patient compartment of an ambulance must be located on the curbside and at the rear.
- 7.3.2 Locks and release handles on the doors shall allow the doors to be locked or opened from inside the patient compartment without using a key.
- 7.3.3 The curbside door opening shall be of sufficient size to accommodate the emergency removal of patients on both cots.
- 7.3.4 Each door shall have suitable hold-open devices for the type and size of door and door stops to prevent damage to the sides of the ambulance body.
- 7.3.5 Each door shall have effective seals to prevent water leakage or carbon monoxide intrusion and to reduce siren and road noise intrusion.
- 7.3.6 A window of the maximum practical size shall be installed in each door.
- 7.3.7 The rear doors shall have fixed windows.
- 7.3.8 If the window in the curbside door is vented, it shall be equipped with a screen and be lockable.

## **7.4 Patient Compartment Seating**

- 7.4.1 A rear-facing bucket seat with a minimum 3-point restraint system and an integral child safety seat shall be installed immediately in front of the forward edge of the main cot;
- 7.4.2 In a single cot configuration, at least one additional seating position shall be located on the curbside.
- 7.4.3 In a dual cot configuration, a flip-down squad seat shall be installed over the curbside cot.
- 7.4.4 The height of the squad seat above the floor shall be the minimum required to accommodate the cot, complete with mattress and linen, below the lowered seat.

## **7.5 Auxiliary Seating (dual cot ambulance)**

- 7.5.1 In a dual cot ambulance, a flip-up rear facing seat shall be permanently mounted adjacent to the side entry door at the front of the patient compartment.
- 7.5.2 The auxiliary seat shall be equipped with seat, back and headrest cushions. When unoccupied, the seat shall flip up automatically.

## **7.6 Squad Bench Lid**

- 7.6.1 If the ambulance patient compartment is equipped with a squad bench, the bench lid shall have a latch to keep it closed and a device to support the lid in an open position.
- 7.6.2 The latch shall meet the requirements in Testing Standard 17.12.

## **7.7 Securing of Cots**

- 7.7.1 A cot retention system, approved for use with the cot being secured, shall be installed for each multi-level cot position.
- 7.7.2 Cot retention systems shall meet the requirements in Testing Standard 17.5.

## **7.8 Action Wall – Medical Control Centre**

- 7.8.1 The action wall area shall be located near the front of the left wall of the patient compartment.
- 7.8.2 The action wall area shall provide a work surface for the attendant seated in the rear-facing attendant seat. It shall incorporate the main oxygen outlet and controls; the suction outlet and controls; a thermostat for the HVAC system; and a reading light.
- 7.8.3 The work surface shall have a raised lip or a recess.

## **7.9 Patient Compartment Switch Panel**

- 7.9.1 Switches to control the patient compartment lights, heating, air conditioning, suction and other patient compartment functions shall be mounted on a switch panel located on the action wall.
- 7.9.2 In addition to the requirement in 7.9.1, these functions may also be controlled from secondary locations in the ambulance.

## **7.10 Interior Lighting**

- 7.10.1 The patient compartment shall have lighting that meets the requirements in Testing Standard 17.9.
- 7.10.2 Patient compartment lighting shall have variable intensity capabilities.

## **7.11 Door-activated Switches**

- 7.11.1 The patient compartment side and rear entrance doors shall be fitted with a switch that operates some interior patient compartment lights for general illumination when the door is open.
- 7.11.2 The rear entrance door shall be fitted with a switch that operates the rear loading lights when the door is open.

# **8 Low-voltage Electrical System**

## **8.1 General**

- 8.1.1 The ambulance conversion and accessory electrical equipment wiring must be served by circuits distinct from the vehicle chassis circuits and controlled by a “master power” switch.
- 8.1.2 If the ambulance conversion circuits include an automatic timer shut-off that is activated after engine shutdown, there shall be an override feature that allows the conversion circuits to be re-energized without the engine being started.
- 8.1.3 Electrical panels located in compartments where equipment may be stored shall have a protective cover.
- 8.1.4 The generating system shall meet the requirements in Testing Standard 17.17, and a certification tag must be affixed to the ambulance.

## **8.2 Batteries**

- 8.2.1 Each battery shall be located in a ventilated area, sealed off from the occupant and oxygen compartments.
- 8.2.2 Despite 8.2.1, a sealed gel-cell (marine type) battery may be stored in an isolated, protected area within an occupant compartment.
- 8.2.3 In addition to the OEM chassis battery or batteries, the ambulance conversion’s electrical system shall include a dedicated battery or batteries that are electrically separated from the OEM battery. To accomplish this, the electrical system may include a battery isolator and a switching device to select the batteries, either simultaneously or independently, if power for the ambulance conversion is routed directly from the generating system, through the isolator, to the load.

### **8.3 Fuses and Circuit Breakers**

8.3.1 All circuits shall be protected by means of fuses or circuit breakers properly sized for the intended load.

### **8.4 Remote Switching**

8.4.1 Any device subject to a load of 25 amps or greater shall be switched remotely by solid state electronic devices or relays.

### **8.5 Electrical Load Rating**

8.5.1 All electrical wiring, switches, outlets, and devices, except circuit breakers and fuses, shall be rated to carry at least 125% of the maximum ampere load for which the circuit is protected.

### **8.6 Wiring**

8.6.1 All electrical wiring shall be copper, with CSA/C-UL approved insulation.

8.6.2 Any variation from 8.6.1 must be approved by the Registrar prior to being installed.

8.6.3 Wiring shall be:

- (a) located in accessible, enclosed and protected locations,
- (b) routed in conduit or high-temperature looms rated at not less than 149°C, and
- (c) protected by grommets where it passes through apertures on the ambulance body.

8.6.4 Wiring must not pass across the floor of the driver compartment, nor under the floor mats or metal trim strips unless protected within a solid channel made of corrosion resistant material.

### **8.7 Power Inverter, 110 Volt**

8.7.1 An ambulance shall be equipped with a 1000 watt inverter to supply 110 volt AC power with sine wave output.

8.7.2 Wiring from the inverter to all 110 volt AC outlets shall be in accordance with the manufacturer's instructions.

## **9 Exterior Lighting Systems**

### **9.1 Emergency Warning Lights, General Requirements**

9.1.1 Every ambulance shall have an emergency warning light system that uses flashing lights and/or rotating beacons, and is comprised of components and devices that comply with the requirements of SAE Standards J575, J576, J578, J591, J595, J1318 and J1889, as applicable to the unit.

9.1.2 The emergency warning light system shall meet the requirements in Testing Standard 17.6.

### **9.2 Forward Roof-level Warning Lights**

9.2.1 A minimum of 2 red flashing or rotating lights and maximum of 1 white flashing or rotating light shall be installed above the level of the windshield on the front of the modular ambulance body or the raised roof.

9.2.2 The white light shall be located toward the vehicle centreline and powered by the 'PRIMARY' emergency warning switch.

9.2.3 The white light shall be wired such that it may be shut off in the event that weather conditions, such as fog or snow, make it advisable.

### **9.3 Side and Rear Roof-level Warning Lights**

- 9.3.1 A minimum of 2 red flashing or rotating lights shall be installed on each side of the modular ambulance body or raised roof, located as close as practicable to the upper corners.
- 9.3.2 A minimum of 2 red flashing or rotating lights shall be installed on the rear of the modular ambulance body or raised roof, located as close as practicable to the upper corners.
- 9.3.3 At least 2 of the emergency warning lights, required in 9.3.2 and meeting the performance criteria in 9.1, shall be visible at a distance of 20 meters behind the ambulance when the loading doors are open.

### **9.4 Grille Lights**

- 9.4.1 Red warning lights shall be installed on the vertical plane of the grille such that the location is in compliance with OEM guidelines regarding air flow through the grille.
- 9.4.2 The grille lights shall consist of 2 flashing red lights located at least 750 mm above the ground and below the bottom edge of the windshield, and separated laterally by at least 450 mm, measured from centreline to centreline of each lamp.

### **9.5 Intersection Warning Lights**

- 9.5.1 An emergency warning light shall be installed as close as practicable to the forward edge of each front fender. The light shall be red, or a combination of red and white.
- 9.5.2 If a red and white light is installed, it shall be wired to flash in an alternating pattern.

### **9.6 Emergency Light Switching**

- 9.6.1 The Primary Emergency Lighting system shall be wired to operate independently of all other warning lights.
- 9.6.2 There shall be a single switch, marked 'PRIMARY/SECONDARY', on the driver's console to control all emergency warning lights in either a primary (emergency response) or secondary (vehicle stopped in the roadway) mode.
- 9.6.3 This switch may activate the warning lights directly or, based on power management principles, may activate a sequencing device.
- 9.6.4 If a sequencing device is installed, there shall not be individual switches to control any of the emergency lighting required in 9.2 to 9.5.
- 9.6.5 An additional switch shall be installed to cut power to the white forward-facing emergency light as required in 9.2.3.
- 9.6.6 Despite 9.6.2, if strobe lights are installed on an ambulance and they are not emergency warning lights required in 9.2 to 9.5, they may be controlled by a separate switch.

### **9.7 Flash Patterns**

- 9.7.1 The primary flash pattern shall include:
  - (a) forward, roof-level warning lights;
  - (b) side, roof-level warning lights;
  - (c) rear, roof-level warning lights;
  - (d) grille lights; and
  - (e) intersection lights.
- 9.7.2 The secondary flash pattern shall, at a minimum, include:
  - (a) 2 forward, roof-level red warning lights; and
  - (b) all rear, roof-level red warning lights.

## **9.8 Wigwags**

- 9.8.1 An ambulance may be equipped with wigwag warning lights consisting of 2 white lights that flash in an alternating or random sequence.
- 9.8.2 Wigwags may
  - (a) utilize the high beam filament of the headlights when permitted by the OEM; or
  - (b) be separate fixtures, mounted on the grille and separated horizontally from the red grille warning lights by at least 60 mm.
- 9.8.3 Wigwags shall be wired to operate independently from all other warning lights and shall be controlled by a separate switch on the driver's console.

## **9.9 Exterior Task Lighting/Scene Lights**

- 9.9.1 A minimum of 2 white floodlights shall be installed on each side of the ambulance.
- 9.9.2 A minimum of 1 white floodlight, unobstructed when the rear doors are open, shall be located on the rear plane of the vehicle.
- 9.9.3 The floodlights shall be installed at least 1800 mm from the ground, angled downward 12 to 15 degrees by means of mounting or lens type, and be installed so as to protrude minimally beyond the outer skin of the ambulance body.
- 9.9.4 Switches on the driver's control console shall control the left, right and rear-facing task lights individually. This mode of control will take precedence over any other modes described elsewhere in this Code.
- 9.9.5 The rear-facing task lighting shall operate automatically when the vehicle transmission is placed in 'REVERSE'.
- 9.9.6 Minimum task light output shall meet the requirements in Testing Standard 17.7.

## **10 Audible Emergency Warning (Siren)**

- 10.1.1 An ambulance shall be equipped with an audible emergency warning device that meets the requirements in Testing Standard 17.8.
- 10.1.2 If the siren control is located above the upper level of the dash, it shall be wired to enable remote operation by activating the OEM horn ring.
- 10.1.3 The siren speakers shall be mounted on the forward vertical plane of the vehicle in the grille or on the bumper or below the bumper.

## **11 Oxygen System**

- 11.1.1 An ambulance shall be equipped with a piped medical oxygen system installed in the patient compartment. The system shall include the following minimum components:
  - (a) a medical oxygen cylinder having at least a 2000-litre capacity that is fitted with a pressure-reducing regulator complete with a contents gauge and preset to 344.5 kilopascals;
  - (b) non-ferrous piping or low pressure, electrically-conductive, medical grade hose;
  - (c) not fewer than 2 self-sealing wall outlets that have gas-specific threaded connectors; and
  - (d) a pressure-compensated flow meter for each wall outlet that is being used to administer oxygen to a patient.
- 11.1.2 The oxygen system must meet the requirements in Testing Standard 17.20.

## **12 Fixed Suction System**

- 12.1.1 An ambulance shall be equipped with a fixed suction system, installed in the patient compartment.
- 12.1.2 The suction system must meet the requirements in Testing Standard 17.21.



## **13 Safety Equipment**

### **13.1 Passenger Restraint**

13.1.1 All seating positions in an ambulance shall have a seat belt that complies with CMVSS.

### **13.2 Grab Rail / Grab Handles**

13.2.1 A grab rail shall be mounted on the ceiling of the patient compartment and span the length of the area above the main cot position.

13.2.2 Grab handles shall be mounted immediately inside each entrance to the patient compartment so as to assist entry.

13.2.3 Grab handles may be mounted on the inside of entrance doors to assist in closing the doors.

13.2.4 Fasteners for all grab rails and handles must be securely mounted into metal tapping plates and/or framing welded to the body structure.

13.2.5 Grab rails and handles must meet the requirements in Testing Standard 17.13.

### **13.3 Occupant Restraint Net**

13.3.1 The patient compartment must have an occupant restraint net positioned between the forward bulkhead and any side-facing seat on the curbside of the patient compartment.

13.3.2 A restraint net shall be located no more than 100 mm from the forward edge of the seat cushion.

13.3.3 A restraint net must be at least 500 mm wide and constructed of cargo webbing or an equivalent material that can be cleaned easily.

13.3.4 A restraint net must be attached to at least 2 points, at least 400 mm apart, located on or near the ceiling and to 2 points, at least 300 mm apart, located on or near the floor using low-profile, quick-release fasteners that allow the net to be easily removed.

13.3.5 Despite 13.3.1, a restraint net is not required if there is a separate seat in the patient compartment, provided in place of a squad bench or other seat, and that separate seat:

(a) is equipped with a 3 or 5-point restraint harness; and

(b) can be oriented to face forward during travel.

13.3.6 A restraint net must meet the requirements in Testing Standard 17.10.

### **13.4 Miscellaneous Safety Equipment and Signs**

13.4.1 "NO SMOKING" and "Buckle Up" signs shall be posted in and clearly visible within the driver's cab and patient compartment.

13.4.2 A puncture-proof sharps container for discarded needles and scalpels shall be installed securely within the patient compartment of the vehicle.

## **14 Environmental Control System**

14.1.1 A climate control system that consists of heating, ventilation and air conditioning components shall be installed in the patient compartment.

14.1.2 This climate control system shall be independent of the cab's climate control system and have controls that are easily accessible to the attendant.

14.1.3 A thermostat system shall automatically control the heating and cooling functions so that the temperature in the patient compartment is maintained within +/- 2°C of the set temperature.

14.1.4 The motors used to exhaust or intake air for air exchange shall comply with C-UL requirements for spark protection (marine).

- 14.1.5 If an auxiliary interior heater is used in an ambulance to maintain the interior temperature above 10°C, the interior heater must be permanently installed in a protective metal box mounted within a cabinet in the patient compartment and be equipped with a thermostat.
- 14.1.6 If the auxiliary heater is powered by 120 volt AC, it must be permanently and directly wired through a ground-fault interrupt breaker to a shoreline connection located on the exterior of the ambulance and have an automatically resetting high-temperature cutout switch.
- 14.1.7 The climate control system must meet the requirements in Testing Standard 17.15.

## **15 Two-way Communication**

- 15.1.1 An ambulance shall have a communication system that allows for all required communication between the ambulance attendants, dispatch and medical direction.

## **16 Exterior Colour, Graphics and Identification Signage**

### **16.1 General**

- 16.1.1 The base colour of the exterior of an ambulance shall be white.
- 16.1.2 Identity signage, including “AMBULANCE” decals, Star of Life and Unit Numbers shall be made of reflective blue material having a minimum coefficient of retroreflection of 35.
- 16.1.3 Signage required in 16.1.2 shall be installed on a solid white background and have a surrounding white border at least 20 mm wide.
- 16.1.4 A maximum of 40% of each of the exterior sides and forward-facing plane, and 100% of the roof of the unit may be used for operator-specific branding.
- 16.1.5 No graphics other than those described below shall be placed on the rear of the ambulance unless approved by the Registrar.
- 16.1.6 Exterior graphics packages must be approved by the Registrar prior to an ambulance receiving its Unit Number.

### **16.2 “AMBULANCE” Decals**

- 16.2.1 An “AMBULANCE” decal, in letters at least 150 mm high and using a bold font shall be installed below the windows on the rear doors.
- 16.2.2 A mirror image “AMBULANCE” decal, in letters at least 100 mm high and using a bold font, shall be installed on the front of the ambulance.
- 16.2.3 The decal required in 16.2.2 shall be located below the bottom of the windshield, above the headlights, and be oriented not less than 60 degrees from horizontal.

### **16.3 Star of Life Decals**

- 16.3.1 One Star of Life decal, with a diameter of at least 300 mm and not more than 500 mm, shall be installed on each side of the ambulance body.
- 16.3.2 A Star of Life decal shall not be interrupted by, incorporated into or partially covered by any other graphics.
- 16.3.3 A Star of Life decal shall be located no further forward than the rear edge of the cab doors.

## 16.4 Conspicuity Stripes

- 16.4.1 Two horizontal, reflective, yellow stripes, having a minimum coefficient of retroreflection of 300, shall run the full length of each side of the ambulance as follows:
- (a) one stripe, at least 100 mm wide, shall be positioned so that the bottom of the stripe is at least 150 mm above the lowest part of the body and the top of the stripe is not above the bottom of the cab windows; and
  - (b) one stripe, at least 50 mm wide, shall be positioned immediately above or below the drip rail.
- 16.4.2 The stripe required in 16.4.1(a) may be interrupted by the wheel wells.
- 16.4.3 The stripe required in 16.4.1(b) may be interrupted by emergency or task lights but shall not be interrupted or covered by any other graphics.
- 16.4.4 Four reflective white stripes, at least 50 mm wide and having a minimum coefficient of retroreflection of 450, shall run vertically between the horizontal yellow stripes on the left and right sides of the ambulance body as follows:
- (a) one stripe shall be positioned immediately behind each of the cab doors;
  - (b) one stripe shall be positioned adjacent to each rear corner; and
  - (c) the stripes may not be interrupted or covered by any other graphics.

## 16.5 Chevrons

- 16.5.1 A two-colour, retroreflective chevron pattern shall be installed on the rear plane of the ambulance.
- 16.5.2 The chevron pattern shall:
- (a) be positioned as high as practicable, but in no case shall it be above a horizontal line drawn across the top of the rear entry doors; and
  - (b) cover at least 50% and, when including the area required for the "AMBULANCE" decal, not more than 60% of the total rear surface area as measured between horizontal lines across the top and bottom of the rear entry doors.
- 16.5.3 The chevron stripes, which may be separated by white spaces not more than 12 mm wide, shall
- (a) incorporate the same yellow as used in 16.4.1 as one of its colours;
  - (b) be upward-pointing at a 45 degree angle toward the centreline of the ambulance body; and
  - (c) be no more than 150 mm wide.

## 16.6 Unit Number

- 16.6.1 An ambulance shall have a Unit Number displayed in 3 locations on the ambulance body exterior:
- (a) in the upper rear corner on each side; and
  - (b) in the upper left corner on the rear plane of the body; or
  - (c) in any other appropriate area approved by the Registrar.
- 16.6.2 The characters shall be 100 mm in height using bold font lettering.

## **PART 2**

### **17 TESTING STANDARDS**

This section sets out the testing requirements and procedures that must be followed to demonstrate compliance with the minimum ambulance vehicle standards set out in Part 1 of this Code.

#### **17.1 Obligation of Ambulance Conversion Manufacturer**

##### **17.1.1 Type Certifications**

- (a) For each model of ambulance sold in Alberta, the manufacturer will provide the Registrar with test results, pictures and any other documentation the Registrar may require.
- (b) A registered professional engineer shall certify that all testing is done in accordance with the Testing Standards set out in this Code and that the test results demonstrate compliance with this Code.

##### **17.1.2 Individual Certifications**

- (a) The manufacturer will test the specified components in each ambulance sold in Alberta to confirm compliance with the Testing Standards set out in this Code.
- (b) The manufacturer shall provide documentation as required in this section to demonstrate compliance.

##### **17.1.3 Special Certifications**

- (a) If the Registrar has grounds to believe that an ambulance does not meet all the standards set out in this Code when an ambulance operator applies for a Unit Number, the Registrar may require the manufacturer to provide further test results, pictures, a registered professional engineer's certification and/or any other documentation to demonstrate compliance with the Testing Standards set out in this Code.

#### **17.2 Ambulance Body Structure Static Load Test – Type Certification**

##### **17.2.1 Scope**

- (a) This standard establishes minimum requirements for testing the structural integrity of an ambulance's patient compartment.

##### **17.2.2 Purpose**

- (a) The purpose of this standard is to demonstrate the static strength of an ambulance's patient compartment when subjected to a uniform load.

##### **17.2.3 Applicability**

- (a) This standard is applicable to all modular ambulance bodies and all Type II ambulances where modifications are made to the OEM roof.

##### **17.2.4 Definitions**

- (a) "Converted curb weight" means the weight of the completed ambulance including all OEM chassis equipment; full complement of fuel, lubricants and coolant; and all standard conversion components and options installed by the ambulance conversion manufacturer.

### 17.2.5 Requirements

- (a) **Roof Test:** When a force of at least 1.5 times the converted curb weight of a Type II ambulance, and of at least 2.5 times the converted curb weight of Type I and III ambulances, is applied to the roof of the body structure through a force application plate:
- (i) downward vertical movement at any point on the application plate shall not exceed 100 mm;
  - (ii) each exterior exit door of the vehicle shall be capable of opening and closing during the full application of the force and after release of the force; and
  - (iii) no structural damage to any load bearing or supporting members (for example torn or broken material, broken welds, popped or sheared body rivets, bolts and/or fasteners) shall be evident during the application of the force and after the release of the force.
- (b) **Side Test:** For Type I and III modular bodies, when a force of at least 2.5 times the converted curb weight of the ambulance is applied to either the driver or passenger side of the body structure through a force application plate:
- (i) downward vertical movement at any point on the application plate shall not exceed 100 mm;
  - (ii) the rear doors of the body shall be capable of opening and closing during the full application of the force and after release of the force; and
  - (iii) no structural damage to any load-bearing or supporting members (for example torn or broken material, broken welds, popped or sheared body rivets, bolts and/or fasteners) shall be evident during the application of the force and after the release of the force.

### 17.2.6 Test Procedure

#### (a) Roof Test

- (i) Place the ambulance on a rigid horizontal surface so that it is entirely supported by means of the chassis frame without any support from the suspension system. If the chassis is constructed without a frame, support the vehicle on its body sill. Remove any components which extend upwards from the vehicle roof.
- (ii) If a modular body is tested off of the chassis that it is intended for, then:
  - 1. the module shall be placed on 'I' beams to simulate the chassis frame; and
  - 2. the total weight applied shall still include at least 2.5 times the converted curb weight of the finished ambulance.
- (iii) Apply a rigid, rectangular force application plate fitted as near as possible to the contour of the ambulance roof.
- (iv) Position the plate on the roof so that its rigid surface is perpendicular to a vertical longitudinal plane and so that in the top projected view, its longitudinal centreline coincides with the longitudinal centreline of the ambulance, and it is centred on the roof.
- (v) With all doors fully closed, apply an evenly distributed vertical force in the downward direction to the application plate at a rate of not more than 13 mm per second, until a force of 225 kg has been applied.
- (vi) Record elevation readings at all 4 corners of the application plate.

- (vii) Apply additional vertical force in a downward direction to the application plate at a rate of not more than 13 mm per second until 50% of the specified force has been applied. Record elevation readings at all 4 corners.
- (viii) Continue to apply a vertical force to the application plate until the total specified force is applied. Record elevation readings at all 4 corners.
- (ix) With the total load applied, test all doors for compliance and record the results.
- (x) Remove the applied load from the application plate. Record elevation readings at all 4 corners. Compare the results with the original readings to see if there was permanent deformation of the roof and record the results.
- (xi) Test all doors for compliance and record all results.

**(b) Side Test**

- (i) Place the body on its left or right side, on a rigid horizontal surface so that the entire body is supported.
- (ii) Apply a rigid, rectangular force application plate fitted as near as possible to the contour of the body side.
- (iii) Position the plate on the side of the body so that its rigid surface is perpendicular to a vertical longitudinal plane and so that in the top projected view, its longitudinal centreline coincides with the longitudinal centreline of the body and it is centred on the side of the body.
- (iv) With all doors fully closed, apply an evenly distributed vertical force in the downward direction to the application plate at a rate of no more than 13 mm per second, until a force of 225 kg has been applied.
- (v) Record elevation readings at all 4 corners of the application plate.
- (vi) Apply additional vertical force in the downward direction to the application plate at a rate of not more than 13 mm per second until 50% of the specified force has been applied. Record elevation readings at all 4 corners.
- (vii) Continue to apply a vertical force to the application plate until the total specified force is applied. Record elevation readings at all 4 corners.
- (viii) With the total load applied, test the rear doors for compliance and record the results.
- (ix) Remove the applied load from the application plate. Record elevation readings at all 4 corners of the body. Compare the results with the original readings to determine if there was permanent deformation of the side.
- (x) Test the rear doors for compliance and record the results.

**(c) Test Equipment**

- (i) Use a flat, rigid rectangular force application plate that is at least 130 mm longer and 130 mm wider than the ambulance roof or side, measured relative to the vehicle's roof or side longitudinal and lateral centre lines.
- (ii) For the purpose of these measurements, the ambulance roof or side is that part of the ambulance, seen in the top projected view that coincides with the patient compartment.

### **17.3 Body Door Retention Components Test – Type Certification**

#### **17.3.1 Scope**

- (a) This standard establishes the minimum requirements for testing body door retention components on the side and rear entry doors, as installed in the vehicle body framework.

#### **17.3.2 Purpose**

- (a) The purpose of this standard is to minimize the possible failure of the doors to remain closed and latched when subjected to a uniform static force.

#### **17.3.3 Applicability**

- (a) This standard shall apply to all ambulances when the side entry and/or rear entry doors are supplied and installed by someone other than the OEM.

#### **17.3.4 Requirements**

- (a) Each door shall be tested and certified to demonstrate compliance with CMVSS 206 “Door Locks and Door Retention Components”, and all other relevant CMVSS requirements.

### **17.4 Pressure Vessel Retention Test – Type Certification**

#### **17.4.1 Scope**

- (a) This standard establishes minimum requirements for testing all mounts and brackets, installed in ambulances, which restrain pressure vessels.
- (b) This is a two-part procedure that tests the bracket designed to hold the pressure vessel and the bracket’s mounting system.
- (c) These tests can be performed together or separately, and shall be documented as such with specific details of the mounting hardware used and the test locations within the ambulance.

#### **17.4.2 Applicability**

- (a) This standard applies to all holders that restrain oxygen tanks, fire extinguishers and tanks containing other pressurized gases.

#### **17.4.3 Definitions**

- (a) “Tank holder” means the retention system, including all hardware, provided for holding the pressure vessel (tank) in the ambulance.
- (b) “Force application cylinder” is a rigid structure with the same physical dimensions as the pressure vessel which the tank holder was designed to restrain.

#### **17.4.4 Requirements**

- (a) **Tank Holder:** As specified in Test Procedure 17.4.5, upon applying a force to the tank holder equal to 25 times the weight of a fully loaded pressure vessel which the tank holder was designed to restrain, plus the weight of the tank holder:
  - (i) the tank holder components shall not fail and/or separate along attachment points;
  - (ii) the tank holder or any component thereof shall not separate from the vehicle at any attachment point; and

- (iii) the force application cylinder shall not disengage from the tank holder.
- (b) **Tank Holder Mount:** As specified in Test Procedure 17.4.5, upon applying a force to the tank holder equal to 25 times the weight of a fully loaded pressure vessel which the tank holder was designed to restrain, plus 10 times the weight of the tank holder:
  - (i) the tank holder or any component thereof shall not separate from the vehicle at any attachment point; and
  - (ii) the part of the vehicle to which the tank holder is attached shall not fail and/or separate at any attachment point.

#### 17.4.5 Test Procedure

##### (a) Tank Holder Test:

- (i) Insert the force application cylinder into the installed tank holder and apply the forces specified below. It is not required to apply the forces simultaneously.
- (ii) Apply a force equal to 25 times the weight of a fully loaded tank(s), which the tank holder was designed to restrain, to either end of the cylinder so that the action of the force coincides with the longitudinal centreline of the cylinder, in each plane.
- (iii) Apply a force equal to 25 times the weight of a fully loaded tank(s), which the tank holder was designed to restrain, to the cylinder in any direction, in a plane perpendicular to the longitudinal centreline of the cylinder and which passes through the location corresponding to the centre of gravity of a full tank.

##### (b) Tank Holder Mount Test:

- (i) Using the installed tank holder, apply the forces specified below. It is not required to apply the forces simultaneously.
- (ii) Apply a force equal to 25 times the weight of a fully loaded tank(s) which the tank holder was designed to restrain, plus 10 times the weight of the tank holder so that the action of the force coincides with the longitudinal centreline of the cylinder, in each plane.
- (iii) Apply a force equal to 25 times the weight of a fully loaded tank(s) which the tank holder was designed to restrain, plus 10 times the weight of the tank holder in a plane perpendicular to the longitudinal centreline of the cylinder and which passes through the location corresponding to the centre of gravity of a full tank, which the holder is designed to restrain.

- (c) In addition to meeting the requirements set out in (a) and (b) of this section, a registered professional engineer shall certify that any horizontal tank holders installed in the ambulance meet the requirements in section 3.7.2 of this Code.

### 17.5 Cot Retention System Test – Type Certification

#### 17.5.1 Scope

- (a) This standard establishes minimum requirements for testing the installation of cot retention systems in single and dual cot ambulances.

#### 17.5.2 Definitions

- (a) “Cot retention system” means a system attached to the floor and/or side wall of



an ambulance that provides means for securing a cot.

### **17.5.3 Requirements**

- (a) The cot retention system, including anchorages and stretcher fastener(s), shall not fail or release when subjected to a force of 12,230 Newtons applied in a horizontal plane in a longitudinal, lateral and vertical direction. (Note that these are three individual tests.)

### **17.5.4 Test Conditions**

- (a) The ambulance floor shall be in a horizontal plane.
- (b) If the ambulance is designed to transport multiple cots, the cot retention system shall be tested in each location.
- (c) If adjustable, the cot retention system shall be adjusted to its most forward position.

### **17.5.5 Test Procedure**

- (a) Using the testing device, apply the specified force through the hooks (or other cot-securing means) used in locking onto the cot.
- (b) Install the testing device in the cot retention system in a manner that will preclude contact friction with the floor or other surfaces.
- (c) Attach a cable with a calibrated, in-line strain gauge to the testing device pivot and apply an initial vertical upward load to the device.
- (d) As rapidly as possible, apply the full specified force to the device.
- (e) Record the applied force, start and finish times and any deformation of the floor, cabinetry or retention mechanism.
- (f) Release the applied load. If any deformation has occurred in the cot retention system, replace the damaged parts. (Note that rotation or deformation of the retention mechanism does not constitute failure.)
- (g) Reinstall the test fixture and repeat the above steps in the longitudinal and again in the lateral direction. Record all resultant data.

### **17.5.6 Test Equipment**

- (a) The testing device is a structure of appropriate design that represents the cot frame and is secured using the hooks (or other cot-securing means) of the cot retention system. Force is applied through a pivot located 380 mm above the floor, at a point representing the centre of the cot.

## **17.6 Emergency Lighting System Test – Type Certification**

### **17.6.1 Scope**

- (a) This standard establishes minimum performance requirements for individual emergency warning lights and the primary emergency lighting system.

### **17.6.2 Requirements**

- (a) Each individual emergency light utilized as part of the primary emergency lighting system shall meet or exceed SAE Standard J845 “Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles”.
- (b) The primary emergency lighting system shall be measured and certified to meet or exceed the requirements set out in this Code and in SAE Standard J2498 “Minimum Performance of the Warning Light System Used on Emergency Vehicles”, sections 1 to 5, 6.2 and 7.

- (c) The minimum optical power requirements, as per Zones described in SAE Standard J2498, are as follows:

Zones	Level	Zone Total at H	Min. Value at Any H Point	Min. Value at Any +/-5° Point
A	Upper	1,000,000	10,000	3,500
B	Upper	400,000	10,000	3,500
C	Upper	800,000	10,000	3,500
D	Upper	400,000	10,000	3,500
A	Lower	150,000	3,750	1,300
BF	Lower	75,000	3,750	1,300
DF	Lower	75,000	3,750	1,300

NOTE: All values are in candela-seconds/minute.

H = Horizontal line passing through the centre of the light source.

### 17.6.3 Test Procedure

- (a) Test procedures shall be in accordance with SAE Standard J2498.  
 (b) In lieu of completing supplementary tests to demonstrate compliance with the Testing Standards in this Code, the ambulance conversion manufacturer may provide documentation from the light manufacturer certifying that the lighting provided has been tested and is capable of providing the required lighting intensities.

## 17.7 Exterior Task Lighting Test – Type Certification

### 17.7.1 Scope

- (a) This standard establishes minimum performance requirements for exterior task lighting intensity.

### 17.7.2 Definitions

- (a) Illumination is the flux of light received in a unit area of a certain size being illuminated. The unit of measure is Lux (Lx). One Lx is the light from the standard candle at a distance of 1 metre and striking a square metre.  
 (b) A light meter is the instrument used for measuring illumination. For this standard, a light meter with a resolution of 0.1 Lx is required.

### 17.7.3 Requirements

- (a) To meet this standard, individual illumination levels must be at least 11 Lx, measured 75 mm above ground level, at a distance of 1.5 metres from the sides and rear of the ambulance, and at least 3.5 Lx at 3 metres from the vehicle.

### 17.7.4 Test Conditions

- (a) Testing shall be done on level ground with the transducer aimed upward.  
 (b) Testing shall be done with minimal ambient light to allow data to be recorded.  
 (c) Ambient air conditions shall be recorded for the test period.  
 (d) All task lights on a specific side of the ambulance are to be tested simultaneously and the electrical load must be recorded as part of the qualification testing.  
 (e) A digital light meter is to be used in all illumination measurements.

- (f) All distance measurements are to be made with conventional steel tapes with a resolution of at least 3 mm.

#### **17.7.5 Test Procedure**

- (a) Place the ambulance on a level surface with no structures within 6 metres of the sides or rear surfaces. Run this test in a structure where ambient light can be controlled or outside after sunset.
- (b) Make sure the electrical section of the ambulance conversion has a fully charged battery pack.
- (c) Lay out a grid of test points off the sides and rear of the test ambulance:
  - (i) parallel lines are laid out 1.5 metres and 3 metres from the sides and rear of the ambulance;
  - (ii) the parallel lines are intersected by perpendicular grid lines extending out from the centre of each exterior task light and from each corner and mid-point of the sides and rear of the ambulance. The intersections of the gridlines form the test points for illumination.
- (d) Measure the ambient illumination at all intersections on the grid. Record these measurements on a graphic map of these locations.
- (e) Turn on the task lights on one side of the ambulance only. Record the illumination level at each grid point on that side of the ambulance. Calculate the light-supplied illumination by subtracting the first measurement from the last at each grid point.
- (f) Repeat (e) on the other side of the ambulance.
- (g) Repeat (e) at the rear of the ambulance.
- (h) Record all data on a top view of the ambulance showing illumination levels at the 1.5-metre and the 3-metre distances.
- (i) Measure current and voltage for each lighted side of the ambulance prior to taking light readings.
- (j) In lieu of completing supplementary tests to demonstrate compliance with the standards in this Code, the ambulance conversion manufacturer may provide documentation from the light manufacturer certifying that the lighting provided has been tested and is capable of providing the required lighting intensities.

### **17.8 Siren Performance Test – Type Certification**

#### **17.8.1 Scope**

- (a) This performance standard establishes the minimum sound level output for the siren / public address system.

#### **17.8.2 Requirements**

- (a) The siren shall be capable of producing a continuous warning sound at a minimum level of 123 decibels (dB), A-weighted, at 3 metres, on axis, in the “wail” mode with “yelp” capable of producing a continuous warning sound at a minimum level of 122 dB with 13.6 volts +/- .2 input, at a frequency in the range of 500 to 2000 Hz maximum.

#### **17.8.3 Test Conditions**

- (a) Vehicle doors, windows and vents must be closed.
- (b) The siren shall be sounded in its loudest mode of operation.
- (c) Perform this test under the following meteorological conditions:
  - (i) the ambient temperature shall be within the range of 0°C to 30°C;
  - (ii) wind velocity is not to exceed 18 km/hr;

- (iii) other meteorological conditions, for example rain and fog, shall be such that they do not influence the measurements;
- (d) Record ambient temperatures, and wind speed and direction relative to the vehicle's positioning.
- (e) Record the date, and start and finish times of the testing.

#### **17.8.4 Test Procedure**

- (a) Position a sound meter on a horizontal plane 3 metres forward of the centreline of the vehicle's hood and 1 metre above ground level.
- (b) Park the vehicle at a location where there are no large reflecting surfaces such as other vehicles, signboards, buildings or hills within 15 metres of the vehicle being tested.
- (c) Set the transmission in 'NEUTRAL' or 'PARK' and accelerate the engine to 50 to 60% of the engine manufacturer's RPM rating. Stabilize the engine at that speed, turn on the siren and measure its highest sound level.
- (d) Return the engine speed to idle and repeat the process as specified above until two maximum sound levels within 2 dB of each other are recorded. Calculate and record the average of these two maximum sound level readings.

### **17.9 Patient Compartment Lighting Level Test – Type Certification**

#### **17.9.1 Scope**

- (a) This standard verifies the performance of an ambulance's interior lighting.

#### **17.9.2 Definitions**

- (a) Illumination is the flux of light received in a unit area of a certain size being illuminated. The unit of measure is Lux (Lx). One Lx is the light from the standard candle at a distance of 1 metre and striking a square metre.
- (b) A light meter is the instrument used for measuring illumination. For this standard, a light meter with a resolution of 0.1 Lx is required.

#### **17.9.3 Requirements**

- (a) The patient compartment floor shall be illuminated at an intensity of at least 160 Lx, measured along the centreline of the clear floor located in the area between the rear and side doors.
- (b) The primary cot shall be provided with a minimum of 376 Lx of illumination measured on at least 90% of the cot's surface area.

#### **17.9.4 Test Conditions**

- (a) The lighting test may be performed at any ambient temperature.
- (b) All openings and windows must be covered over to keep out exterior ambient light.
- (c) The vehicle's engine must be started and high idle engaged.

#### **17.9.5 Test Procedure**

- (a) With the vehicle running, perform the following test:
  - (i) With the cot removed, mark the centreline of the floor between the left wall and the squad bench.
  - (ii) Mark the floor every 150 mm along the centreline from the rear doors to the side door.
  - (iii) With the dome lights set on their highest setting and using a calibrated light meter, record the readings every 150 mm along the centreline of the floor.

- (b) With the vehicle running, perform the following test:
  - (i) With the cot installed, mark the top of the cot in a 150 mm grid. This can be done on a flat, non-reflective surface laid on top of the cot mattress.
  - (ii) With the dome lights set on their highest setting and using a calibrated light meter, record the readings in the centre of each 150 mm square.

## **17.10 Occupant Restraint Net Test – Type Certification**

### **17.10.1 Scope**

- (a) This standard establishes the minimum static load requirements for the occupant restraint net and its fasteners.

### **17.10.2 Requirements**

- (a) Fasteners shall be tested and certified to withstand the application of a force of at least 22,240 Newtons divided equally among the number of fasteners securing the net.
- (b) The occupant restraint net shall be tested and certified to withstand a force of 13,345 Newtons.

### **17.10.3 Test Procedure – Fasteners**

- (a) Attach a force application device to each fastener and apply the required load in a plane parallel to the fastener.
- (b) Repeat the test procedure applying the load perpendicular to the initial plane.
- (c) Examine the fasteners and record the results.

### **17.10.4 Test Procedure – Occupant Restraint Net**

- (a) Apply a force in a forward direction at the centre of the installed net using a suitable solid block to distribute the load.
- (b) Examine the restraint device and fasteners, and record the results.

## **17.11 Cabinet Structure and Fastener Test – Type Certification**

### **17.11.1 Scope**

- (a) This standard establishes minimum requirements for testing the installation of medical supply cabinets, benches, bulkheads and partitions in an ambulance.

### **17.11.2 Applicability**

- (a) Each cabinet and combination of cabinets mounted on a single wall shall be tested separately.
- (b) Each bulkhead and partition shall be tested with any cabinet(s) that, together with it, forms a single cohesive component.

### **17.11.3 Requirements**

- (a) The structure and fasteners of the components shall resist separation when subjected to a load equivalent to 25 times its empty weight or 10,000 Newtons, whichever is greater.

#### **17.11.4 Test Procedure**

- (a) Apply the required force to the component using a force application device such that the force is spread equally over the fasteners.
- (b) Apply the force in a lateral direction. Observe and record the results.
- (c) Apply the force in a longitudinal direction. Observe and record the results.

### **17.12 Equipment Restraint Devices Test – Type Certification**

#### **17.12.1 Scope**

- (a) This standard establishes the minimum static load requirements for devices that secure any equipment or materials, which weigh over 5.0 kg and are stored within the vehicle.

#### **17.12.2 Applicability**

- (a) This standard applies to doors, hatches and covers as well as equipment-specific mounting brackets, securing straps, cargo nets and other restraints for open storage areas on all ambulances.

#### **17.12.3 Requirements**

- (a) When a force equal to 10 times the weight of the intended equipment or material, plus the weight of the restraint is applied to the restraint:
  - (i) the restraint shall not fail and/or separate along the attachment points; and
  - (ii) the restraint or any component thereof shall not separate from the vehicle at any attachment point.

#### **17.12.4 Test Procedure**

- (a) Attach a force application device to the restraint and apply the required load incrementally in a plane parallel to the fasteners.
- (b) Repeat the test procedures, applying the load perpendicular to the initial plane.
- (c) Examine the restraint and record the results.

### **17.13 Grab Rail / Grab Handle Retention Test – Type Certification**

#### **17.13.1 Scope**

- (a) This standard establishes the minimum static load requirements for all grab rails and grab handles.

#### **17.13.2 Requirements**

- (a) A grab rail or grab handle shall not detach, loosen or deform during the application of a 135 kg load in the directions specified in sections 17.13.3 and 17.13.4.

#### **17.13.3 Test Procedure – Grab Rail**

- (a) With the vehicle parked on a flat surface, measure the grab rail for straightness and the space between the top sides of the rail and headliner or supporting cabinetry.
- (b) Attach a force application device to the grab rail at a midpoint between 2 securing points and apply the required load incrementally in a plane parallel to the rail fasteners. Hold the load for 2 minutes and release.

- (c) If equipped with more than 2 securing points, repeat (b) at the midpoint between 2 other securing points.
- (d) Repeat the above test procedures, applying the load perpendicular to the initial plane.
- (e) Examine and measure the grab rail for loosening or deformation and record the results.

#### **17.13.4 Test Procedure – Grab Handle**

- (a) Attach a force application device to the midpoint of the grab handle and apply the required load incrementally in a plane parallel to the handle fasteners.
- (b) Repeat the test procedures, applying the load perpendicular to the initial plane.
- (c) Examine the grab handle for loosening or deformation and record the results.
- (d) The above test procedures shall be completed for each different material to which the grab handles are secured.

### **17.14 Bumper and Step Test – Type Certification**

#### **17.14.1 Scope**

- (a) This standard establishes the minimum requirements for testing an ambulance's steps while the ambulance is not in motion.

#### **17.14.2 Applicability**

- (a) This standard applies to the rear step and bumper as well as any fixed or retractable exterior step (including running boards), located at a side entrance of an ambulance.

#### **17.14.3 Definitions**

- (a) "Independent rear step" means the rear step independent of the rear bumper.
- (b) "Combination rear step bumper" means that the rear step and bumper are intrinsic in design and construction.
- (c) "Application plate" means a test weight approximately 900 mm long x 250 mm wide and weighing a minimum of 225 kg.

#### **17.14.4 Requirements**

- (a) Independent rear step and fixed or retractable side steps:
  - (i) when the application plate is applied to the centre of the step area, it shall not deflect more than 25 mm; and
  - (ii) after removal of the application plate, there shall not be more than 6.5 mm of permanent deformation.
- (b) Combination rear step bumper:
  - (i) when the application plate is applied to the centre of the step area and at each outboard end of the bumper, if there is a step area available, it shall not deflect more than 25 mm; and
  - (ii) after removal of the application plate, there shall not be more than 6.5 mm of permanent deformation.

#### **17.14.5 Test Conditions**

- (a) The test may be performed at any ambient temperature.

#### **17.14.6 Test Procedure – All Steps, Including Running Boards**

- (a) Park the vehicle on a level flat surface and place jack stands under the chassis frame rails to prevent spring deflection during the test.
- (b) Measure and record the step height at the centre and at each end of the step.
- (c) Apply the application plate as close to the centre of the step as possible.
- (d) Measure and record the step height at the centre and at each end of the step.
- (e) Remove the application plate and measure and record any permanent deformation.

#### **17.14.7 Test Procedure – Combination Rear Step Bumper**

- (a) Park the vehicle on a level flat surface and place jack stands under the chassis frame rails to prevent spring deflection during the test.
- (b) Measure and record the step height at the centre and at each end of the rear step.
- (c) Apply the application plate as close to the centre of the rear step as possible.
- (d) Measure and record the step height at the centre and at each end of the rear step.
- (e) Remove the application plate from the step area and apply the plate as close as possible to the centreline of the outside bumper step area.
- (f) Measure and record the amount of deflection at the centre of the step and the two outside corners of the bumper.
- (g) Remove the application plate and repeat the procedure on the opposite corner of the outside bumper step area.
- (h) Measure and record the amount of deflection at the centre of the step and the two outside corners of the bumper.
- (i) Remove the application plate and measure and record any permanent deformation, measuring at the centre and at each end of the step.

### **17.15 Interior Climate Control Test – Type Certification**

#### **17.15.1 Scope**

- (a) This standard establishes 3 separate performance requirements for the Heating, Ventilation and Air Conditioning (HVAC) systems of ambulances.

#### **17.15.2 HVAC Requirements:**

- (a) Vehicles shall be equipped with heating, ventilation and air conditioning systems that can be operated collectively using recirculated air and ambient air, and that can maintain the interior temperature within an established comfort zone of +20°C to +25°C when operating in ambient temperatures of between -30°C and +35°C.
- (b) The heating system(s) shall have sufficient capacity to raise the temperature in the vehicle cab and patient compartment simultaneously to a minimum dry bulb temperature of 20°C, at all 10 test points (9 in the patient compartment and 1 in the cab), within 30 minutes of the engine reaching operating temperatures. The temperature gradient within the 9 thermocouples in the patient compartment shall not exceed 5°C on completion of the test.



- (c) The air conditioning system(s) shall have sufficient capacity to lower the temperature at midpoints between the floor and ceiling of the driver and patient compartments simultaneously to a dry bulb temperature of 23°C within 30 minutes of the engine being started. The temperature gradient within the vehicle shall not exceed 5°C on completion of the test.
- (d) The ventilation system(s) shall be capable of providing a complete change of the air within the ambulance every 4 minutes when the vehicle is static.

#### **17.15.3 Heating System Test:**

- (a) The vehicle (with doors open) shall be cold soaked so as to obtain a temperature reading of -30°C +/- 2.5°C, in both compartments, when the time measurement commences.
- (b) Start the engine with the transmission in 'NEUTRAL' or 'PARK' and allow the engine to come up to the operating temperature range as specified by the OEM. Then run the engine at the high idle setting, as permitted by the OEM, and then commence the time measurement.
- (c) Time and temperatures shall be recorded from 9 equally spaced test thermocouples in the patient compartment and 1 test thermocouple located at the intersection of the centre horizontal and vertical planes of the vehicle cab.
- (d) At a minimum, verification readings shall be recorded at the following time intervals until the test is successfully completed or failure is declared after the 30-minute mark:
  - (i) at vehicle (engine) start time;
  - (ii) when the engine reaches its normal operating temperature range or when the reading at one or more thermocouples rises to -27.5°C (start of test time measurement);
  - (iii) at the 15-minute mark; and
  - (iv) at the 30-minute mark.
- (e) In the patient compartment, the 9 thermocouples, in stacks of 3, shall be positioned as follows:
  - (i) the horizontal axis shall be located at the centreline of the vehicle chassis and one stack of 3 thermocouples shall be located at each of the 1/4, mid and 3/4 point distances between the rear doors and bulkhead; and
  - (ii) in the vertical plane, each stack shall consist of 1 thermocouple located at the 1/4, mid and 3/4 point distances between the finished floor and the underside of the ceiling.
- (f) Heating equipment may be in (air) recirculation mode and all compartment openings, including partition door/window and exhaust vents shall be closed.

#### **17.15.4 Air Conditioning System Test:**

- (a) The vehicle (with doors open) shall be heat soaked so as to obtain a temperature of +35°C +/- 2.5°C, in both compartments, when the time measurement commences.
- (b) Start the engine with the transmission in 'NEUTRAL' or 'PARK', run it at the high idle setting, as permitted by the OEM, and commence the time measurements.

- (c) Record a minimum of 3 verification readings of time and temperature (at vehicle start time, the 15-minute mark, and the end time) at the thermocouple placements specified in section 17.15.3(e).
- (d) Air conditioning equipment may be in air recirculation mode and all compartment openings, including partition doors/windows, shall be closed.
- (e) Conduct the test with a coolant system charge that does not exceed pressures recommended by the OEM. Record the system pressure at the start and the end of the test.

#### **17.15.5 Ventilation System Test:**

- (a) Ventilation shall be controlled and evaluated separately within each compartment.
- (b) A registered professional engineer may calculate and certify that the air exchange requirements in 17.15.2(d) are met.

### **17.16 Carbon Monoxide Test – Type Certification**

#### **17.16.1 Scope**

- (a) This standard establishes the minimum requirements for testing for the presence of carbon monoxide (CO) gas in ambulances.

#### **17.16.2 Requirements**

- (a) Determine the CO content in the ambient air and the vehicle through a series of operating performance test periods.
- (b) The resultant difference between the highest readings in each of the 3 operating states and the average ambient condition shall not exceed 10 parts per million of CO.

#### **17.16.3 Test Conditions**

- (a) Calibrate the equipment at the start of the test. Detail how the meter was calibrated at the start of the test and confirm calibration at the end of the test.
- (b) Open the vehicle doors and auxiliary windows and ventilate the ambulance with fresh air for 10 minutes with the engine off.
- (c) Do not conduct testing during high wind periods (above 25 kph) or during any type of precipitation.

#### **17.16.4 Test Equipment**

- (a) MSA Model I or Model II CO monitor or equivalent instrument with an accuracy of +/- 4%.
- (b) Canister of 60–100 parts per million CO.

#### **17.16.5 Test Procedure**

- (a) Sample the ambient air around the vehicle and record the results.
- (b) Close the windows and doors. Ensure that the heating, air conditioning and ventilation systems are off.
- (c) Start and idle the engine in 'PARK' for 10 minutes, then take the following measurements:
  - (i) monitor CO in the driver compartment, around the doors, windows, floor, engine cowling and openings from the engine compartment for the first 5 minutes and record the results; and

- (ii) monitor CO in the patient compartment, at the head of the main cot, for the remaining 5 minutes and record the results.
- (d) Drive the vehicle for 10 minutes on traffic-laden city streets at urban speeds of 30 to 60 kph. Ensure that the heating, air conditioning and ventilation systems are off. Repeat sampling in the driver and patient compartments during driving time and record the results.
- (e) Drive the vehicle for 10 minutes at highway speeds of 80 to 100 kph. Ensure that the heating, air conditioning and ventilation systems are off. Repeat sampling in the driver and patient compartments during driving time and record the results.
- (f) Stop the vehicle and repeat the sampling of ambient air around the vehicle. Average the results of the 2 ambient air samples taken around the vehicle.

## **17.17 Low-voltage Electrical System Test – Individual Certification**

### **17.17.1 Scope**

- (a) This standard establishes testing and certification requirements for ambulance low-voltage electrical systems.

### **17.17.2 Applicability**

- (a) Each ambulance's electrical system shall be tested.

### **17.17.3 Requirements**

- (a) The generating system shall produce the maximum required output at the regulated voltage and at an engine speed not exceeding the OEM-recommended high idle speed.
- (b) If the ambulance is equipped with a 12 volt DC load management system, then the ambulance shall be tested in the condition which imposes the maximum electrical current load while the load management system is operating.

### **17.17.4 Test Conditions**

- (a) The ambulance shall be complete and ready for delivery, including all equipment as specified by the purchaser.
- (b) The OEM and conversion batteries shall be fully charged.
- (c) Ambient temperature shall be a minimum of 21°C.
- (d) The engine shall be warmed up to operating temperature prior to the test period and a minimum under hood temperature of 93°C shall be achieved during the test.

### **17.17.5 Test Procedure**

- (a) Install ammeters to measure the maximum load imposed on the OEM batteries and the conversion batteries separately.
- (b) Install voltmeters to monitor the voltage of the OEM batteries and the conversion batteries separately.
- (c) Start the engine and set the speed, in accordance with section 17.17.3(a), which will maintain the voltage of both the conversion and the OEM batteries between 12.8 and 15 volts for the duration of the test.
- (d) Run the engine for a 15-minute warm-up period.
- (e) At the end of 15 minutes, begin the test by turning on the following systems (loads) simultaneously:

- (i) ignition system;
  - (ii) headlights (low beam) and all CMVSS running lights;
  - (iii) windshield wipers (on low speed);
  - (iv) cab air conditioning (at the coldest setting with the highest blower speed);
  - (v) 2-way radio in receive mode (or add a five amp load if the radio is not installed);
  - (vi) patient compartment ceiling lighting (on high setting);
  - (vii) patient compartment air conditioning (on coldest setting/ highest blower speed);
  - (viii) emergency warning light system in primary mode and with wigwags on;
  - (ix) 10 amp medical load or its equivalent;
  - (x) left and right scene lights;
  - (xi) rear scene lights;
  - (xii) any optional fixed electrical loads specified by the purchaser beyond the scope of this Code; and
  - (xiii) any optional variable electrical loads specified by the purchaser beyond the scope of this Code, set to 60% of the rated maximum.
- (f) The test period shall last 15 minutes.
  - (g) Record the ammeter readings (in amps) at the beginning and end of the test period.
  - (h) Monitor the voltage of each battery (or battery bank) for the duration of the test. Record the highest and lowest voltage reading of each battery (or battery bank).
  - (i) Add the higher of the 2 readings on each ammeter to obtain the required maximum output of the 12 volt DC electrical system.
  - (j) Compare the required maximum output to the generating system's rated maximum output at 93°C and 14 volts DC.

#### **17.17.6 Certification**

- (a) The ambulance conversion manufacturer shall attach an electrical system certification label to the completed ambulance, certifying that the electrical system complies with section 17.17. The information that must be provided on the certification label is set out in Appendix A of this Code.

### **17.18 Vehicle Weights – Individual Certification**

#### **17.18.1 Scope**

- (a) This standard establishes requirements for the distribution of the weight and payload allowance for an ambulance.

#### **17.18.2 Definitions**

- (a) "Converted curb weight" means the weight of the completed ambulance including all OEM chassis equipment; a full complement of fuel, lubricants and coolant; and all standard conversion components and options installed by the ambulance conversion manufacturer.
- (b) "GAWR" means the Gross Axle Weight Rating, defined as the maximum allowable weight each axle assembly is designed to carry, as assigned to each axle by the chassis manufacturer.
- (c) "GVWR" means Gross Vehicle Weight Rating, defined as the maximum allowable vehicle weight, including fuel, fluids, passengers and payload, as assigned by the chassis manufacturer.

- (d) "Payload allowance" means the weight obtained by subtracting the converted curb weight from the GVWR.

### **17.18.3 Requirements**

- (a) The converted curb weight distribution, on a level surface, shall be such that:
- (i) no less than 30% and no more than 50% of the vehicle's weight is on the front suspension; and
  - (ii) the weight on the left and right wheels on any axle is within 5 percentage points of each other.
- (b) Where the OEM specifies a weight distribution requirement that differs from (a), the conversion shall conform to that requirement and the ambulance manufacturer shall keep a copy of the OEM specification with the test results.
- (c) When loaded to the GVWR, the weight on each axle shall be within its respective GAWR.
- (d) Each unit shall have a payload allowance of at least 770 kg (1,700 lbs.) over and above the converted curb weight of the ambulance.
- (e) The use of ballast to achieve proper weight distribution is prohibited.

### **17.18.4 Weight Distribution Test Procedure**

- (a) Weigh the completed ambulance to obtain
- (i) the total converted curb weight;
  - (ii) the converted curb weight of each axle; and
  - (iii) the converted curb weight of the left and right wheel of each axle.
- (b) The front to rear weight distribution is calculated as follows:
- (i) divide the weight of each axle by the total converted curb weight and multiply by 100 to obtain the percentage of weight on each axle.
- (c) The side to side weight distribution is calculated as follows:
- (i) divide the weight of each wheel by the total converted curb weight of that axle and multiply by 100 to obtain the percentage of weight on each side; and
  - (ii) subtract the smaller percentage from the larger percentage.

### **17.18.5 Certification**

- (a) The ambulance conversion manufacturer shall complete a weight compliance document. The information that must be provided on the compliance document is set out in Appendix B of this Code.
- (b) The manufacturer shall provide a copy of the weight compliance document to the purchaser when the ambulance is delivered.
- (c) The manufacturer shall attach a label to the vehicle showing the GVWR, converted curb weight and payload allowance so as to demonstrate compliance with section 17.18.3(d).

## **17.19 Centre of Gravity Location – Type Certification**

### **17.19.1 Scope**

- (a) This standard establishes requirements for the location of the Actual Centre of Gravity (ACG) of an ambulance.

### **17.19.2 Requirements**

- (a) The ambulance manufacturer or a registered professional engineer shall calculate the location of the ACG of the fully converted ambulance.

- (b) A registered professional engineer shall certify that the ACG is at or below the maximum height as set out by the OEM, and is in compliance with the longitudinal and lateral limits set by the OEM.
- (c) The ambulance manufacturer shall provide a copy of the engineer's certificate to the purchaser when the ambulance is delivered.
- (d) The use of ballast to achieve proper location of the ACG is prohibited.

## **17.20 Oxygen System Test – Individual Certification**

### **17.20.1 Scope**

- (a) This standard establishes testing requirements for the on-board oxygen system.

### **17.20.2 Requirements**

- (a) When subjected to a proof pressure of at least 1034 kilopascals (kPa), the oxygen system shall show no pressure drop over a period of 2 hours.
- (b) Every ambulance shall be tested and a certificate demonstrating compliance with (a) presented to the purchaser when the ambulance is delivered.

### **17.20.3 Test Procedure**

- (a) Connect a cylinder of medical air, nitrogen gas or equivalent, complete with a pressure regulator, set to deliver gas at 1034 kPa, to the oxygen system inlet.
- (b) Turn the cylinder on to pressurize the system and inspect all joints for leaks. Fix any leaks noted.
- (c) Attach a pressure gauge (0-1380 kPa) securely to the oxygen outlet at the action wall.
- (d) Pressurize the system to 1034 kPa and record the gauge reading. Turn off the cylinder, leaving it attached to the inlet connector.
- (e) Record the gauge reading after 2 hours.
- (f) After successful completion of testing, the system shall be capped with plastic end caps and tagged with a certificate tag setting out the:
  - (i) testing start time;
  - (ii) initial pressure reading;
  - (iii) testing end time;
  - (iv) final pressure reading;
  - (v) date of testing; and
  - (vi) signature of the tester.

## **17.21 Fixed Suction System Test – Individual Certification**

### **17.21.1 Scope**

- (a) This standard establishes the test requirements for a fixed suction system.

### **17.21.2 Definitions**

- (a) "Suction tubing" means transparent or translucent, non-kinking tubing that is at least 3 metres long and has a minimum inside diameter of 6.5 mm.
- (b) "Collection bottle" means a transparent glass or plastic vessel, with a minimum capacity of 1,000 ml, which is used to collect aspirate.

- (c) "Vacuum indicator gauge" means a gauge that indicates the vacuum level with a numerical value at least every 100 mm Hg and a total range of at least 0–760 mm Hg.
- (d) "Vacuum control and shut-off valve" means a device used to adjust vacuum levels and to discontinue aspiration instantly.

#### **17.21.3 Requirements**

- (a) The suction system shall achieve a vacuum of at least 300 mm Hg within 4 seconds after the suction tube is clamped off.
- (b) The system shall provide a free airflow of at least 30 litres per minute (lpm) and not more than 38 lpm measured at the distal end of the suction tubing.
- (c) Every ambulance shall be tested and a certificate demonstrating compliance with (a) and (b) presented to the purchaser when the ambulance is delivered.

#### **17.21.4 Test Conditions**

- (a) The test may be performed at any ambient temperature.
- (b) Start the engine and engage the high idle speed control for the duration of the test.
- (c) The vacuum control and shut-off valve shall be fully open.

#### **17.21.5 Test Procedure**

- (a) Vacuum Performance:
  - (i) install the suction tubing on the collection bottle inlet;
  - (ii) turn on the vacuum pump;
  - (iii) clamp or plug the end of the suction tubing;
  - (iv) using a stopwatch, start the timing when the end of the suction tubing is clamped; and
  - (v) record the gauge reading at the end of 4 seconds.
- (b) Airflow Performance:
  - (i) attach a flowmeter to the distal end of the suction tubing and record the flow rate.

## **APPENDIX A – ELECTRICAL SYSTEM CERTIFICATION LABEL**

The following information shall appear on the certification label:

- a. The data furnished herein is based upon turning on the following electrical equipment and electrical load(s) simultaneously:
1. Ignition system
  2. Headlights (low beam) and all CMVSS required lights
  3. Windshield wipers (low speed)
  4. Cab air conditioning (at coldest setting with highest blower speed)
  5. Radio in receiving mode (or equal load, if not equipped)
  6. Patient module dome lighting (in high-intensity setting)
  7. Patient module air conditioning (at coldest setting with highest blower speed)
  8. Emergency warning lighting system in “Primary” mode (See Code, section 9.7.1)
  9. 10-amp medical load or equal
  10. Left and right side task lights
  11. Rear task lights
  12. Optional 12-volt DC equipment and lights.

This vehicle is \_\_\_\_\_/is not \_\_\_\_\_ equipped with a load management system.

**NOTE:** IF EQUIPPED WITH AN ELECTRICAL LOAD MANAGEMENT SYSTEM, CERTAIN LOADS/FUNCTIONS LISTED ABOVE MAY HAVE BEEN INHIBITED AUTOMATICALLY 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 THE MAXIMUM ATTAINABLE ELECTRICAL LOAD.

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. Nominal 12-volt DC current rating at 93° C at 14-volt DC: \_\_\_\_\_ amps.

g. Test data:

1. Lowest DC voltage at common point during test with loads 1–11: \_\_\_\_\_ volts.

2. Lowest DC voltage at common point during test with loads 1–12: \_\_\_\_\_ volts.

3. Engine speed control setting: \_\_\_\_\_ rpm.

4. DC current draw at common point during test with loads 1–11: \_\_\_\_\_ amps.

5. DC current draw at common point during test with loads 1–12  
without load management system: \_\_\_\_\_ amps.

h. Generating reserve:

1. Generating reserve (+)/overload (-) with loads 1–11: \_\_\_\_\_ amps.  
(difference between f. 2 and g. 4).

2. Generating reserve (+)/overload (-) with loads 1–12: \_\_\_\_\_ amps.  
without load management system (difference between f. 2 and g. 5).

i. Date of test: \_\_\_\_\_.



## **APPENDIX B – AMBULANCE WEIGHT DISTRIBUTION CERTIFICATE**

The following information shall appear on the certification label:

- Gross Vehicle Weight Rating \_\_\_\_\_ kg
- Chassis Curb Weight Distribution:
  - Chassis Curb Weight \_\_\_\_\_ kg
  - Front Axle
    - Gross Axle Weight Rating \_\_\_\_\_ kg
    - Chassis Curb Axle Weight \_\_\_\_\_ kg
    - Chassis Curb Left Side Weight \_\_\_\_\_ kg
    - Chassis Curb Right Side Weight \_\_\_\_\_ kg
  - Rear Axle
    - Gross Axle Weight Rating \_\_\_\_\_ kg
    - Chassis Curb Axle Weight \_\_\_\_\_ kg
    - Chassis Curb Left Side Weight \_\_\_\_\_ kg
    - Chassis Curb Right Side Weight \_\_\_\_\_ kg
- Converted Curb Weight Distribution:
  - Front Axle
    - Converted Curb Axle Weight \_\_\_\_\_ kg
    - Converted Curb Left Side Weight \_\_\_\_\_ kg
    - Converted Curb Right Side Weight \_\_\_\_\_ kg
  - Rear Axle
    - Converted Curb Axle Weight \_\_\_\_\_ kg
    - Converted Curb Left Side Weight \_\_\_\_\_ kg
    - Converted Curb Right Side Weight \_\_\_\_\_ kg
  - Converted Curb Weight \_\_\_\_\_ kg
  - Payload (GVWR - Converted Curb Weight) \_\_\_\_\_ kg
- Calculations:
  - Front/Rear Weight Distribution  
Percentage weight on front axle \_\_\_\_\_ %
  - Front Axle Weight Distribution  
Percentage difference left side to right side \_\_\_\_\_ %
  - Rear Axle Weight Distribution  
Percentage difference left side to right side \_\_\_\_\_ %