



Ground Ambulance Vehicle Standards Code

This publication is issued under the Open Government Licence – Alberta
(<http://open.alberta.ca/licence>).

Emergency Health Services
Health Service Delivery Division
Alberta Health
18th Floor, ATB Place
10025 Jasper Avenue NW
Edmonton, AB T5J 2N3

Phone 780-422-9654
Fax 780-422-0134
ehs@gov.ab.ca

Open Government Portal URL.

This publication is available online at <https://open.alberta.ca/publications/ground-ambulance-vehicle-standards-code-2021>

Ground Ambulance Vehicle Standards Code January 2021 | Alberta Health
© 2021 Government of Alberta | March 1, 2021 | ISBN 978-1-4601-4976-8

Contents

• Part A – General	5
• 1.0 Interpretation	5
• 2.0 General Requirements - All Vehicles	6
• 3.0 Construction and Design Details	6
• 4.0 Chassis Requirements	9
• 5.0 Driver's Cab	9
• 6.0 Exterior Colour, Graphics and Identification Signage	10
• Part B – Class 1: Emergency Response Ambulance	13
• Class 2: Emergency Transfer Ambulance	13
• 7.0 Driver's Cab	13
• 8.0 Construction	14
• 9.0 Patient Compartment	15
• 10.0 Low-voltage Electrical System	16
• 11.0 Exterior Lighting Systems	17
• 12.0 Audible Emergency Warning	19
• 13.0 Medical Systems	20
• 14.0 Safety Equipment	20
• 15.0 Interior Climate Control System	21
• Part C – Class 3 Ambulance: Primary Response Units and Emergency Response Support Vehicles	21
• 16.0 Driver's Cab	21
• 17.0 Construction	22
• 18.0 Patient Compartment	22
• 19.0 Low-voltage Electrical System	23
• 20.0 Exterior Lighting Systems	23
• 21.0 Audible Emergency Warning (Siren)	24
• 22.0 Safety Equipment	25
• Part D – Class 4 Ambulance: Regulated Non-Emergent Transport (RNET)	25
• 23.0 Interpretation	25
• 24.0 Construction	25
• 25.0 Patient Compartment	26
• 26.0 Low-voltage Electrical System	26
• 27.0 Exterior Lighting Systems	27
• 28.0 Medical Systems	27
• 29.0 Safety Equipment	27
• 30.0 Environmental Control System	27

• Part E: Testing Standards	28
• 31.0 Obligation of Ambulance Conversion Manufacturer	28
• 32.0 Ambulance Body Structure Static Load Test – Type Certification	28
• 33.0 Body Door Retention Components Test – Type Certification	30
• 34.0 Pressure Vessel Retention Test – Type Certification	31
• 35.0 Cot Retention System Test – Type Certification	32
• 36.0 Emergency Lighting System Test – Type Certification	33
• 37.0 Exterior Task Lighting Test – Type Certification	34
• 38.0 Siren Performance Test – Type Certification	35
• 39.0 Passenger Compartment Lighting Level Test – Type Certification	36
• 40.0 Occupant Restraint Net Test – Type Certification	37
• 41.0 Cabinet Structure and Fastener Test – Type Certification	38
• 42.0 Equipment Restraint Devices Test – Type Certification	38
• 43.0 Assist Rail / Assist Handle Retention Test – Type Certification	39
• 44.0 Bumper and Step Test – Type Certification	39
• 45.0 Environmental Control System Test – Type Certification	41
• 46.0 Carbon Monoxide Test – Type Certification	42
• 47.0 Low-voltage Electrical System Test – Individual Certification	43
• 48.0 Vehicle Weights – Individual Certification	45
• 49.0 Centre of Gravity Location – Type Certification	46
• 50.0 Oxygen System Test – Individual Certification	47
• 51.0 Fixed Suction System Test – Individual Certification	47
Appendix A -- Electrical System Certification Label	49
Appendix B -- Ambulance Weight Distribution Certificate	50

Part A – General

1.0 Interpretation

For the purpose of this standard,

CMVSS	means the Canada Motor Vehicle Safety Standards issued by Transport Canada
CSA	means the Canadian Standards Association
C-UL	means a certification provided by the Underwriters' Laboratories of Canada
Class 1 Ambulance	means a vehicle defined in the Ground Ambulance Regulation as a Class 1 ambulance, primarily dispatched in response to calls from the public for assistance in emergencies
Class 2 Ambulance	means a vehicle defined in the Ground Ambulance Regulation as a Class 2 ambulance, primarily dispatched to provide emergency interfacility patient transport services
Class 3 Ambulance	means a vehicle defined in the Ground Ambulance Regulation as a Class 3 ambulance, which may be dispatched in a response, rescue, transport or support role
Class 4 Ambulance	means a vehicle defined in the Ground Ambulance Regulation as a Class 4 ambulance, which is dispatched to provide non-emergency patient transport services
Final-stage manufacturer	means a manufacturer or installer of components such that an OEM vehicle meets the standards for a class of ambulance defined in this Code
HVAC	means heating, ventilation and air conditioning
OEM	means original equipment manufacturer, which is the manufacturer of a completed vehicle or an incomplete cab/chassis combination that is used by a final-stage manufacturer to produce a class of ambulance defined in this Code
SAE Standard	means a standard established by the Society of Automotive Engineers for the construction and testing of automotive components
Testing Standard	means a testing standard as set out in Part E of this Code
Type I ambulance	means a conventional truck cab and chassis that has a remountable modular body that contains the patient compartment
Type II ambulance	means a standard van that has an integral cab and body with the patient compartment contained within the body and that may have a raised roof over the patient compartment
Type III ambulance	means a cutaway van cab and chassis that has a remountable modular body that contains the patient compartment
Warning light	means a flashing or rotating light that conveys visible emergency warning to the public and complies with the requirements of SAE Standards J575, J576, J578, J591, J595, J1318 and J1889, as applicable

2.0 General Requirements - All Vehicles

2.1 Compliance

2.1.1 All classes of ambulance covered by this standard shall comply with the following, listed in order of precedence:

- (a) Canada Motor Vehicle Safety Standards (CMVSS);
- (b) Ground Ambulance Vehicle Standards Code, dated January 2021, as amended from time to time by Alberta Health;
- (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.

2.3 Modifications to Approved Ambulances

2.3.1 No modification or addition may be made to an ambulance, after it is approved for use by the Registrar, unless the modification or addition complies with the requirements in this Code.

2.3.2 The ambulance's owner shall ensure that any modifications or additions are in compliance with 2.3.1.

3.0 Construction and Design Details

3.1 Passenger Restraint

3.1.1 Each permanently installed seating position in an ambulance shall have a seatbelt that complies with CMVSS.

3.2 Interior Safety

3.2.1 To the greatest extent possible, the interior walls and ceiling shall present a simple plane surface.

3.2.2 The interior of the patient and driver compartments shall be free of all sharp projections.

3.2.3 Lighting, controls, and all hangers or supports for equipment and other devices shall be mounted as flush as possible with the surrounding surface.

3.3 Bolsters

3.3.1 Bolsters (protective padding) shall be provided

- (a) at the top sills of doors where a person would be normally walking when entering or leaving an ambulance;
- (b) at edges, corners and all other locations that may present a hazard to persons moving about or seated within an ambulance.

3.3.2 Bolsters may be installed by an OEM or a final-stage manufacturer and may include appropriately configured seats with integral headrests.

3.3.3 All exposed edges and corners without padding shall be rounded with at least a 15mm radius or a 3mm chamfer.

3.4 Polycarbonate Window Glazing

3.4.1 Any doors or windows, whether fixed or operable, that are installed on the interior by a final-stage manufacturer shall be made of transparent polycarbonate.

3.4.2 Polycarbonate doors and windows shall bear a permanent identifying mark that certifies compliance with Motor Vehicle Safety Regulations (C.R.C., c.1038), Section 205 – Glazing Materials.

3.5 Cabinet Construction and Fastenings

- 3.5.1 Cabinets shall be constructed of metal or lightweight materials with a metal framework.
- 3.5.2 All interior cabinets, benches, bulkheads and partitions shall be attached to the vehicle body using machine screws or bolts that are securely attached to metal tapping plates and/or framing that is welded to the body structure.
- 3.5.3 Despite 3.5.2, bulkheads and partitions may be integral parts of the vehicle body or may be attached by welding.
- 3.5.4 All interior structures added by a final-stage manufacturer, including cabinets, benches, bulkheads and partitions, shall meet the requirements in Testing Standard 46.0.

3.6 Equipment Retention

- 3.6.1 The interior shall have readily accessible space for the storing and securing of all equipment and supplies, as well as patients' property or other goods that may be transported from time to time.
- 3.6.2 Doors, drawers and lids on supply cabinets or other spaces where equipment and supplies may be stored shall be fitted with positive latches.
- 3.6.3 Open storage areas shall be fitted with equipment restraint devices appropriate for the type of equipment that will be secured in that area.
- 3.6.4 Doors, drawers, lids and other equipment restraint devices shall meet the requirements in Testing Standard 42.0.
- 3.6.5 The final-stage manufacturer shall affix a label to each storage area that indicates the maximum weight that may be stored in the area. The maximum weight is determined in Testing Standard 42.3.

3.7 Interior Finishes

- 3.7.1 The finish of all interior surfaces that are installed by a final-stage manufacturer shall be impervious to soap and water, disinfectants and mildew.
- 3.7.2 All surfaces, edges, corners and joints that can be exposed to any fluid shall be sealed by a waterproof bonding material.
- 3.7.3 All entry steps shall be covered with heavy-duty ribbed rubber matting or other anti-skid material.
- 3.7.4 Floor covering in the cab of an ambulance shall be OEM rubber matting.
- 3.7.5 Despite 3.7.4, the cab of a Class 3 or Class 4 ambulance may have an OEM floor covering of another material provided it has a protective cover equivalent to 3.7.4.
- 3.7.6 Floor covering in other than the cab:
 - a) in any area where a person can walk, shall provide a static friction coefficient equal to or greater than 0.8 under dry conditions.
 - b) in a passenger car shall be rubber matting or an OEM floor covering of another material, provided it has a protective cover equivalent to 3.7.4.

3.8 Pressure Vessel Retention

- 3.8.1 Mounts and brackets that restrain pressure vessels, including medical gas cylinders, fire extinguishers and any other pressurized gas cylinders, shall meet the requirements in Testing Standard 34.0.
- 3.8.2 In addition, a holder that is used to restrain a pressure vessel in a horizontal position shall:
 - 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.

3.9 Vehicle Weight

- 3.9.1 An ambulance shall be weighed in accordance with the requirements in Testing Standards 48.0 and 49.0, and be certified as meeting the weight distribution, payload allowance and centre of gravity standards for that class of ambulance.
- 3.9.2 When applying to the Registrar to have a vehicle approved for use, the applicant shall supply documentation, provided by the final-stage manufacturer, certifying compliance with 3.9.1.
- 3.9.3 A Class 4 ambulance that is an OEM passenger car is exempt from 3.9.1 except when a cot anchor or wheelchair lift is installed.

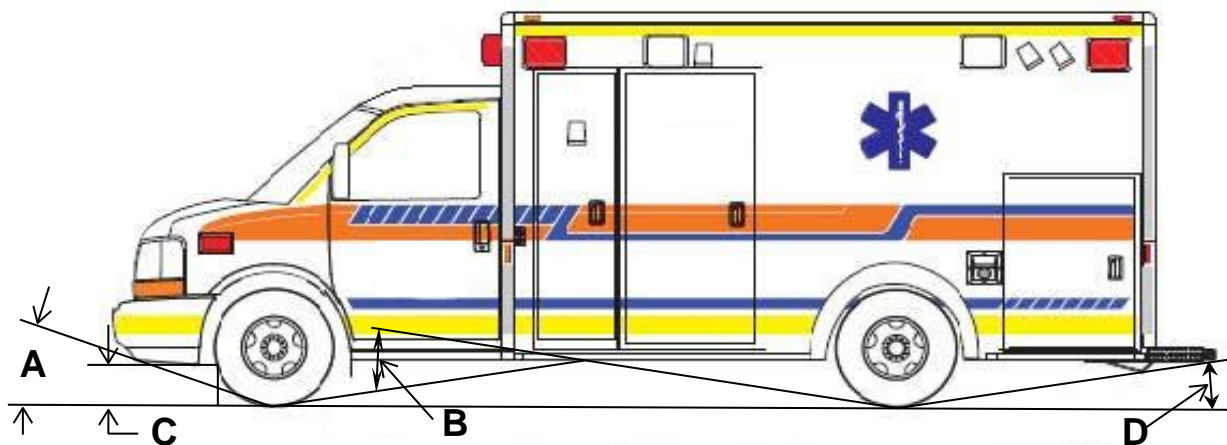
3.10 Loading Height

- 3.10.1 When an ambulance is designed and equipped to accommodate a patient on a multi-level cot, the loading height, measured from the ground to floor level, shall be:
- a) on a two-wheel-drive ambulance, not more than 840mm, or
 - b) on a four-wheel-drive ambulance, not more than 970mm.
- 3.10.2 The loading height may be measured at the door sill if there is a differential of more than 15mm between the floor height and the door sill and a sloped transition is installed.
- 3.10.3 If the standard in 3.10.1 is achieved through use of a variable-height suspension system, the system shall include safety features that prevent:
- a) the suspension from being lowered unless one or both rear doors are opened; and
 - b) the vehicle from being driven unless the suspension is in the raised position.
- 3.10.4 A vehicle that is equipped with a ramp or a device that assists with lifting and loading a cot or mobility aid may have a door sill height in excess of the standards specified in 3.10.1.
- 3.10.5 A ramp that is used to load a cot or a mobility aid shall have a maximum gradient of one in four (1:4) when deployed to ground level.

3.11 Vehicle Clearance

3.11.1 The following clearances shall be maintained when measured in accordance with the diagram:

- “A” – Approach angle 16°
- “B” – Breakover angle 10°
- “D” – Departure angle 10°



- 3.11.2 The minimum clearance to any structure located forward of the front tires or rearward of the rear tires (measurement “C and D”) shall be at least 200mm.
- 3.11.3 The minimum ground clearance of any component on an ambulance shall be at least 150mm.

- 3.11.4 Altering or replacing the rear OEM bumper, or adding anything to the rear of a vehicle, shall not cause a reduction in the required rear curb clearance or departure angle.

4.0 Chassis Requirements

4.1 Modifications

- 4.1.1 Any modifications or additions to an OEM vehicle shall be completed using OEM certified processes.
- 4.1.2 All modified vehicles shall meet or exceed OEM strength and performance characteristics.
- 4.1.3 When a unibody structure or the length of any OEM chassis frame member is cut and modified at any point between the front and rear axles, an engineer shall provide a certificate stating that the requirements of 4.1.1 and 4.1.2 have been met.

4.2 Metric Speedometer and Odometer

An ambulance shall have a speedometer and odometer that indicate speed and distance in units of kilometres per hour and kilometres, respectively.

4.3 Backup Alarm

- 4.3.1 An ambulance shall be equipped with an alarm that sounds whenever the vehicle is in 'REVERSE' gear.
- 4.3.2 The backup alarm shall be sufficiently loud so as to be audible over the ambient noise level, including the operation of any ambulance components.
- 4.3.3 Despite 4.3.1, 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'.
- 4.3.4 The automatic reset feature may have a delay of up to 20 seconds.

4.4 Exhaust System

- 4.4.1 The exhaust system shall
 - a) not terminate below an exit door, a window or other opening used for ventilation; and
 - b) terminate at, or no more than 100mm beyond, the body perimeter.
- 4.4.2 An ambulance that has been completed by a final stage manufacturer or modified from OEM standards shall meet the requirements in Testing Standard 46.0.

5.0 Driver's Cab

5.1 General

- 5.1.1 The seat travel of each of the driver and front 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 an ambulance, no equipment or fixtures are to be mounted on the engine cowling or firewall, unless fasteners and methods of securing that are specifically designed to prevent this problem are used. Any mounting on the cowling shall be done without damaging the integrity of the cowl, firewall, any insulation or heat shields.

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 any supplemental restraint systems.
- 5.2.2 Nothing mounted in the cab may be positioned so it blocks, or may block, the driver's full view of the windshield or any rear-view mirror or window.
- 5.2.3 No light fixture shall be mounted onto the exterior of an ambulance in a manner that projects its light output, either directly or through mirrors, into the cab.

5.3 Door Hardware

- 5.3.1 Entrance door hardware installed by a final-stage manufacturer shall meet the requirements in Testing Standard 33.0.

6.0 Exterior Colour, Graphics and Identification Signage

6.1 All Ambulances

- 6.1.1 The base colour of the exterior of an ambulance shall be white.
- 6.1.2 No graphics other than those described in 6.3, 6.4 and 6.5 shall be placed on the rear plane of an ambulance unless approved by the Registrar.
- 6.1.3 The Registrar shall approve the exterior graphics package before an ambulance operator is given approval to use an ambulance.

6.2 Identification Signage

- 6.2.1 Identification signage required in 6.3, 6.4 and 6.5 shall be made of reflective blue material having
- a minimum coefficient of retroreflection of 30 cd/lx/m² when viewed from an observation angle of 0.2° and an entrance angle of -4°; and
 - the following four pairs of chromaticity coordinates in terms of the CIE 1931 Standard Colorimetric System:

x	y
0.140	0.035
0.244	0.210
0.190	0.255
0.065	0.216

- 6.2.2 All identification signage shall be installed on a solid white background and have a surrounding white border at least 20mm wide.
- 6.2.3 Letters and numerals shall have a stroke width-to-height ratio of approximately 1:5.

6.3 Identification Decals

- 6.3.1 Class 1 and Class 2 ambulances shall have
- an 'AMBULANCE' decal, in letters 150±5mm high, shall be installed below the windows on the rear doors, within the area covered by the chevrons; and
 - a mirror image 'AMBULANCE' decal, in letters 100±5mm high, shall be installed below the bottom of the windshield and above the headlights on the front of the vehicle.
- 6.3.2 Class 3 ambulances shall have
- an 'EMS' decal, in letters between 120mm and 150mm high, on the rear of the vehicle.
 - a mirror image 'EMS' decal, in letters between 75mm and 100mm high, installed below the bottom of the windshield and above the headlights on the front of the vehicle.

6.4 Star of Life Decals

- 6.4.1 Star of Life decals shall not be interrupted by, incorporated into or partially covered by any other graphics.
- 6.4.2 A Star of Life decal shall be located no further forward than the rear edge of the cab doors.

- 6.4.3 Despite 6.4.1 and 6.4.2, a small Star of Life image may be installed on the cab doors if it is incorporated into an ambulance operator's corporate logo.
- 6.4.4 Class 1 and Class 2 ambulances shall have one Star of Life decal, with a diameter of 300mm to 500mm, installed above the horizontal centreline on each side of the vehicle.
- 6.4.5 Class 3 ambulances shall have one Star of Life decal, with a diameter of 200mm to 500mm, installed above the horizontal centreline on each side of the vehicle.
- 6.4.6 A Class 4 ambulance shall not display a Star of Life image.

6.5 Unit Identification Number

- 6.5.1 A unit identification number (Unit ID), as assigned by the Registrar, shall be installed in three exterior body locations.
- 6.5.2 Class 1 and Class 2 ambulances shall have a Unit ID, in characters 100±5mm high, installed
 - a) one in the upper rear corner on each side; and
 - b) one in the upper left corner on the rear plane of the body; or
 - c) in any other appropriate area approved by the Registrar.
- 6.5.3 Class 3 and Class 4 ambulances shall have a Unit ID, in characters between 50mm and 100mm high, installed
 - a) one on each upper front fender, behind the centerline of the front wheel; and
 - b) one on the left rear plane of the body, mounted as high as practicable; or
 - c) in any other appropriate area approved by the Registrar.

6.6 Conspicuity Stripes

- 6.6.1 Horizontal conspicuity stripes shall be made of reflective fluorescent lime/yellow material having
 - a) a minimum coefficient of retroreflection of 270 cd/lx/m² when viewed from at an observation angle of 0.2° and an entrance angle of -4°; and
 - b) the following four pairs of chromaticity coordinates in terms of the CIE 1931 Standard Colorimetric System:

x	y
0.387	0.610
0.369	0.546
0.428	0.496
0.460	0.540

- 6.6.2 Vertical conspicuity stripes shall be made of reflective white material having a minimum coefficient of retroreflection of 400 cd/lx/m² when viewed from an observation angle of 0.2° and an entrance angle of -4°.
- 6.6.3 A conspicuity stripe shall not be interrupted, except by the wheel wells, nor shall it be partially covered by any other graphics.
- 6.6.4 Class 1 and Class 2 ambulances shall have
 - a) one horizontal fluorescent lime/yellow stripe, at least 100mm wide, running the full length of each side of the vehicle, including the front bumper;
 - b) the stripe required in (a) positioned between horizontal lines drawn 150mm above the lowest margin of white on the side of the body and the bottom of the cab windows;

- c) one horizontal fluorescent lime/yellow stripe, 50±5mm wide, positioned immediately above or below the drip rail on the body.
- d) fluorescent lime/yellow stripes, 25±5mm wide, installed on the 'A' pillar and top of the cab doors;
- e) vertical white stripes, 50±5mm wide, installed between the horizontal lime/yellow stripes on the left and right sides of an ambulance body;
- f) the stripes required in (e) positioned immediately behind each of the cab doors and adjacent to each rear corner.

6.6.5 Class 3 ambulances shall have

- a) one horizontal fluorescent lime/yellow stripe, at least 100mm wide, running the full length of each side of the vehicle, including the front bumper;
- b) the stripe required in (a) positioned between horizontal lines drawn 150mm above the lowest margin of white on the side of the body and the bottom of the cab windows;
- c) one horizontal fluorescent lime/yellow stripe, 25±5mm wide, positioned immediately above or below the drip rail on the body.
- d) Despite (c), the upper horizontal stripe may be deleted if a Class 3 ambulance is an OEM passenger car and there is insufficient room above any windows on the side of the vehicle for the stripe to be installed.

6.6.6 Class 4 ambulances shall have at least one horizontal fluorescent lime/yellow stripe

- a) that is at least 50mm wide;
- b) running the full length of each side on each side of the vehicle; and
- c) if there is only one stripe, positioned between horizontal lines drawn 150mm above the lowest margin of white on the side of the body and the bottom of the cab windows.

6.7 Chevrons

6.7.1 A two-colour, retroreflective chevron pattern shall be installed on the full width of the rear plane of the vehicle.

6.7.3 The chevron stripes shall

- a) incorporate the same fluorescent lime/yellow required in 6.4.1 as one of its colours; and
- b) be 150±5mm wide and may be separated by white spaces not more than 12mm wide;
- c) point upwards at a 45° angle toward the centreline of the body.

6.7.4 Class 1 and Class 2 ambulances shall have chevrons that

- a) start at a level even with the bottom of the rear doors;
- b) cover 60±5% of the rear surface plane between horizontal lines across the top and bottom of the rear entry doors; and
- c) include the area required for the "AMBULANCE" decal required in 6.3.1.

6.7.5 Class 3 and Class 4 ambulances shall have chevrons that

- a) cover between 40% and 60% of the non-glass, surface area on the rear plane; and
- b) are located as low as practicable.

6.7.6 Despite 6.7.3(b), a Class 4 ambulance may have chevron stripes that are between 100mm and 150mm wide.

6.8 Operator-specific Branding

6.8.1 Class 1 and Class 2 ambulances may have operator-specific branding that covers

- a) not more than 40% of the area, measured separately
 - i) between the upper and lower horizontal conspicuity stripes on each side of the body;
 - ii) between the horizontal conspicuity stripe and the lower edge of the window on each side of the cab; and
 - b) 100% of the roof area of the vehicle.
- 6.8.2 Class 3 and Class 4 ambulances may have operator-specific branding that covers
- a) not more than 40% of the area between the horizontal conspicuity stripes required in 6.6.
 - b) 100% of the roof area of the vehicle.
- 6.8.3 If a Class 3 or Class 4 ambulance has only one horizontal conspicuity stripe, as permitted in 6.6.5 and 6.6.6 respectively, the area designated for operator-specific branding shall be measured between the horizontal stripe and the lower edge of any windows on the side of the vehicle.

Part B – Class 1: Emergency Response Ambulance Class 2: Emergency Transfer Ambulance

7.0 Driver's Cab

7.1 Driver's Console

- 7.1.1 A central console located in the cab shall contain
- a) controls for the emergency warning lights, siren, and other ambulance functions;
 - b) a voltmeter that monitors the voltage of both the OEM and conversion batteries; and
 - c) an ammeter that indicates the charge being supplied by the generating system.
- 7.1.2 Design and location of the console and the placement of the controls shall favour the driver as primary user but allow access to control functions from the passenger seat.
- 7.1.3 All switch and gauge functions shall be clearly labelled and illuminated so as to be visible in all lighting conditions.
- 7.1.4 Nothing installed or stowed in the cab shall
- a) impede the driver's access to any of the console controls; or
 - b) block the driver's view of any the controls, gauges or indicator lights.
- 7.1.5 The top of the switch panel shall not be positioned more than 30mm above the top of the dashboard.

7.2 Door Open Warning

- 7.2.1 One or more 'DOOR OPEN' warning lights shall be located so as to be clearly visible to the driver.
- 7.2.2 The warning light(s) shall flash whenever a patient compartment entry door or exterior storage compartment door is open and may only be overridden by the ambulance conversion master power switch or the ignition switch.
- 7.2.3 If a 'DOOR OPEN' warning light is located on the driver's switch console, the visual display shall be at least 15mm in diameter.
- 7.2.4 If a 'DOOR OPEN' warning light is located in the headliner above the rear-view mirror, the visual display shall be at least 50mm in diameter.
- 7.2.5 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.

7.3 Automatic Engine High-Idle RPM Control

- 7.3.1 Class 1 and Class 2 ambulances shall have an engine high-idle RPM control that increases the engine speed to sustain the ambulance's total continuous electrical load, and maximum heating/air conditioning output.
- 7.3.2 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.
- 7.3.3 The device shall be preset so that it engages automatically whenever the safety controls are activated and the voltage of the OEM battery or the conversion battery falls below 12.5 volts.
- 7.3.4 The device shall disengage automatically when the operator depresses the service brake pedal, moves the transmission from 'PARK' or releases the parking brake.

8.0 Construction

8.1 Modular Body

- 8.1.1 Modular bodies shall be constructed of aluminum and shall be of all-welded construction.
- 8.1.2 Construction methods shall prevent electrolytic reactions between dissimilar metals and materials.
- 8.1.3 Despite 8.1.1, the Registrar may approve other construction materials and methods.
- 8.1.4 The body shall be mounted to the chassis with fasteners deemed appropriate by SAE standards and vibration-isolating body mounts designed and installed in accordance with the chassis manufacturer's guidelines.
- 8.1.5 Modular bodies shall not be welded to the frame at any point.
- 8.1.6 A modular body structure shall meet the requirements in Testing Standard 32.0.

8.2 Type II Raised Roof

- 8.2.1 A Type II ambulance may be fitted with an extended roof system in order to meet the requirements of 9.2.1(a).
- 8.2.2 An extended roof system shall incorporate rollover protection, inner and outer finish panels and trim.
- 8.2.3 A roof that has been modified by a final stage manufacturer shall meet the requirements in Testing Standard 32.5.

8.3 Rear Bumper and Steps

- 8.3.1 A step bumper shall be located at the rear doors of the ambulance.
- 8.3.2 The rear step shall be positioned so that the stepping surface is approximately halfway between the ground and the finished floor of the ambulance.
- 8.3.3 The position of the rear step shall not reduce the angle of departure to less than 10° as measured in accordance with 3.11.1.
- 8.3.4 A safety grating step shall run the width of the rear door opening, be at least 225mm deep and pivot to permit ambulance attendants to move closer when loading and unloading a cot.
- 8.3.5 The rear bumper and step shall meet the requirements in Testing Standard 44.0.

8.4 Entrance Steps

- 8.4.1 The first step at an entrance door shall be located approximately halfway between ground level and the finished floor of the passenger compartment.
- 8.4.2 The stepping surface shall be at least 200mm deep from edge to riser.
- 8.4.3 If the distance from the ground to first step is more than 400mm, a second fixed or retractable step shall be provided.
- 8.4.4 A fixed or retractable step that is added by a final-stage manufacturer at any entrance shall meet the requirements in Testing Standard 49.0.

9.0 Patient Compartment

9.1 Bulkhead Partition

- 9.1.1 The cab and patient compartment shall be separated by a solid bulkhead partition that is either an integral part of the ambulance body or is secured by welding or bolting to tapping plates, in compliance with 3.5.2.
- 9.1.2 The bulkhead shall have a communication window, latchable from the driver's side, which has an area of at least 9000mm².
- 9.1.3 Despite 9.1.1, the partition may incorporate a passageway with a hinged or sliding door that is lockable without the use of a key from the driver's side. The door shall have a window which has an area of at least 9000mm².
- 9.1.4 If a passageway is present, a sealed fluid barrier 15±5mm high shall be installed on the floor.

9.2 Patient Compartment Dimensions

- 9.2.1 The patient compartment of an ambulance shall have the following:
 - a) at least 1600mm between the finished floor and the ceiling;
 - b) at least 3000mm between the bulkhead partition immediately behind the driver's seat and the inside of the rear doors;
 - c) at least 680mm between the backrest of the rear-facing attendant's seat and the forward edge of the main cot;
 - d) at least 250mm between the rear edge of the main cot mattress and the inside of the rear doors; and
 - e) a clear aisle of at least 250mm in width between the main cot and the curbside seating or a second cot. The aisle shall not be reduced by more than 40mm by the cantilever of any seat cushion.
- 9.2.2 If a side-facing CPR seat is installed in the street-side cabinetry, there shall be a clear aisle of at least 200mm between the edge of the seat cushion and the main cot, and it shall not reduce the distance required in 9.2.1(e).

9.3 Patient Compartment Doors and Windows

- 9.3.1 A Class 1 and Class 2 ambulance shall have patient compartment entry doors located on the curbside and at the rear.
- 9.3.2 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.
- 9.3.3 The curbside door opening shall be of sufficient size to accommodate the removal of a patient on a cot or alternate transport device, as defined in the Regulation.
- 9.3.4 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.
- 9.3.5 Each door shall have effective seals to prevent water leakage or carbon monoxide intrusion.
- 9.3.6 Entrance door hardware installed by a final-stage manufacturer shall meet the requirements in Testing Standard 33.0.
- 9.3.7 A window of the maximum practical size shall be installed in each door.
- 9.3.8 The rear doors shall have fixed windows.
- 9.3.9 Side windows that are operable shall be equipped with a screen and be lockable.
- 9.3.10 Windows shall be suitably treated so as to ensure the privacy of persons within the patient compartment at all times.

9.4 Patient Compartment Seating

- 9.4.1 A rear-facing bucket seat with at least a 3-point restraint system and an integral child safety seat shall be installed immediately in front of the forward edge of the main cot.
- 9.4.2 In a single cot configuration, at least one additional seating position shall be located on the curbside.
- 9.4.3 In a dual cot configuration, at least two attendant seating positions shall be provided within the patient compartment.
- 9.4.4 A CPR seat located in the street-side cabinets, adjacent to the main cot, does not meet the requirements of a seating position required in 9.4.3.

9.5 Securing of Cots

- 9.5.1 A cot retention system, approved for use with the cot being secured, shall be installed for each multi-level cot position.
- 9.5.2 A multi-level cot on which a patient is transported shall be parallel with the longitudinal axis of the ambulance.
- 9.5.3 Cot retention systems shall meet the requirements in Testing Standard 35.0.

9.6 Attendant Work Area – Medical Control Centre

- 9.6.1 An ambulance shall have one or more attendant work areas located adjacent to attendant seating positions within the patient compartment.
- 9.6.2 The work area located nearest to the main cot shall contain incorporate
 - a) at least one oxygen outlet and controls;
 - b) a fixed suction outlet and controls;
 - c) a thermostat for the HVAC system;
 - d) a work surface for the attendant; and
 - e) a reading light.
- 9.6.3 The work surface shall be recessed or have a raised perimeter lip that is sealed against intrusion of liquids.

9.7 Patient Compartment Switch Panel

Switches to control the patient compartment lights, HVAC system, suction and other electrical functions shall be located in one or more switch panels that are easily accessible from the attendant seating positions.

9.8 Patient Compartment Lighting

- 9.8.1 The patient compartment shall have variable intensity lighting.
- 9.8.2 The side entrance steps shall be automatically illuminated when the door is opened.
- 9.8.3 Patient compartment lighting shall meet the requirements in Testing Standard 39.0.

9.9 Door-activated Switches

- 9.9.1 Courtesy lights shall be activated automatically in the passenger compartment when an entrance door is opened.
- 9.9.2 Exterior task lighting shall be activated automatically when the side and rear passenger compartment entrance doors are opened.

10.0 Low-voltage Electrical System

10.1 General

- 10.1.1 The ambulance conversion and accessory electrical equipment wiring shall be served by circuits distinct from the vehicle chassis circuits and controlled by a 'Master Power' switch.

- 10.1.2 The ambulance conversion circuits shall include an automatic timer that shuts off power to the conversion not more than 10 minutes after engine shutdown.
- 10.1.3 In addition to 10.1.2, there shall be an override feature that allows the conversion circuits to be re-energized without the engine being started.
- 10.1.4 Electrical panels and devices that are located in compartments where equipment or supplies may be stored shall have a protective cover.
- 10.1.5 The generating system shall meet the requirements in Testing Standard 47.0, and a certification tag shall be affixed to the ambulance.

10.2 Batteries

- 10.2.1 Each battery shall be located in a ventilated area, sealed off from the occupant and oxygen compartments.
- 10.2.2 Despite 10.2.1, a sealed gel-cell or absorbed glass mat battery may be stored in an isolated, protected area within an occupant compartment and should be vented to the outside.
- 10.2.3 An ambulance conversion's electricity storage system shall be served by one or more dedicated batteries that are electrically separated from the OEM battery system.

10.3 Fuses and Circuit Breakers

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

10.4 Remote Switching

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

10.5 Electrical Load Rating

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.

10.6 Wiring

- 10.6.1 All electrical wiring shall be copper, with CSA/C-UL approved insulation.
- 10.6.2 Any variation from 10.6.1, other than data wire used in multiplex electrical systems, shall be approved by the Registrar.
- 10.6.3 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.
- 10.6.4 Wiring shall 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.

10.7 Power Inverter, 110 Volts

- 10.7.1 An ambulance shall be equipped with a power inverter that has a rated sine wave output of at least 1000 watts at 110 volts AC.
- 10.7.2 Wiring from the inverter to all 110 volt AC outlets shall be in accordance with the manufacturer's instructions.

11.0 Exterior Lighting Systems

11.1 Emergency Warning Light System, General Requirements

- 11.1.1 Emergency warning lights shall be either red or white as required in this section.
- 11.1.2 The warning light system shall meet the requirements in Testing Standard 36.0.

11.2 Forward Roof-level Warning Lights

- 11.2.1 A minimum of four red warning lights shall be installed above the top level of the windshield on the front of an ambulance, located as close as practicable to the upper corners.
- 11.2.2 A maximum of one white warning light shall be installed toward the vehicle centreline above the level of the windshield on the front of an ambulance.

11.3 Side and Rear Roof-level Warning Lights

- 11.3.1 A minimum of two red warning lights shall be installed on each side of an ambulance, located as close as practicable to the upper corners.
- 11.3.2 A minimum of two red warning lights shall be installed on the rear of an ambulance, located as close as practicable to the upper corners.
- 11.3.3 At least two of the warning lights, required in 11.3.2, shall be visible at a distance of not less than 20 metres behind an ambulance when the loading doors are open.
- 11.3.4 The requirements in Testing Standard 36.2.3 shall continue to be met if open loading doors impede the light output of any rear warning lights.
- 11.3.5 Despite 11.1.1, an ambulance may be equipped with a rear-facing, amber traffic direction device if it is wired so that it can be activated only when the vehicle's gear shift is in 'PARK'.

11.4 Grille Lights

- 11.4.1 A minimum of two 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.
- 11.4.2 The grille lights shall be located at least 750mm above the ground and below the bottom edge of the windshield, and be separated laterally by at least 450mm, measured from centreline to centreline of each lamp.

11.5 Intersection Warning Lights

- 11.5.1 A side-facing warning light shall be installed as close as practicable to the forward edge of each front fender.
- 11.5.2 The intersection lights shall be red, or a combination of red and white.
- 11.5.3 If a red and white warning light is installed, it shall flash in an alternating pattern.

11.6 Emergency Warning Light Switching

- 11.6.1 The Primary Emergency Warning Light system shall be wired to operate independently of all other warning lights.
- 11.6.2 A single switch, marked 'PRIMARY/SECONDARY', on the driver's console shall control all emergency warning lights in either a primary (emergency response) or secondary (vehicle stopped in the roadway) mode.
- 11.6.3 This switch may activate emergency warning lights directly or it may activate a sequencing device.
- 11.6.4 If a sequencing device is installed, there shall not be individual switches to control any of the emergency warning lights required in 11.2 to 11.5.
- 11.6.5 The white, forward-facing, warning light shall be activated, without any other actions required by the driver, each time the emergency warning light switch is set to 'PRIMARY' mode.
- 11.6.6 The driver's switch panel shall include a momentary switch that allows the white, forward-facing, warning light to be deactivated and reactivated independently when the emergency warning lights are operating in 'PRIMARY' mode.
- 11.6.7 Despite 11.6.2, if red strobe lights are installed on an ambulance and they are not warning lights required in 11.2 to 11.5, they may be controlled by a separate switch.

11.7 Flash Patterns

- 11.7.1 The forward roof-level warning lights shall flash in a random sequence or where not more than two rear-facing warning lights are installed, they shall flash simultaneously.

- 11.7.2 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.
- 11.7.3 The secondary flash pattern shall, at a minimum, include:
- a) two forward, roof-level red warning lights; and
 - b) all rear, roof-level red warning lights.

11.8 Wigwag Warning Lights

- 11.8.1 An ambulance may be equipped with wigwag warning light system consisting of two forward-facing white lights that are mounted below the level of the windshield and flash in an alternating or random sequence.
- 11.8.2 When permitted by the OEM, wigwags may
- a) utilize the high beam filament of the headlights or;
 - b) be a separate light source mounted within the OEM headlight fixture.
- 11.8.3 Despite 11.8.2, wigwags may be separate fixtures that are mounted outboard of the grille lights and immediately adjacent to the OEM headlights.
- 11.8.4 Wigwag light fixtures shall be separated horizontally from the red grille warning lights by not less than 130mm, measured between the edges of the lenses.
- 11.8.5 Wigwags shall operate independently from all other warning lights and shall be controlled by a separate switch on the driver's console.

11.9 Exterior Task Lighting

- 11.9.1 A minimum of two white floodlights shall be installed on each side of an ambulance.
- 11.9.2 A minimum of one white floodlight, unobstructed when the rear doors are open, shall be located on the rear plane of an ambulance.
- 11.9.3 The floodlights shall be installed at least 1800mm from the ground, angled downward 12-15° by means of mounting or lens type.
- 11.9.4 Switches on the driver's control console shall control the left, right and rear-facing floodlights individually. This mode of control will take precedence over any modes described elsewhere in this Code.
- 11.9.5 The rear-facing task lighting shall operate automatically when the vehicle transmission is placed in 'REVERSE'.
- 11.9.6 Task light intensity shall meet the requirements in Testing Standard 42.0.

12.0 Audible Emergency Warning

12.1 Siren

- 12.1.1 An ambulance shall be equipped with an audible emergency warning system consisting of a siren amplifier and one or more speakers.
- 12.1.2 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.
- 12.1.3 The siren speakers shall be mounted on the forward vertical plane of an ambulance according to installation instructions from the siren manufacturer and any guidelines provided by the OEM.
- 12.1.4 The audible emergency warning system shall meet the requirements in Testing Standard 38.0.

13.0 Medical Systems

13.1 Medical Oxygen System

- 13.1.1 An ambulance shall be equipped with a piped medical oxygen system installed in the patient compartment.
- 13.1.2 The system shall include:
 - a) a tank holder that meets the requirements in Section 3.8, Pressure Vessel Retention.
 - b) a medical oxygen tank 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 (kPa);
 - c) non-ferrous piping or low pressure, electrically-conductive, medical grade hose;
 - d) at least two self-sealing wall outlets that have DISS (gas-specific) threaded connectors; and
 - e) a pressure-compensated flow meter for each outlet that is being used to administer oxygen to a patient.
- 13.1.3 Ceiling-mount oxygen delivery ports shall be fully recessed and be supplied by a wall-mounted flow meter.
- 13.1.4 The system shall meet the requirements in Testing Standard 50.0.

13.2 Fixed Suction System

- 13.2.1 An ambulance shall have a fixed suction system installed in the patient compartment.
- 13.2.2 The suction system shall include
 - a) a suction pump that is powered by the vehicle's electrical system and vented to the exterior of the vehicle;
 - b) a vacuum indicator gauge with a numerical value at least every 100mm Hg and a total range of at least 0–760 mm Hg.
 - c) a control valve to adjust vacuum levels;
 - d) a securely-attached, transparent collection bottle with a capacity of at least 1000ml; and
 - e) transparent or translucent, non-kinking suction tubing that is at least 3 metres long and has an inside diameter of at least 6.5mm.
- 13.2.3 The suction system shall meet the requirements in Testing Standard 51.0.

14.0 Safety Equipment

14.1 Assist Rails / Assist Handles

- 14.1.1 An assist rail shall be mounted on the ceiling of the patient compartment and span the length of the area above the main cot position.
- 14.1.2 An assist handle shall be mounted on or adjacent to each patient compartment entrance.
- 14.1.3 Assist rails and assist handles shall meet the requirements in Testing Standard 43.0.

14.2 Occupant Restraint Net

- 14.2.1 An occupant restraint net shall be positioned between the forward bulkhead and any side-facing seat on the curbside of the patient compartment.
- 14.2.2 A restraint net shall be located no more than 100mm from the forward edge of the seat cushion.
- 14.2.3 A restraint net shall be at least 500mm wide and constructed of cargo webbing or an equivalent material that can be cleaned easily.
- 14.2.4 A restraint net shall be attached to at least two points, at least 400mm apart, located on or near the ceiling and to two points, at least 300mm apart, located on or near the floor using low-profile, quick-release fasteners that allow the net to be easily removed.

- 14.2.5 Despite 14.2.1, a restraint net is not required if there is a separate seat in the patient compartment, which replaces a squad bench or other seat, and that separate seat:
- a) is equipped with a three- or five-point restraint harness; and
 - b) can be oriented to face forward during travel.

14.2.6 A restraint net shall meet the requirements in Testing Standard 40.0.

14.3 Miscellaneous Safety Equipment and Signs

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

14.3.2 A puncture-resistant, leak-proof sharps container of horizontal design, with minimum 2-litre capacity, counterbalanced internal door and positively latching lid, shall be installed within the patient compartment of an ambulance.

14.3.3 The installation of the sharps container shall meet the requirements in Testing Standard 42.0.

15.0 Interior Climate Control System

15.1 General

15.1.1 Heating, ventilation and air conditioning (HVAC) components shall be installed in the patient compartment.

15.1.2 The patient compartment HVAC system shall be independent of the OEM HVAC system and have controls that are easily accessible to the attendant.

15.1.3 A thermostat, capable of maintaining the set temperature within +/- 2°C, shall be positioned in the patient compartment.

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

15.1.5 If an auxiliary interior heater is used in an ambulance to maintain the interior temperature above 10°C, the interior heater shall be permanently installed in a protective metal box mounted within a cabinet in the patient compartment and be equipped with a thermostat.

15.1.6 If the auxiliary heater is powered by 120 volt AC, it shall 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.

15.1.7 The HVAC system shall meet the requirements in Testing Standard 45.0.

15.1.8 When an ambulance body is remounted on a different chassis, the final stage manufacturer shall provide the Registrar with documents certifying that the HVAC system is compliant with 15.1.7.

Part C – Class 3 Ambulance: Primary Response Units and Emergency Response Support Vehicles

16.0 Driver's Cab

16.1 Door Open Warning

16.1.1 A Class 3 ambulance shall have 'DOOR OPEN' warning lights that comply with 7.2.

16.2 Switch Panel

16.2.1 A central console located in the cab shall contain

- a) controls for emergency warning lights, siren, and other ambulance functions;
- b) a voltmeter that monitors the voltage of the battery systems;
- c) an ammeter that indicates the charge supplied by the generating system; and
- d) controls for HVAC and interior lighting.

- 16.2.2 In addition to the requirement in 16.2.1, the HVAC and interior lighting functions may also be controlled from secondary locations in the ambulance.
- 16.2.3 All switch and gauge functions shall be clearly labelled and illuminated so as to be visible in all lighting conditions.
- 16.2.4 Nothing installed or stowed in the cab shall
 - a) impede the driver's access to the console controls; or
 - b) block the driver's view of any the controls, gauges or indicator lights.
- 16.2.5 The top of the switch panel shall not be positioned more than 30mm above the top of the dashboard.

17.0 Construction

17.1 Certifications

- 17.1.1 The final stage manufacturer shall provide test documentation and an engineer's certificate stating that an ambulance meets the requirements in CMVSS 216 or CMVSS 220 when the manufacturer has:
 - a) constructed a multi-purpose passenger vehicle by adding a passenger body to a cab-chassis vehicle or truck; or
 - b) altered the roof or body structure of a passenger car, multi-purpose passenger vehicle, truck or bus.

17.2 Safety Barrier

- 17.2.1 If equipment or supplies are carried in an area behind the driver's or any passenger's seat, a safety barrier shall be installed to restrain the equipment in event of a collision.
- 17.2.2 The safety barrier shall meet the requirements in Testing Standard 42.0.

17.3 Entrance Steps

- 17.3.1 An auxiliary step shall be provided at each passenger entrance where the height of the first step is more than 400mm above ground level.
- 17.3.2 Fixed or retractable auxiliary steps, including those at the cab entrances, shall meet the requirements in Testing Standard 44.0.

18.0 Patient Compartment

18.1 Patient Compartment Dimensions

- 18.1.1 If a Class 3 ambulance is equipped to transport a patient in a recumbent posture, the transport area shall have at least:
 - a) 650mm between the top surface of the transport device on which the patient is secured and the ceiling; and
 - b) 1930mm between the back of the driver's seat and the rear doors.

18.2 Patient Securement

- 18.2.1 A patient transported in a recumbent posture shall be secured by a retention system that orients the patient and transport device parallel with the longitudinal axis of the vehicle.
- 18.2.2 A retention system required in 18.2.1 shall be tested to meet the requirements in Testing Standard 46.0 based on securing a mass of not less than 150kg.

18.3 Interior Lighting

- 18.3.1 If a Class 3 ambulance is equipped to transport a patient in a recumbent posture, the interior shall have lighting with variable intensity capabilities.

- 18.3.2 When on the highest setting, the lighting required in 18.3.1 shall meet the requirements in Testing Standard 39.3.4.

19.0 Low-voltage Electrical System

19.1 General

- 19.1.1 Emergency warning lights, siren and accessory electrical equipment installed by a final-stage manufacturer shall be served by wiring circuits distinct from the OEM chassis circuits and controlled by a “master power” switch.
- 19.1.2 The ambulance conversion circuits shall include an automatic timer that shuts off power to the conversion not more than 10 minutes after engine shutdown.
- 19.1.3 Despite 19.1.2, there shall be an override feature that allows the conversion circuits to be re-energized without the engine being started.
- 19.1.4 Electrical panels located in compartments where equipment or supplies may be stored shall have a protective cover.
- 19.1.5 The generating system shall meet the requirements in Testing Standard 47.0, and a certification tag shall be affixed to the ambulance.

19.2 Batteries

- 19.2.1 An ambulance conversion’s electricity storage system shall be served by one or more dedicated batteries that are electrically separated from the OEM battery system.
- 19.2.2 Each battery shall be located in a ventilated area, sealed off from the occupant and oxygen compartments.

19.3 Fuses and Circuit Breakers

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

19.4 Remote Switching

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

19.5 Electrical Load Rating

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.

19.6 Wiring

- 19.6.1 All electrical wiring shall be copper, with CSA/C-UL approved insulation.
- 19.6.2 Any variation from 19.6.1, other than data wire used in multiplex electrical systems, shall be approved by the Registrar.
- 19.6.3 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 an ambulance body.
- 19.6.4 Wiring shall 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.

20.0 Exterior Lighting Systems

20.1 Emergency Warning Lights

- 20.1.1 Emergency warning lights shall be either red or white as required in this section.

- 20.1.2 A minimum of four red emergency warning lights and maximum of one white emergency warning light, mounted above a plane parallel to the top of the windshield, shall provide emergency warning to the front of the ambulance. The white light shall be located near to the vehicle's centreline.
- 20.1.3 At least one red emergency warning light, mounted above a plane parallel to the top of the windshield, shall provide emergency warning to the left and right sides of an ambulance.
- 20.1.4 A minimum of two red emergency warning lights, mounted above a plane parallel to the top of the windshield shall provide emergency warning to the rear of an ambulance.
- 20.1.5 Despite anything else in this section, the front, side and rear emergency warning lights may be incorporated into a single, roof-mounted light bar so long as the light bar is mounted near the midpoint of an ambulance's length.
- 20.1.6 At least two emergency warning lights shall be visible behind an ambulance when the rear doors are open.
- 20.1.7 Despite 20.1.1 the rear of an ambulance may be equipped with an amber, directional arrow device, provided it is wired so that it can only be activated when the vehicle's gear shift is in 'PARK'.
- 20.1.8 The emergency warning light system shall meet the requirements in Testing Standard 36.0.

20.2 Grille Lights

- 20.2.1 A minimum of two red emergency warning lights shall be installed on the vertical plane of the grille such that the location is compliant with any OEM guidelines regarding air flow through the grille.
- 20.2.2 The grille lights shall be located between top of the bumper and the bottom of the windshield, and separated laterally as far as practicable.

20.3 Intersection Warning Lights

- 20.3.1 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.
- 20.3.2 If a red and white light is installed, it shall be wired to flash in an alternating pattern.

20.4 Emergency Light Switching

- 20.4.1 The emergency warning lights shall be wired and controlled as required in 11.6.

20.5 Flash Patterns

- 20.5.1 The emergency warning lights shall flash in the patterns required in 11.7.

20.6 Wigwags

- 20.6.1 A Class 3 ambulance may be equipped with wigwag warning lights.
- 20.6.2 Wigwag warning lights shall comply with the requirements in 11.8.

20.7 Exterior Task Lighting

- 20.7.1 A Class 3 ambulance may have exterior white floodlights to provide task lighting to the sides and rear of the vehicle.
- 20.7.2 If a Class 3 ambulance is equipped to transport a patient in a recumbent position, a minimum of one white floodlight shall be installed in a manner so as to provide task lighting at the rear of the ambulance when the patient is being loaded.
- 20.7.3 Task lights shall be individually controlled by switches on the driver's control console.
- 20.7.4 Despite 20.7.3, a task light that is mounted on the inside of a rear lift gate may be controlled by a switch adjacent to the rear entrance.
- 20.7.5 A light required in 20.7.2 shall meet the requirements in Testing Standard 37.3 (c).

21.0 Audible Emergency Warning (Siren)

- 21.1 A Class 3 ambulance shall be equipped with an audible emergency warning system consisting of a siren amplifier and one or more speakers.

- 21.2 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.
- 21.3 The siren speakers shall be mounted on the forward vertical plane of an ambulance according to installation instructions from the manufacturer and any guidelines provided by the OEM.
- 21.4 The siren system shall meet the requirements in Testing Standard 38.0.

22.0 Safety Equipment

22.1 Assist Handles

- 22.1.1 An assist handle, installed by either the OEM or a final-stage manufacturer shall be available at each passenger entry door.
- 22.1.2 Assist handles installed by a final stage manufacturer shall meet the requirements in Testing Standard 43.0.

22.2 Miscellaneous Safety Equipment and Signs

- 22.2.1 “NO SMOKING” and “Buckle Up” signs shall be posted in and clearly visible within the driver’s cab and patient compartment.

Part D – Class 4 Ambulance: Regulated Non-Emergent Transport (RNET)

23.0 Interpretation

Chassis-cab	means an incomplete vehicle with a completed occupant compartment that requires only the addition of a cargo-carrying surface, work-performing equipment or load-bearing component to perform its intended functions
Mobility Aid	means a device used to facilitate the transport, in a seated posture, of a person with a disability (e.g. powered scooters and manual or powered wheelchairs)
Multi-purpose Passenger Vehicle	means a vehicle having a designated seating capacity of 10 or less that is constructed either on a chassis-cab or truck chassis, but does not include a passenger car, truck or bus
Technical Standards Document	means a standards document published under the Motor Vehicle Safety Regulations from time to time by Transport Canada

24.0 Construction

24.1 Certifications

- 24.1.1 The final stage manufacturer shall provide test documentation and an engineer’s certificate stating that the vehicle meets the requirements in CMVSS 220 when the manufacturer has:
 - a) constructed a multi-purpose passenger vehicle by adding a passenger body to a cab-chassis vehicle or truck; or
 - b) altered the roof or body structure of a passenger car, multi-purpose passenger vehicle, truck or bus.

25.0 Patient Compartment

25.1 Patient Compartment Dimensions

- 25.1.1 A Class 4 ambulance that has a combined purpose, one of which is to transport a passenger using a multi-level cot, shall have at least
- a) 1275mm headroom between the floor and the ceiling;
 - b) 1830mm of headroom if it is designed such that a patient would be required to walk to a seat;
 - c) 2150mm between fixed structures at the head and foot of the cot;
- 25.1.2 A Class 4 ambulance that has a combined purpose, one of which is to transport a passenger using a mobility aid, shall have at least
- a) 1500mm of the interior headroom;
 - b) 1830mm of interior headroom if it is designed such that a patient would be required to walk to a seat.

25.2 Patient Compartment Doors

- 25.2.1 A Class 4 ambulance that transports a passenger with physical disabilities shall have an ambulatory entrance door that meets the requirements of CSA D409-02, Sections 6.3.
- 25.2.2 A Class 4 ambulance that transports a passenger using a mobility aid shall have an emergency exit door that meets the requirements of CSA D409-02, Section 6.4.

25.3 Patient Compartment Seating

- 25.3.1 Each seat or mobility aid in which a passenger is transported in a seated posture shall face either forward or rearward.
- 25.3.2 When a passenger is transported in a mobility aid, there shall be dedicated space and a restraint system that meet the requirements of CSA D-409-02, Section 7.

25.4 Securing of Cots

- 25.4.1 A cot retention system, approved for use with the cot being secured, shall be installed for each multi-level cot position.
- 25.4.2 A multi-level cot on which a passenger is transported shall be parallel with the longitudinal axis of the ambulance.
- 25.4.3 Cot retention systems shall meet the requirements in Testing Standard 35.0.

25.5 Mobility Aid Access

- 25.5.1 A Class 4 ambulance that transports a passenger using a mobility aid shall have:
- a) an entrance that meets CSA D409-02, Section 6.3.3; and
 - b) a lift that meets CSA D409-02, Section 8 or a ramp that meets CSA D409-02, Section 9.

26.0 Low-voltage Electrical System

26.1 General

Accessory equipment that is added by a final-stage manufacturer shall be served by electrical circuits that are distinct from the OEM chassis circuits and controlled by a “master power” switch.

26.2 Switch Panel

- 26.2.1 Where electrical appliances and circuits are installed in addition to those supplied by the OEM, the additions shall be controlled by a switch panel that is readily accessible to the driver.
- 26.2.2 In addition to the switch panel required in 26.2.1, these functions may also be controlled from secondary locations in the vehicle.

27.0 Exterior Lighting Systems

27.1 General

- 27.1.1 A Class 4 ambulance may not be equipped with emergency warning lights or a siren.
- 27.1.2 Despite 27.1.1, a Class 4 ambulance may be fitted with one or more amber warning lights, in addition to any amber OEM lights, if they are wired so that they can be activated only when the vehicle's gear shift is in 'PARK'.

27.2 Exterior Task Lighting

- 27.2.1 If a Class 4 ambulance is equipped to transport a passenger on a multi-level cot or in a mobility aid, there shall be a minimum of 1 white floodlight to provide task lighting at the entrance where the patient is being loaded.
- 27.2.2 Task lights may be controlled by door-activated switches or manual switches located adjacent to the entrance.
- 27.2.3 A light required in 27.2.1 shall meet the requirements in Testing Standard 37.3(c).

28.0 Medical Systems

28.1 Medical Oxygen System

- 28.1.1 A Class 4 ambulance may have a piped medical oxygen system installed in the passenger compartment.
- 28.1.2 If a piped medical oxygen system is installed, it shall include:
 - a) a tank holder that meets the requirements in 3.8;
 - b) a medical oxygen cylinder having at least a 1,700-litre capacity that is fitted with a pressure-reducing regulator complete with a contents gauge and preset to 344.5 kPA;
 - c) non-ferrous piping or low pressure, electrically-conductive, medical grade hose;
 - d) one or more self-sealing wall outlets that have gas-specific threaded connectors; and
 - e) a pressure-compensated flow meter for each wall outlet that is being used to administer oxygen to a patient.
- 28.1.3 The system shall meet the requirements in Testing Standard 50.0.

28.2 Fixed Suction System

- 28.2.1 A Class 4 ambulance may have a fixed suction system installed in the patient compartment.
- 28.2.2 The suction system shall comply with the requirements in 13.2.2.
- 28.2.3 The suction system shall meet the requirements in Testing Standard 51.0.

29.0 Safety Equipment

29.1 Assist Handles / Assist Rails

Assist handles and assist rails installed by a final-stage manufacturer shall meet the requirements in Testing Standard 43.0.

29.2 Miscellaneous Safety Equipment and Signs

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

30.0 Environmental Control System

30.1 General

- 30.1.1 Heating, ventilation and air conditioning (HVAC) components that are installed in a Class 4 ambulance by a final-stage manufacturer shall be capable of maintaining the passenger

compartment within a temperature range of 16°C to 25°C when ambient temperatures are -18°C to +35°C.

30.1.2 An HVAC system described in 30.1.1 shall meet the requirements in Testing Standard 45.0.

Part E: Testing Standards

31.0 Obligation of Ambulance Conversion Manufacturer

31.1 Type Certifications

- 31.1.1 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.
- 31.1.2 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.
- 31.1.3 Despite 31.1.2, CMVSS certifications made by an OEM, as evidenced by the National Safety Mark decal attached to the vehicle, are acceptable provided the vehicle has not been altered since its manufacture.

31.2 Individual Certifications

- 31.2.1 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.
- 31.2.2 The manufacturer shall provide documentation as required in this section to demonstrate compliance.

31.3 Special Certifications

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.

32.0 Ambulance Body Structure Static Load Test – Type Certification

32.1 Scope

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

32.2 Purpose

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

32.3 Applicability

- 32.3.1 This standard is applicable to all Class 1 and Class 2 modular ambulance bodies and all other ambulances where modifications have been made to the OEM roof.
- 32.3.2 A Class 4 ambulance that is a bus may be certified by the bus manufacturer to a CMVSS 220 (roll-over protection).

32.4 Interpretation

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
-----------------------	---

32.5 Roof Test Requirements

When a force of at least 2.5 times the converted curb weight of a Type I and III ambulance, and of at least 1.5 times the converted curb weight of a Type II and all applicable Class 3 and 4 ambulances, is applied to the roof of the body structure through a force application plate:

- a) downward vertical movement at any point on the application plate shall not exceed 100mm;
- b) 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
- c) 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.

32.6 Side Test Requirements

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:

- a) downward vertical movement at any point on the application plate shall not exceed 100mm;
- b) 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
- c) 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.

32.7 Roof Test Procedure

- a) 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.
- b) If a modular body is tested off of the chassis that it is intended for, then:
 - (i) the module shall be placed on 'I' beams to simulate the chassis frame; and
 - (ii) the total weight applied shall still include at least 2.5 times the converted curb weight of the finished ambulance.
- c) Apply a rigid, rectangular force application plate fitted as near as possible to the contour of the ambulance roof.
- d) 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.
- e) 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 13mm per second, until a force of 2,200 newtons has been applied.
- f) Record elevation readings at all four corners of the application plate.
- g) Apply additional vertical force in a downward direction to the application plate at a rate of not more than 13mm per second until 50% of the specified force has been applied. Record elevation readings at all four corners.
- h) Continue to apply a vertical force to the application plate until the total specified force is applied. Record elevation readings at all four corners.
- i) With the total load applied, test all doors for compliance and record the results.

- j) Remove the applied load from the application plate. Record elevation readings at all four corners. Compare the results with the original readings to see if there was permanent deformation of the roof and record the results.
- k) Test all doors for compliance and record all results.

32.8 Side Test Procedure

- a) Place the body on its left or right side, on a rigid horizontal surface so that the entire body is supported.
- b) Apply a rigid, rectangular force application plate fitted as near as possible to the contour of the body side.
- c) 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.
- d) 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 13mm per second, until a force of 2,200 newtons has been applied.
- e) Record elevation readings at all four corners of the application plate.
- f) Apply additional vertical force in the downward direction to the application plate at a rate of not more than 13mm per second until 50% of the specified force has been applied. Record elevation readings at all four corners.
- g) Continue to apply a vertical force to the application plate until the total specified force is applied. Record elevation readings at all four corners.
- h) With the total load applied, test the rear doors for compliance and record the results.
- i) Remove the applied load from the application plate. Record elevation readings at all four corners of the body. Compare the results with the original readings to determine if there was permanent deformation of the side.
- j) Test the rear doors for compliance and record the results.

32.9 Test Equipment

- a) Use a flat, rigid rectangular force application plate that is at least 130mm longer and 130mm wider than the ambulance roof or side, measured relative to the vehicle's roof or side longitudinal and lateral centrelines.
- b) 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.

33.0 Body Door Retention Components Test – Type Certification

33.1 Scope

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.

33.2 Purpose

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.

33.3 Applicability

This standard shall apply to all ambulances when any passenger entry door is supplied and installed by a manufacturer other than the OEM.

33.4 Requirements

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.

34.0 Pressure Vessel Retention Test – Type Certification

34.1 Scope

- 34.1.1 This standard establishes minimum requirements for testing all pressure vessel restraints installed in an ambulance or attached to any equipment in an ambulance.
- 34.1.2 This is a two-part procedure that tests the restraint designed to secure the pressure vessel and the restraint's mounting system.
- 34.1.3 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.

34.2 Applicability

This standard applies to all restraints that secure oxygen tanks, fire extinguishers and tanks containing other pressurized gases.

34.3 Interpretation

"Force application cylinder" is a rigid structure with the same physical dimensions as the pressure vessel which the tank holder was designed to restrain
"Required force" means the force that must be applied to the tank holder and tank holder mount
"Tank holder" means the restraint system, including all hardware, provided for securing pressure vessels (tanks) in the ambulance

34.4 Tank Holder Requirements

- a) The required force for this test is 25 times the weight of the fully loaded pressure vessel(s) that the tank holder was designed to restrain.
- b) When the required force is applied to the force application cylinder:
 - 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 at any point from the structure to which it is attached; and
 - iii) the force application cylinder shall not disengage from the tank holder.

34.5 Tank Holder Mount Requirements

- a) The required force for this test is 25 times the weight of the fully loaded pressure vessel(s) that the tank holder was designed to restrain plus 10 times the weight of the tank holder.
- b) When the required force is applied to the tank holder:
 - i) the tank holder or any component thereof shall not separate at any attachment point from the vehicle or any structure within the vehicle to which it is attached; and
 - ii) the part of the vehicle or other structure to which the tank holder is attached shall not fail and/or separate at any attachment point.

34.6 Tank Holder Test Procedure

- a) Insert the force application cylinder into the installed tank holder and apply the required force as specified below. It is not required to apply the forces simultaneously.
- b) Apply the required force to either end of the cylinder so that the action of the force coincides with the longitudinal centreline of the cylinder, in each plane.
- c) Apply the required force 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 the full tank(s).

34.7 Tank Holder Mount Test Procedure

- a) Apply the required force to the installed tank holder as specified below. It is not required to apply the forces simultaneously.
- b) Apply the required force so that the action of the force coincides with the longitudinal centreline of the cylinder, in each plane.
- c) Apply the required force in a plane perpendicular to the longitudinal centreline of the cylinder and which passes through the location corresponding to the centre of gravity of the full tank(s).

34.8 Additional Requirements

In addition to meeting the requirements set out in 34.6 and 34.7, a registered professional engineer shall certify that any horizontal tank holders installed in the ambulance meet the requirements in 3.8.2.

35.0 Cot Retention System Test – Type Certification

35.1 Scope

This standard establishes minimum requirements for testing the installation of cot retention systems in all classes of ambulances and encourages final stage manufacturers to establish and certify the maximum load tolerance for main cot retention systems.

35.2 Interpretation

Cot retention system	means a system attached to an ambulance that provides means for securing a cot
----------------------	--

35.3 Requirements

- 35.3.1 The cot retention system, including anchorages and stretcher fastener(s), shall not fail or release when subjected to a minimum application load of 10 times the combined mass of the cot restraint hardware, the intended cot and a 90th percentile male per current Canadian Community Health Survey data.
- 35.3.2 The load shall be applied in a horizontal plane in a longitudinal, lateral and vertical direction. (Note that these are three individual tests.)
- 35.3.3 For each model of ambulance produced for sale in Alberta, a final stage manufacturer shall provide the Registrar with documentation that states the maximum mass to which the cot retention system has been tested and is certified.
- 35.3.4 A final stage manufacturer shall provide an ambulance purchaser with documentation that states the load rating of the cot retention system.

35.4 Test Equipment

- 35.4.1 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.
- 35.4.2 Force is applied through a pivot located 380mm above the floor, at a point representing the centre of the cot.

35.5 Test Conditions

- 35.5.1 The ambulance floor shall be in a horizontal plane.
- 35.5.2 If the ambulance is designed to secure multiple cots, the cot retention system shall be tested
 - a) in each intended location; or
 - b) in a manner that allows certification of the system at each installation location.
- 35.5.3 If adjustable, the cot retention system shall be adjusted to its most forward position.

35.6 Test Procedure

- 35.6.1 Using the testing device, apply the specified force through the hooks (or other cot-securing means) used in locking onto the cot.
- 35.6.2 Install the testing device in the cot retention system in a manner that will preclude contact friction with the floor or other surfaces.
- 35.6.3 Attach a cable with a calibrated, inline strain gauge to the testing device pivot and apply an initial vertical upward load to the device.
- 35.6.4 As rapidly as possible, apply the full specified force to the device.
- 35.6.5 Record the applied force, start and finish times and any deformation of the floor, cabinetry or retention mechanism.
- 35.6.6 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.)
- 35.6.7 Reinstall the test fixture and repeat the above steps in the longitudinal and again in the lateral direction. Record all resultant data.

36.0 Emergency Lighting System Test – Type Certification

36.1 Scope

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

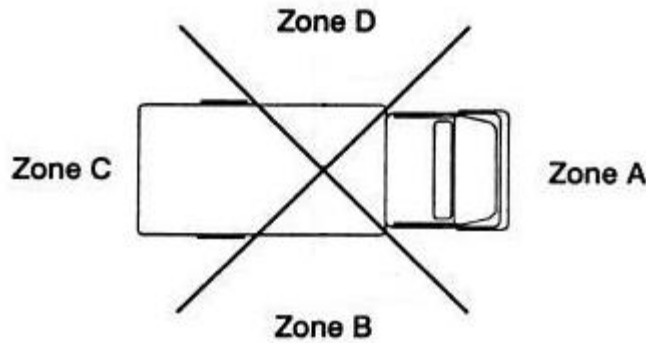
36.2 Requirements

- 36.2.1 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”.
- 36.2.2 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.
- 36.2.3 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

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

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



36.3 Test Procedure

- 36.3.1 Test procedures shall be in accordance with SAE Standard J2498.
- 36.3.2 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.

37.0 Exterior Task Lighting Test – Type Certification

37.1 Scope

This standard establishes minimum performance requirements for exterior task lighting intensity.

37.2 Interpretation

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
Light meter	is the instrument used for measuring illumination. For this standard, a light meter with a resolution of 0.1 Lx is required

37.3 Illumination Requirements

- 37.3.1 To meet this standard, individual illumination levels shall be
 - a) for a Class 1 or Class 2 ambulance, when measured 75mm above ground level
 - (i) at least 11 Lx at a distance of 1.5 metres from the vehicle; and
 - (ii) at least 3.5 Lx at a distance of 3 metres from the vehicle.
 - b) for a Class 3 ambulance, at least 11 Lx at 75mm above ground level and 400mm lateral from the door sill.
 - c) for a Class 4 ambulance
 - (i) at least 22 Lx at floor level at the centre of a mobility aid lift or ramp; and
 - (ii) at least 11 Lx at 75mm above ground level and 400mm lateral from the door sill.

37.4 Illumination Test Conditions

- 37.4.1 Testing shall be done on level ground with the transducer aimed upward.
- 37.4.2 Testing shall be done with minimal ambient light to allow data to be recorded.
- 37.4.3 Ambient air conditions shall be recorded for the test period.

- 37.4.4 All task lights on a specific side of the ambulance are to be tested simultaneously and the electrical load shall be recorded as part of the qualification testing.
- 37.4.5 A digital light meter is to be used in all illumination measurements.
- 37.4.6 All distance measurements are to be made with conventional steel tapes with a resolution of at least 3mm.

37.5 Illumination Test Procedure

- 37.5.1 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.
- 37.5.2 Make sure the electrical section of the ambulance conversion has a fully charged battery pack.
- 37.5.3 For Class 1 and Class 2 ambulances, lay out a grid of test points off the sides and rear of the test ambulance:
 - a) parallel lines are laid out 1.5 metres and 3 metres from the sides and rear of the ambulance;
 - b) the parallel lines are intersected by perpendicular gridlines extending out from the centre of each exterior task light and from each corner and midpoint of the sides and rear of the ambulance. The intersections of the gridlines form the test points for illumination.
- 37.5.4 Measure the ambient illumination at all intersections on the grid. Record these measurements on a graphic map of these locations.
- 37.5.5 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.
- 37.5.6 Repeat 37.5.5 on the other side of the ambulance.
- 37.5.7 Repeat 37.5.5 at the rear of the ambulance.
- 37.5.8 Record all data on a top view of the ambulance showing illumination levels at the 1.5-metre and the 3-metre distances.
- 37.5.9 If a Class 3 or Class 4 ambulance is equipped to transport a patient in a recumbent posture, take a measurement at 75mm above ground level and 400mm lateral from the centre of the loading door sill and record the data.
- 37.5.10 If a Class 4 ambulance is equipped with a wheelchair lift or a ramp, perform the following two tests:
 - a) with the lift or ramp stowed, take a measurement at 75mm above ground level and 400mm lateral from the centre of the door sill and record the data.
 - b) deploy the lift platform to the vehicle's floor level and take a measurement at the centre point and record the data. If a ramp is used, set up the ramp and take a measurement in the centre of the ramp, at 500mm from the door sill.
- 37.5.11 Measure current and voltage for each lighted side of the ambulance prior to taking light readings.
- 37.5.12 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.

38.0 Siren Performance Test – Type Certification

38.1 Scope

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

38.2 Requirements

The siren shall be capable of producing a continuous warning sound at a minimum level of 123 decibels [dB(A)] 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(A) with 13.6 volts \pm .2 input, at a frequency in the range of 500 to 2000 Hz maximum.

38.3 Test Conditions

- 38.3.1 Vehicle doors, windows and vents shall be closed.
- 38.3.2 The siren shall be sounded in its loudest mode of operation.
- 38.3.3 Perform this test under the following meteorological conditions:
 - a) the ambient temperature shall be within the range of 0°C to 30°C;
 - b) wind velocity is not to exceed 18 km/h;
 - c) other meteorological conditions, for example rain and fog, shall be such that they do not influence the measurements;
- 38.3.4 Record ambient temperatures, and wind speed and direction relative to the vehicle's position.
- 38.3.5 Record the date, and start and finish times of the testing.

38.4 Test Procedure

- 38.4.1 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.
- 38.4.2 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.
- 38.4.3 Set the transmission in 'NEUTRAL' or 'PARK' and accelerate the engine to 50 to 60% of its maximum engine speed rating. Stabilize the engine at that speed, turn on the siren and measure its highest sound level.
- 38.4.4 Return the engine speed to idle and repeat the process as specified above until two maximum sound levels within 2 dB(A) of each other are recorded. Calculate and record the average of these two maximum sound level readings.

39.0 Passenger Compartment Lighting Level Test – Type Certification

39.1 Scope

This standard verifies the performance of an ambulance's interior lighting.

39.2 Interpretation

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 a standard candle at a distance of 1 metre and striking a square metre
Light meter	is the instrument used for measuring illumination. For this standard, a light meter with a resolution of 0.1 Lx is required

39.3 Requirements

- 39.3.1 The passenger compartment of an ambulance shall be illuminated at an intensity of at least
 - a) 160 Lx over the centreline of the clear floor when the ceiling lights are in the highest setting;
 - b) 38 Lx over 80% of the centreline of the clear floor when the ceiling lights are in the lowest setting; and
 - c) 22 Lx at the centre point of each internal entrance step when the door is opened.
- 39.3.2 Ambulances where all passenger positions are OEM-installed seats are exempt from 39.3.1.
- 39.3.3 In a Class 1 or Class 2 ambulance, every position where a patient can be transported in a recumbent posture shall be illuminated with at least 376 Lx measured on at least 90% of the top surface area of the transport device.

- 39.3.4 In a Class 3 or Class 4 ambulance, every position where a patient can be transported in a recumbent posture shall be illuminated with at least 376 Lx measured on at least 50% of the centre line of the transport device.
- 39.3.5 In a Class 4 ambulance, every position where a passenger can be transported seated in a mobility aid shall be illuminated with at least 376 Lx at the centre of the top surface of the mobility device.

39.4 Test Conditions

- 39.4.1 The lighting test may be performed at any ambient temperature.
- 39.4.2 Cover all openings and windows to keep out exterior ambient light.
- 39.4.3 The vehicle's engine shall be started and high idle engaged.

39.5 Test Procedure – Floor

- 39.5.1 With the vehicle running, perform the following test:
 - a) With the cot removed, mark the centreline of the floor between the left wall and the squad bench.
 - b) Mark the floor every 150mm along the centreline from the rear doors to the side door.
 - c) With the dome lights set on their highest setting and using a calibrated light meter, record the readings every 150mm along the centreline of the floor.
 - d) With the dome lights set on their lowest setting, record readings every 150mm along 80% of the centerline and at the centre of each internal entry step.

39.6 Test Procedure – Recumbent Transport Position

- 39.6.1 Class 1 or Class 2 ambulance,
 - a) with the cot or alternate transport device installed, mark the top surface in a 150mm grid. This can be done on a flat, non-reflective surface laid on top of the device.
 - b) with the engine running and the dome lights set on their highest setting, use a calibrated light meter to measure the readings in the centre of each 150mm square.
- 39.6.2 Class 3 or Class 4 ambulance,
 - a) with the cot or alternate transport device installed, mark the centreline of the top surface every 150mm.
 - b) with the engine running, use a calibrated light meter to measure the readings every 150mm along at least 50% of the centreline of the intended transport device.

40.0 Occupant Restraint Net Test – Type Certification

40.1 Scope

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

40.2 Requirements

- 40.2.1 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.
- 40.2.2 The occupant restraint net shall be tested and certified to withstand a force of 13,345 newtons.

40.3 Test Procedure – Fasteners

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

40.4 Test Procedure – Occupant Restraint Net

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

41.0 Cabinet Structure and Fastener Test – Type Certification

41.1 Scope

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

41.2 Applicability

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

41.3 Requirements

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.

41.4 Test Procedure

- 41.4.1 Apply the required force to the component using a force application device such that the force is spread equally over the fasteners.
- 41.4.2 Apply the force in a lateral direction. Observe and record the results.
- 41.4.3 Apply the force in a longitudinal direction. Observe and record the results.

42.0 Equipment Restraint Devices Test – Type Certification

42.1 Scope

This standard establishes the minimum static load requirements for devices that secure any equipment or supplies and the securement of the equipment or supplies within the device.

A device that is mounted to a surface and is intended to secure equipment shall be tested in such a manner that both the mounting and the device's capability to secure the equipment are shown to meet the requirements (e.g. mounts for cardiac monitors and sharps containers).

42.2 Applicability

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

42.3 Requirements

- 42.3.1 When a force equal to 10 times the mass of the intended equipment or supplies plus the mass of the restraint is applied to the restraint:
 - a) the restraint shall not fail and/or separate along the attachment points;
 - b) the restraint or any component thereof shall not separate from the vehicle at any attachment point; and
 - c) the thing being restrained shall not separate from the device.
- 42.3.2 Despite 42.3.1, when the mass of the intended equipment or supplies is not evident, a designated storage area shall be tested to secure a mass of 10kg or a computed mass of 45kg per m³, whichever is greater.
- 42.3.3 A safety barrier in a Class 3 ambulance shall be tested to secure a mass of at least 150kg.

42.4 Test Procedure

- 42.4.1 When testing the restraint device for an enclosed storage space, determine the interior volume of the storage space and compute the force required in 42.3.2.
- 42.4.2 Attach a force application device to the restraint and apply the required load incrementally in a plane parallel to the fasteners.
- 42.4.3 Repeat the test procedures, applying the load perpendicular to the initial plane.
- 42.4.4 Examine the restraint and record the results.
- 42.4.5 When testing an equipment-specific restraint device, install the equipment, or a suitable alternative into the device. Apply the required force such that the fasteners are loaded in a plane parallel to the fasteners. Then apply the required force perpendicular to the initial plane.
- 42.4.6 If the load applied either of the test procedures in 42.4.5 does not test whether the equipment will be restrained in the device, apply a third load in a manner that would test the device's capability to restrain the equipment.

43.0 Assist Rail/Assist Handle Retention Test – Type Certification

43.1 Scope

This standard establishes the minimum static load requirements for all assist rails and assist handles.

43.2 Requirements

Assist rails and assist handles shall not detach, loosen or deform during the application of a 135kg load in the directions specified in 43.3 and 43.4.

43.3 Test Procedure – Assist Rail

- 43.3.1 With the vehicle parked on a flat surface, measure the assist rail for straightness and the space between the top sides of the rail and headliner or supporting cabinetry.
- 43.3.2 Attach a force application device to the assist rail at a midpoint between two securing points and apply the required load incrementally in a plane parallel to the rail fasteners. Hold the load for two minutes and release.
- 43.3.3 If equipped with more than two securing points, repeat (b) at the midpoint between two other securing points.
- 43.3.4 Repeat the above test procedures, applying the load perpendicular to the initial plane.
- 43.3.5 Examine and measure the assist rail for loosening or deformation and record the results.

43.4 Test Procedure – Assist Handle

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

44.0 Bumper and Step Test – Type Certification

44.1 Scope

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

44.2 Applicability

This standard applies to any fixed or retractable exterior step or running board that is installed by a final stage manufacturer.

44.3 Interpretation

Independent step	means a step independent of a bumper or any other structure
Combination rear step bumper	means that the rear step and bumper are intrinsic in design and construction
Application plate	means a test weight approximately 900mm long x 250mm wide and weighing a minimum of 225kg

44.4 Requirements

44.4.1 Independent fixed or retractable steps:

- a) when the application plate is applied to the centre of the step area, it shall not deflect more than 25mm; and
- b) after removal of the application plate, there shall not be more than 6.5mm of permanent deformation.

44.4.2 Combination rear step bumper:

- a) 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 25mm; and
- b) after removal of the application plate, there shall not be more than 6.5mm of permanent deformation.

44.5 Test Procedure – Fixed and Retractable Steps, Running Boards

44.5.1 Park the vehicle on a level flat surface and place jack stands under the chassis frame rails to prevent spring deflection during the test.

44.5.2 Measure and record the height at the centre and at each end of the step.

44.5.3 Apply the application plate as close to the centre of the step as possible.

44.5.4 Measure and record the height at the centre and at each end of the step.

44.5.5 Remove the application plate and measure and record any permanent deformation.

44.6 Test Procedure – Combination Rear Step Bumper

44.6.1 Park the vehicle on a level flat surface and place jack stands under the chassis frame rails to prevent spring deflection during the test.

44.6.2 Measure and record the step height at the centre and at each end of the rear step.

44.6.3 Apply the application plate as close to the centre of the rear step as possible.

44.6.4 Measure and record the step height at the centre and at each end of the rear step.

44.6.5 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.

44.6.6 Measure and record the amount of deflection at the centre of the step and the two outside corners of the bumper.

44.6.7 Remove the application plate and repeat the procedure on the opposite corner of the outside bumper step area.

44.6.8 Measure and record the amount of deflection at the centre of the step and the two outside corners of the bumper.

44.6.9 Remove the application plate and measure and record any permanent deformation, measuring at the centre and at each end of the step.

45.0 Environmental Control System Test – Type Certification

45.1 Scope

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

45.2 Class 1 and Class 2 HVAC Requirements:

- 45.2.1 Class 1 and Class 2 ambulances 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 +23°C when operating in ambient temperatures of between -30°C and +35°C.
- 45.2.2 The heating system(s) shall have sufficient capacity to raise the temperature in the vehicle cab and passenger compartment simultaneously to a minimum dry bulb temperature of 20°C, at all 10 test points (nine in the patient compartment and one in the cab), within 30 minutes of the engine reaching operating temperatures. The temperature gradient within the nine thermocouples in the passenger compartment shall not exceed 5°C on completion of the test.
- 45.2.3 The air conditioning system(s) shall have sufficient capacity to lower the temperature at midpoints between the floor and ceiling of the driver and passenger 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.
- 45.2.4 The ventilation system(s) shall be capable of providing a complete change of the air within the ambulance every four minutes when the vehicle is static.

45.3 Class 3 and Class 4 HVAC Requirements:

- 45.3.1 Class 3 and Class 4 ambulances 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 +16°C to +25°C when operating in ambient temperatures of between -18°C and +35°C.
- 45.3.2 The heating system(s) shall have sufficient capacity to raise the temperature in the vehicle cab and passenger compartment simultaneously to a minimum dry bulb temperature of 16°C at a point 450mm above the floor at the centre of the passenger compartment within 30 minutes of the engine reaching operating temperatures.
- 45.3.3 The air conditioning system(s) shall have sufficient capacity to lower the temperature at midpoint between the floor and ceiling in the centre of the passenger compartment to a dry bulb temperature of 25°C within 30 minutes of the engine being started.
- 45.3.4 The ventilation system(s) shall be capable of providing a complete change of the air within the vehicle every six minutes when the vehicle is static.

45.4 Heating System Test – Class 1 and 2 ambulances:

- 45.4.1 The vehicle (with doors open) shall be cold soaked so as to obtain an interior temperature reading of -30°C ± 2.5°C when the time measurement commences.
- 45.4.2 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.
- 45.4.3 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:
 - a) at vehicle (engine) start time;
 - b) 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);
 - c) at the 15-minute mark; and
 - d) at the 30-minute mark.

- 45.4.4 The time and temperatures shall be recorded from nine equally spaced test thermocouples in the patient compartment and one test thermocouple located at the intersection of the centre horizontal and vertical planes of the vehicle cab.
- 45.4.5 In the passenger compartment, the nine thermocouples, in stacks of three, shall be positioned as follows:
- a) the horizontal axis shall be located at the centreline of the vehicle chassis and one stack of three thermocouples shall be located at each of the 1/4, mid and 3/4 point distances between the rear doors and bulkhead; and
 - b) in the vertical plane, each stack shall consist of one thermocouple located at the 1/4, mid and 3/4 point distances between the finished floor and the underside of the ceiling.
- 45.4.6 Heating equipment may be in (air) recirculation mode and all compartment openings, including partition door/window and exhaust vents shall be closed.

45.5 Heating System Test – Class 3 and Class 4 ambulances:

- 45.5.1 Perform the test in the manner described in 45.4.1 through 45.4.3 except
- a) the vehicle shall be cold soaked to a temperature of $-18^{\circ}\text{C} \pm 2.5^{\circ}\text{C}$; and
 - b) start of the test time measurement begins when the engine reaches its normal operating temperature range or when the reading of the thermocouple rises to -15.5°C
- 45.5.2 The time and temperatures shall be recorded from one thermocouple located 450mm above the floor in the centre of the passenger compartment.
- 45.5.3 Heating equipment may be in (air) recirculation mode and all doors, windows and exhaust vents shall be closed.

45.6 Air Conditioning System Test – All Classes:

- 45.6.1 The vehicle (with doors open) shall be heat soaked so as to obtain an interior temperature of $+35^{\circ}\text{C} \pm 2.5^{\circ}\text{C}$ when the time measurement commences.
- 45.6.2 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.
- 45.6.3 Record a minimum of three verification readings of time and temperature (at vehicle start time, the 15-minute mark, and the end time) at the thermocouple placements specified in 45.4.5 or 45.5.2, as the case may be.
- 45.6.4 Air conditioning equipment may be in air recirculation mode and all compartment openings, including partition doors/windows, shall be closed.
- 45.6.5 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.

45.7 Ventilation System Test:

- 45.7.1 Ventilation shall be controlled and evaluated separately within each compartment using good engineering practices.
- 45.7.2 The test report shall contain a detailed description of the methodology used, pictures of the procedure and the results.

46.0 Carbon Monoxide Test – Type Certification

46.1 Scope

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

46.2 Requirements

- 46.2.1 Determine the CO content in the ambient air and the vehicle through a series of operating performance test periods.

46.2.2 The resultant difference between the highest readings in each of the three operating states and the average ambient condition shall not exceed 10 parts per million of CO.

46.3 Test Conditions

46.3.1 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.

46.3.2 Open the vehicle doors and auxiliary windows and ventilate the ambulance with fresh air for 10 minutes with the engine off.

46.3.3 Do not conduct testing during high wind periods (above 25 km/h) or during any type of precipitation.

46.4 Test Equipment

46.4.1 MSA Model I or Model II CO monitor or equivalent instrument with an accuracy of +/- 4%.

46.4.2 Canister of 60–100 parts per million CO.

46.5 Test Procedure

46.5.1 Sample the ambient air around the vehicle and record the results.

46.5.2 Close the windows and doors. Ensure that the heating, air conditioning and ventilation systems are off.

46.5.3 Start and idle the engine in 'PARK' for 10 minutes, then take the following measurements:

- a) monitor CO in the driver compartment, around the doors, windows, floor, engine cowling and openings from the engine compartment for the first five minutes and record the results; and
- b) monitor CO in the patient compartment, at the head of the main cot, for the remaining five minutes and record the results.

46.5.4 Drive the vehicle for 10 minutes on traffic-laden city streets at urban speeds of 30 to 60 km/h. 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.

46.5.5 Drive the vehicle for 10 minutes at highway speeds of 80 to 100 km/h. 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.

46.5.6 Stop the vehicle and repeat the sampling of ambient air around the vehicle. Average the results of the two ambient air samples taken around the vehicle.

47.0 Low-voltage Electrical System Test – Individual Certification

47.1 Scope

47.1.1 This standard establishes testing and certification requirements for ambulance low-voltage electrical systems.

47.2 Applicability

Each ambulance's electrical system shall be tested.

47.3 Requirements

47.3.1 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.

47.3.2 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.

47.4 Test Conditions

47.4.1 The ambulance shall be complete and ready for delivery, including all equipment as specified by the purchaser.

47.4.2 The OEM and conversion batteries shall be fully charged.

- 47.4.3 Ambient temperature shall be a minimum of 21°C.
- 47.4.4 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.

47.5 Test Procedure

- 47.5.1 Install ammeters to measure the maximum load imposed on the OEM batteries and the conversion batteries separately.
- 47.5.2 Install voltmeters to monitor the voltage of the OEM batteries and the conversion batteries separately.
- 47.5.3 Start the engine and set the speed, in accordance with 47.3.1. Ensure that the voltage of the OEM batteries remains between 12.8 and 15 volts for the duration of the test.
- 47.5.4 Run the engine for a 15-minute warm-up period.
- 47.5.5 At the end of 15 minutes, begin the test by ensuring that the following systems (loads) are turned on simultaneously:
 - a) ignition system;
 - b) headlights (low beam) and all CMVSS running lights;
 - c) windshield wipers (on low speed);
 - d) cab air conditioning (at the coldest setting with the highest blower speed);
 - e) two-way radio in receive mode (or add a 5 amp load if the radio is not installed);
 - f) patient compartment ceiling lighting (on high setting);
 - g) patient compartment air conditioning (on coldest setting/highest blower speed);
 - h) emergency warning light system in primary mode and with wigwags on;
 - i) 10 amp medical load or its equivalent;
 - j) left and right scene lights;
 - k) rear scene lights;
 - l) any optional fixed electrical loads specified by the purchaser beyond the scope of this Code; and
 - m) any optional variable electrical loads specified by the purchaser beyond the scope of this Code, set to 60% of the rated maximum.
- 47.5.6 The test period shall last 15 minutes.
- 47.5.7 Record the ammeter readings (in amps) at the beginning and end of the test period.
- 47.5.8 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).
- 47.5.9 Add the higher of the two readings on each ammeter to obtain the required maximum output of the 12 volt DC electrical system.
- 47.5.10 Compare the required maximum output to the generating system's rated maximum output at 93°C and 14 volts DC.

47.6 Test Procedure – OEM Passenger Vehicle Amperage Draw (See 47.1.2)

- 47.6.1 Install ammeters to measure the maximum load imposed on the OEM batteries.
- 47.6.2 Install voltmeters to monitor the voltage of the OEM batteries.
- 47.6.3 Start the engine and set the speed, in accordance with 47.3.1. Ensure that the voltage of the OEM batteries remains between 12.8 and 15 volts for the duration of the test.
- 47.6.4 Run the engine for a 15-minute warm-up period.

- 47.6.5 At the end of 15 minutes, begin the test by ensuring that the following systems (loads) are turned on simultaneously:
- a) ignition system;
 - b) headlights (low beam) and all CMVSS running lights;
 - c) windshield wipers (on low speed);
 - d) air conditioning (at the coldest setting with the highest blower speed);
 - e) interior ceiling lights;

47.7 Certification

- 47.7.1 The ambulance conversion manufacturer shall attach an electrical system certification label to the completed ambulance, certifying that the electrical system complies with 47.5.
- 47.7.2 The information that shall be provided on the certification label is set out in Appendix A of this Code.

48.0 Vehicle Weights – Individual Certification

48.1 Scope

This standard establishes requirements for the distribution of the weight and payload allowance for an ambulance.

48.2 Interpretation

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
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
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
Payload allowance	means the weight obtained by subtracting the converted curb weight from the GVWR

48.3 Requirements

- 48.3.1 The converted curb weight distribution, on a level surface, shall be such that:
- a) no less than 30% and no more than 50% of the vehicle’s weight is on the front suspension; and
 - b) the weight on the left and right wheels on any axle is within 5 percentage points of each other.
- 48.3.2 Where the OEM specifies a weight distribution requirement that differs from 52.3.1(a) the conversion shall conform to that requirement and the ambulance manufacturer shall keep a copy of the OEM specification with the test results.
- 48.3.3 When loaded to the GVWR, the weight on each axle shall be within its respective GAWR.
- 48.3.4 Use of ballast to achieve proper weight distribution is prohibited.
- 48.3.5 Each Class 1 and Class 2 ambulance shall have a payload allowance of at least 770kg (1,700 lbs.) over and above the converted curb weight of the ambulance.
- 48.3.6 The GVWR of a Class 3 and Class 4 ambulance shall be more than the sum of

- a) the converted curb weight of the vehicle plus an allowance of
- b) 75kg for the driver;
- c) 75kg for each seated passenger position;
- d) 125kg for each position where a passenger may be transported in a recumbent posture;
- e) 150kg for each mobility aid position; and
- f) 45kg for miscellaneous equipment and supplies.

48.4 Weight Distribution Test Procedure

48.4.1 Weigh the completed ambulance to obtain

- a) the total converted curb weight;
- b) the converted curb weight of each axle; and
- c) the converted curb weight of the left and right wheel of each axle.

48.4.2 The front to rear weight distribution is calculated as follows:

- a) divide the weight of each axle by the total converted curb weight and
- b) multiply by 100 to obtain the percentage of weight on each axle.

48.4.3 The side to side weight distribution is calculated as follows:

- a) divide the weight of each wheel by the total converted curb weight of that axle and
- b) multiply by 100 to obtain the percentage of weight on each side; and
- c) subtract the smaller percentage from the larger percentage.

48.5 Certification

48.5.1 The ambulance conversion manufacturer shall complete a weight compliance document. The information that shall be provided on the compliance document is set out in Appendix B of this Code.

48.5.2 The manufacturer shall provide a copy of the weight compliance document to the purchaser when the ambulance is delivered.

48.5.3 The manufacturer shall attach a label to the vehicle showing the GVWR, converted curb weight and payload allowance so as to demonstrate compliance with 53.3.5 or 53.3.6, whichever the case may be.

49.0 Centre of Gravity Location – Type Certification

49.1 Scope

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

49.2 Applicability

49.2.1 This standard applies to all ambulance classifications.

49.2.2 OEM passenger vehicles are exempt from the requirements of this section provided they have not been structurally modified or fitted with interior cabinetry.

49.3 Requirements

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

49.3.2 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.

49.3.3 The ambulance manufacturer shall provide a copy of the engineer's certificate to the purchaser when the ambulance is delivered.

49.3.4 The use of ballast to achieve proper location of the ACG is prohibited.

50.0 Oxygen System Test – Individual Certification

50.1 Scope

This standard establishes testing requirements for a fixed oxygen system.

50.2 Requirements

50.2.1 When subjected to a proof pressure of at least 1034 kPa, the oxygen system shall show no pressure drop over a period of two hours.

50.2.2 Every ambulance shall be tested and a certificate demonstrating compliance with (a) presented to the purchaser when the ambulance is delivered.

50.3 Test Procedure

50.3.1 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.

50.3.2 Turn the cylinder on to pressurize the system and inspect all joints for leaks. Fix any leaks noted.

50.3.3 Attach a pressure gauge (0-1380 kPa) securely to the oxygen outlet at the action wall.

50.3.4 Pressurize the system to 1034 kPa and record the gauge reading. Turn off the cylinder, leaving it attached to the inlet connector.

50.3.5 Record the gauge reading after two hours.

50.3.6 After successful completion of testing, the system shall be capped with plastic end caps and tagged with a certificate tag setting out the:

- a) testing start time;
- b) initial pressure reading;
- c) testing end time;
- d) final pressure reading;
- e) date of testing; and
- f) signature of the tester.

51.0 Fixed Suction System Test – Individual Certification

51.1 Scope

This standard establishes the testing requirements for a fixed suction system.

51.2 Requirements

51.2.1 The suction system shall achieve a vacuum of at least 300mm Hg within four seconds after the suction tube is clamped off.

51.2.2 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.

51.2.3 Every ambulance shall be tested and a certificate demonstrating compliance with 56.2.1 and 56.2.2 shall be provided to the purchaser when the ambulance is delivered.

51.3 Test Conditions

51.3.1 The test may be performed at any ambient temperature.

51.3.2 Start the engine and engage the high idle speed control for the duration of the test.

51.3.3 The vacuum control and shut-off valve shall be fully open.

51.4 Test Procedure

51.4.1 Vacuum Performance:

- a) install the suction tubing on the collection bottle inlet;
- b) turn on the vacuum pump;
- c) clamp or plug the end of the suction tubing;
- d) using a stopwatch, start the timing when the end of the suction tubing is clamped; and
- e) record the gauge reading at the end of four seconds.

51.4.2 Airflow Performance:

- a) attach a flow meter 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

- Gross Vehicle Weight Rating (GVWR) _____ kg**

- Chassis Curb Weight Distribution:
 - Chassis Curb Weight _____ kg
 - Front Axle
 - Gross Axle Weight Rating (GAWR) _____ kg
 - Converted Axle Weight, Total _____ kg
 - Converted Axle Weight, Left Side _____ kg
 - Converted Axle Weight, Right Side _____ kg
 - Rear Axle
 - Gross Axle Weight Rating (GAWR) _____ kg
 - Converted Axle Weight, Total _____ kg
 - Converted Axle Weight, Left Side _____ kg
 - Converted Axle Weight, Right Side _____ 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 _____%

** Minimum information required on the compliance label to be attached to an ambulance