



Washington Office of Superintendent of
PUBLIC INSTRUCTION

Washington State School Bus Specifications



2025

SPECIFICATIONS FOR SCHOOL BUSES

2025

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The Superintendent would like to acknowledge the dedicated work of all those involved in the development and production of this manual. The result of this work is a safer, more efficient school bus to provide transportation for the students of Washington State, to and from school and school activities.

DEFINITIONS

The following definitions are used in this manual:

- "School bus" shall mean every vehicle with a seating capacity of more than ten persons, including the driver, regularly used to transport students to and from school or in connection with school activities.
- A Type A school bus shall mean a conversion bus constructed utilizing a cutaway front section vehicle with a left side driver's door. This definition includes two classifications: Type A-1, with a Gross Vehicle Weight Rating (GVWR) of 14,500 pounds or less; and Type A-2, with a GVWR greater than 14,500 pounds, not to exceed 36-passenger seating capacity.
- A Type B school bus shall mean a conversion or body constructed and installed upon a van or front section vehicle chassis, or stripped chassis, with a GVWR greater than 10,000 pounds, designed for carrying more than ten persons. Part of the engine is beneath and/or behind the windshield and beside the driver's seat, and the service entrance door is behind the front wheels.
- A Type C school bus shall mean a body installed upon a flat back cowl chassis, or a stripped chassis, with a GVWR greater than 21,500 pounds, designed for carrying more than ten persons. The service entrance door is behind the front wheels. This type also includes the above chassis with a passenger seating capacity greater than 36 and may have a left side driver's door.
- A Type D school bus shall mean a body installed upon a chassis, with a GVWR greater than 10,000 pounds, designed for carrying more than ten persons. The engine may be behind the windshield and beside the driver's seat, at the rear of the bus behind the rear wheels, or midship between the front and rear axles. The service entrance door is ahead of the front wheels.
- A Special Needs School bus shall mean any Type A, B, C, or D school bus as defined in this section, which has been modified to transport students requiring the use of a Wheelchair/Mobility Aid Position or Lift.
- A Multifunction School Activity Bus (MFSAB) shall mean a school bus whose purposes do not include transporting students to and from home or school bus stops, "as defined in 49 CFR 571.3." this subcategory of school bus meets all FMVSS for school buses except the traffic control requirements.

SECTION I: SCHOOL BUS SPECIFICATIONS

Air cleaner

- The bus shall be equipped with a heavy duty, dry-element, or equivalent, air cleaner.
- All diesel engine air filters shall include a latch-type restriction indicator that retains the maximum restriction developed during operation of the engine. The indicator shall include a reset control.

Aisle

Minimum width of all aisles shall be 12 inches. (Also see SECTION II, Special Needs Page 45).

Alternator

- Alternators shall have the following capacities:
 - ✓ Buses 15,000 lbs. or less Gross Vehicle Weight Rating (GVWR) shall have a minimum output of at least 130 amperes. Buses equipped with an electrically powered wheelchair lift and/or air conditioning shall be equipped with the highest rated capacity available from the chassis OEM.
 - ✓ All buses over 15,000 lbs. GVWR, shall be equipped with a heavy-duty truck or bus-type alternator, having a minimum output rating of at least 200 amperes, and shall produce a minimum current output of 50 percent of the output rating at engine idle speed.
 - ✓ Buses over 15,000 lbs equipped with an electrically powered wheelchair lift and/or air conditioning shall have a minimum alternator output of 240 amps and may be equipped with a device that advances the engine idle speed when the voltage drops to, or below, a pre-set level.
- A belt driven alternator shall be capable of handling the rated capacity of the alternator with no detrimental effect on any other driven components. (For estimating required alternator capacity, see School Bus Manufacturers Technical Council's publication. "School Bus Technical Reference" available at [NASDPTS' website](#).)
- A direct-drive alternator is permissible in lieu of a belt drive.

Axle Loading

See Code of Federal Regulation (CFR) 49, Parts 567 and 568 and Revised Code of Washington (RCW) 46.44.041 and RCW 46.44.042. (See Appendix, Page 70, Item 18.)

Axles

- The front and rear axle and suspension systems shall have a gross axle weight rating (GAWR) at ground corresponding with the respective front and rear weight loads of the bus loaded to the rated passenger capacity.
- The rear axle shall be full floating.

- The front axle shall have oil bath hubs or maintenance free sealed greased bearings.

Back-Up Alarm (Optional)

An automatic audible alarm may be installed behind the rear axle and shall comply with the published Backup Alarm Standards (SAE J994b), providing a minimum of 112 dBA, or shall have a variable volume feature that allows the alarm to vary from 87 dBA to 112 dBA sound level, staying at least 5 dBA above the ambient noise level.

Battery

- The battery shall have a minimum cold cranking capacity rating equal to the cranking current required for 30 seconds at 0° Fahrenheit (-17.8°C) and a minimum reserve capacity rating of 120 minutes at 25 amperes.
- Two batteries or more are acceptable if the combined capacity rating meets or exceeds the preceding requirements.
- Buses may be equipped with a battery shut-off switch. If equipped, the switch is to be mounted in a location not readily accessible to the driver or passengers.
- **Type A** The battery or batteries may be standard installation provided by the chassis manufacturer. If a second battery is required to meet the Cold Cranking Amps (CCA) requirement, and not placed under the hood, it must be mounted as stated in Item 5, below.
- **Type B, C, D** The battery(ies) shall be securely attached on a slide-out or swing-out tray in a closed, vented compartment in the body skirt whereby the battery may be exposed to the outside for convenient servicing. Battery compartment door or cover shall be hinged at the front or top and secured by an adequate and conveniently operated latch or other type fastener. The door may be an integral part of the battery slide tray.
- The battery cable lengths shall be according to School Bus Manufacturer's Technical Council (SBMTC), School Bus Technical Reference Book, current edition. (*See Appendix, Page 69, Item 2.*)

Belt cutter

All buses shall be equipped with a belt cutter. The belt cutter shall be secured in the driver's compartment within the driver's reach while the driver is seated. If not in view, the compartment must be labeled. The belt cutter shall be durable and designed to prevent the operator or others from being cut during use.

Body Sides, Exterior

Exterior body sides shall be free of all projections or protuberances capable of snagging or catching clothing. Fuel door latches (Mouse Ears) could constitute a snagging hazard and should be removed.

Brakes

- All brake lines shall be protected from excessive heat and vibration and be so installed as to prevent chafing.

- Parking brake control shall be in plain view and within easy reach of the driver while seated in a normal driving position with the seat belt fastened.
- All brake systems shall be designed to permit visual inspection of brake lining wear without removal of any chassis components, except the dust cover.
- The parking brake shall meet the holding requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 571.121.s5.6.2 and FMVSS No. 571.105.s.5.2.1.
- Antilock brake systems for either air or hydraulic brakes shall include control of all axles in compliance with FMVSS No. 121 and 105, respectively.

Brakes, Air

- The service brake system shall act directly on all wheels.
- Each bus shall have a braking system with spring or air-actuated emergency/parking brake capability.
- The emergency/spring brakes shall be automatically applied when the air pressure in all service reservoirs falls below 45 pounds per square inch (PSI) and activates at no less than 20 PSI.
- The emergency/spring brakes shall remain applied after automatic or manual application, even upon restoration of service reservoir system air, until parking control is manually released by the driver.
- The chassis brake system shall conform to the provisions of FMVSS No. 105, *Hydraulic and Electric Brake Systems*, No. 106, *Brake Hoses*, and No. 121, *Air Brake Systems*, as applicable. All buses shall have either a parking pawl in the transmission or a park brake interlock that requires the service brake to be applied to allow release of the parking brake.
- The vehicle securement switch, if installed, shall be a switch located in the driver compartment within easy reach of the driver from a driving position. When applied, the switch will activate a system that will secure the bus by means of applying the service brake, spring brake, or transmission lockup or any combination. Deactivation may be by other means than the switch. The spring brake control valve (PP1) may be a part of this system but does not take the place of this switch. The switch shall be guarded as to prevent accidental application.
- The Safety Brake Sets "Brake Alert System" which warns the driver when they leave their seat is allowed.
- All air brake systems shall be equipped with a desiccant-type air dryer installed according to manufacturer's specifications.
- All buses with air brakes shall be equipped with a compressor rated no less than 12- cubic feet per minute (CFM).
- The air braking system shall include an illuminated gauge or gauges on the instrument panel to monitor service air pressure. Audible and visible low-pressure indicators will give continuous warning to the operator when the air pressure in either system falls below 60 PSI.
- The supply or "wet tank" reservoir shall be equipped with a condensate drain valve that can be operated from either the driver's compartment or from alongside the bus body.

- All reservoirs shall have a condensate drain valve. The service brake reservoirs shall have the largest available dump valve that can be manually operated from inside or outside the bus. There shall be a fitting to allow the system to be charged from shop air.

Brakes, Hydraulic

- Buses shall be equipped with dual hydraulic brake systems, shall be power assisted and of the type that will operate even if the engine is not running.
- All brake systems shall be equipped with warning signals, readily audible and visible to the operator that will give a continuous warning should any malfunction of either the brake pressure system or booster system occur. Those brake systems using vacuum shall give continuous warning when the vacuum in the system available for braking is eight (8) inches of mercury or less, and shall have an illuminated gauge which will indicate to the operator the vacuum available for the operation of the brakes? (A1, A2, and B buses - gauge not required.)
- Any vacuum power assist unit shall be the largest unit recommended by the manufacturer for the model chassis.
- An auxiliary vacuum reservoir may be supplied by the manufacturer to supply other vacuum-powered accessories. The reservoir supply shall be protected by a check valve.

Bumpers, Front

- The front bumper shall be of pressed steel channel or equivalent material (except Type A buses having a GVWR of 14,500 lbs. or less, which may be OEM supplied) at least 3/16 inches thick and not less than 8 inches wide (high). It shall extend beyond the forward-most part of the body, grille, hood, and fenders and shall extend to the outer edges of the fenders at the bumper's topline.
- The front bumper, except breakaway bumper ends, shall be of sufficient strength to permit pushing a vehicle of equal gross vehicle weight (GVW) without permanent distortion to the bumper, chassis, or body.
- The bumper shall be designed or reinforced so that it will not deform when the bus is lifted by a chain that is passed under the bumper (or through the bumper if holes are provided for this purpose) and attached to both tow eyes. For the purpose of meeting this specification, the bus shall be empty and positioned on a level, hard surface and both tow eyes shall share the load equally.

Bumpers, Rear

- Rear bumper shall be attached to the chassis frame in such a manner that it may be easily removed, shall be so braced as to develop full strength of bumper section from rear or side impact.
- Rear bumper shall extend beyond the rear-most part of the body surface at least 1 inch, measured at the floor line.
- Rear bumper shall be shielded between body and bumper so as to discourage hitching of rides on the rear of the bus.

- **Type A and B** Rear bumper shall be wrapped around the back corners of the bus. It shall extend forward at least 6 inches, measured from the rear-most point of the body at the floor line.
- **Type A and B** Rear bumper shall be of pressed steel channel, or equivalent strength material, and must be at least 1/8 inch thick and minimum 8 inches wide (high) and of sufficient strength to permit being pushed by another vehicle without permanent distortion.

Camera Systems

Exterior

Exterior view camera systems may be installed to view areas of restricted visibility outside of the bus. Such systems if installed, shall meet the following:

- Cameras:
 - ✓ Shall be a color not contrasting to its background and it shall not interfere with any safety system lettering. Back up cameras are exempt from the contrasting color requirement. These camera housings shall be black or school bus yellow.
 - ✓ Shall not extend over six inches from the surface of the bus.
 - ✓ Shall be mounted as high as possible.
- Exterior Camera System Monitors:
 - ✓ Shall not be mounted where it blocks the driver view in any direction.
 - ✓ Shall only activate when the bus is in reverse for a rear camera or in park for side cameras. For buses without a park position in the transmission, the monitor shall only activate when the parking brake is applied. A forward-facing system monitor shall only activate with the red 8 light warning system.
 - ✓ Shall be automatically controlled without requiring driver action.

Interior

- Cameras may be mounted in the front, side, back and/or mid-ship of the bus. If mid-ship, they must be mounted off center and over a seat back. Corners and sharp edges shall be rounded or covered with a protective material. If mounted on the windshield, they must not be in the Out-of-Service Area as referenced in the WSP Inspection Manual.
- Recording equipment shall be mounted as not to produce any tripping hazard if floor mounted.
- The exterior camera system monitor may be incorporated as part of the interior rear-view mirror as long as when the monitor is inactive, it does not interfere with the normal use of the mirror.

Capacity Plate

A label indicating the maximum design capacity of the bus shall be located near or incorporated in the bus body identification label.

Certification

Chassis, body, and after-market parts manufacturers shall, upon request, certify to the Office of Superintendent of Public Instruction (OSPI) that their product meets all Washington State and National School Transportation Specifications & Procedures on items not covered by certification issued under requirements of the National Traffic and Motor Vehicle Safety Act.

Clutch

- Clutch torque capacity shall be equal to or greater than the engine torque output.
- A starter interlock shall be installed to prevent actuation of the starter if the clutch pedal is not depressed.

Color

- School bus body shall be painted National School Bus Yellow. (See *Appendix*, Page 70, Item 6.)
- All Rub rails and bumpers shall be gloss black. The rub rails trim color shall be at least 2 inches wide.
- Body side lettering shall be black on National School Bus Yellow or National School Bus Yellow on black.
- Grilles may be the manufacturer's standard production color.
- Chassis shall be black. (See *Appendix*, Page 70, Item 7.) Cowl and fenders shall be in National School Bus Yellow (NSBY). (See *Appendix*, Page 70, Item 6 or non-reflective yellow.) The hood may be non-reflective black (See *Appendix*, Page 70, Item 8) or non-reflective yellow.
- The roof of the bus may be painted white except for the vertical portion of the front and rear roof caps. (See *Appendix*, Page 79, Item 19.)
- Wheels may be black, yellow, or manufacturer's standard color.
- Multifunction school activity buses (MFSABs) shall be exempt from these requirements.

Construction

- **Side Intrusion Test:** The bus body shall be constructed to withstand an intrusion force equal to the curb weight of the vehicle, but shall not exceed 20,000 lbs., whichever is less. Each vehicle shall be capable of meeting this requirement when tested in accordance with the procedures set forth below.
- The complete body structure, or a representative seven-body section mockup with seats installed, shall be load-tested at a location 24 inches plus or minus 2 inches above the floor line, with a maximum 10-inch diameter cylinder, 48 inches long, mounted in a horizontal plane.
- The cylinder shall be placed as close as practicable to the mid-point of the tested structure, spanning two internal vertical structural members. The cylinder shall be statically loaded to the required force of curb weight or 20,000 lbs., whichever is less, in a horizontal plane with the load applied from the exterior toward the interior of the test structure.
- Once the minimum load has been applied, the penetration of the loading cylinder into the passenger compartment shall not exceed a maximum of 10 inches from its original point of

contact. There can be no separation of lapped panels or construction joints. Punctures, tears, or breaks in the external panels are acceptable but are not permitted on any adjacent panel.

- Body companies shall certify compliance with this intrusion requirement, including test results, if requested.
- Construction shall be dust-proof and watertight.
- All openings between the chassis and passenger compartment must be sealed. (See Openings, Page 34).
- Colorado Rack and Load Test requirement for all buses ordered after September 1, 2023. The Colorado Rack and Load Test is designed to verify the structural integrity and crashworthiness of school bus design. The test simulates a rollover crash by applying a constant load along the full length of the bus body. This ensures that all pushout windows and emergency exits will be fully functional after an accident occurs. If the school bus should rollover, the Colorado Rack Test ensures that the strength of the passenger cage has sufficient strength to withstand a rollover. For a school bus to be in compliance with the Colorado Rack Test, the structure of the bus cannot deflect more than 5⅛ inches, and all emergency exits must still be operational.

Crossing Control Arm

- All school buses shall be equipped with a crossing control arm. The crossing arm shall:
 - ✓ Be right side mounted on front bumper and be so constructed to prevent injury to students.
 - ✓ When opened, this arm shall extend at least 5 feet 6 inches from the foremost surface of the bumper.
 - ✓ The crossing control arm shall extend simultaneously with the stop signal arm(s), activated by stop signal arm controls.
- Air-braked buses may be equipped with an air or electric actuated control arm. If air, an air pressure regulator valve mounted in an accessible location shall be provided.
- Non-air-braked buses may be equipped with either electric or vacuum actuated control arms.
- If an electric unit is installed on any bus, a quick disconnect plug near the bumper shall be provided. Override switch is not allowed.
- All air, electrical, or vacuum hoses and wiring shall be securely mounted and protected by grommets or loom wherever they pass through or over body or chassis members.
- The crossing arm wand, if painted, shall be school bus yellow or yellow and black.
- The assembly shall include a device attached to the bumper near the end of the arm to automatically retain the arm while in the stowed position. That device shall not interfere with normal operations of the crossing control arm.

Defrosters

- Defrosting and defogging equipment shall direct a sufficient flow of heated air onto the windshield, the window to the left of the driver, and the glass in the viewing area directly to the right of the driver to reduce the amount of frost, fog and/or snow.
- The defrosting and defogging system shall conform to SAE Standards J381 and 382. (See Appendix, Page 70, Item 9.)

- The defroster and defogging system shall be capable of furnishing heated outside ambient air, except that part of the system furnishing additional air to the windshield, entrance door and stepwell may be of the re-circulating air type.

Doors, Service

- The service door shall be located on the right side of the bus within the driver's view.
- Vertical closing edges shall be equipped with flexible material.
- The service door shall be equipped with padding at the top edge of the door opening. Pad shall be at least 3 inches wide and 1 inch thick, including the backing, and extend the full width of the door opening. This may be accomplished with multiple sections with no more than 1 inch between sections.
- The glass in the door shall be of AS-3 grade or better. The bottom of the glass panel(s) shall not be more than 10 inches from the top surface of the bottom step. The top of each upper glass panel when viewed from the interior shall be not more than 3 inches below the interior door control cover or header pad.
- Side cargo-type doors are not permitted.
- The service door shall be a split-type, sedan-type, or jackknife-type. (Split-type door includes any sectioned door, which divides and opens inward or outward.) If one section of a split-type door opens inward and the other opens outward, the front section shall open outward.
- The service door shall have minimum horizontal opening of 24 inches and minimum vertical opening of 68 inches.
- The service door may have manufacturer-supplied lock. It shall not be a padlock-type outside door lock.
- The service door shall be power operated, under control of the driver, and so designed as to afford easy release. The door shall be equipped with a manual release in case of power failure.

Drive Shaft

Torque capacity of the drive shaft assembly shall at least equal maximum engine torque as developed through lowest transmission gear reduction. The drive shaft or each portion, if segmented, shall be equipped with a protective metal guard or guards of sufficient strength to prevent the front of the driveline from dropping to the ground, if broken.

Electrical System/Wiring

- All wiring shall conform to SAE J1292, January 2008 Edition of the Standard.
- Circuits.
 - Wiring shall be arranged in circuits as required, with each circuit protected by a fuse, circuit breaker or field effect transistor. A system of color and/or number coding shall be used and an appropriate identifying wiring diagram of each body as manufactured shall be provided to the end user along with the wiring diagram provided by the chassis manufacturer. A system of color and number coding shall be used on buses

manufactured after January 1, 1992. The following body interconnecting circuits shall be color-coded as noted:

FUNCTION	COLOR
Left-Rear Directional Light	Yellow
Right-Rear Directional Light	Dark Green
Stoplights	Red
Back-up Lights	Blue
Taillights	Brown
Ground	White
Ignition Feed, Primary Feed	Black

The color of cables shall correspond to SAE J1128, October 2013 Edition of the Standard.

- Wiring shall be arranged in at least six regular circuits, as follows:
 - ✓ Head, tail, stop (brake) and instrument panellamp:
 - ✓ Clearance and stepwell lamps. (Stepwell lamp shall be actuated when the service door is opened.).
 - ✓ Dome lamps.
 - ✓ Ignition and emergency doorsignal.
 - ✓ Turn signal lamps; and
 - ✓ Alternately flashing signallamps.
- Any of the above combination circuits may be subdivided into additional independent circuits.
- There shall be at least one circuit for each additional heater or defroster installed.
- Whenever possible, all other electrical functions (such as sanders and electric-type windshield wipers) shall be provided with independent and properly protected circuits.
- The entire electrical system of the body shall be designed for the same voltage as the chassis on which the body is mounted.
- All wiring shall have an amperage capacity equal to or exceeding the designed load.
- All wiring splices shall be done at an accessible location and noted as splices on the wiring diagram.
- The body power wire shall be attached to a special terminal on the chassis.
- All wires passing through metal openings shall be protected by a grommet.
- Wires not enclosed within the body shell shall be fastened securely at intervals of not more than 18 inches. All joints shall be soldered or joined by equally effective connectors.
- Chassis manufacturer shall install a readily accessible terminal strip or connector on the body side of the cowl, or at an accessible location in the engine compartment of vehicles designed without a cowl, that shall contain the following terminals for the body connections:

Body Connectors
A. Main 100-amp body circuit
B. Tail lamps
C. Right-turn signals
D. Left-turn signals
E. Stop Lamps
F. Back-up lamps
G. Instrument panel lights (dimmer controlled)

Emergency Equipment

Fire Extinguisher

- The bus shall be equipped with at least one UL-approved pressurized, dry chemical fire extinguisher. The extinguisher shall be securely mounted in a bracket, located in the driver's compartment and readily accessible to the driver and passengers. A pressure gauge shall be mounted on the extinguisher and shall be easily read without moving the extinguisher from its mounted position.
- The fire extinguisher shall have a total rating of 2A:10B:C or greater and at least 5 lbs. capacity. The operating mechanism shall be sealed with a type of seal that will not interfere with the use of the fire extinguisher.

First Aid Kit

- The bus shall have a removable, moisture-proof and dust-proof first aid kit in an accessible place in the driver's compartment. It shall be properly mounted, secured and identified as a first aid kit. The location of the first aid kit shall be marked. Contents of the first aid kit shall be in compliance with state standards.
- Suggested contents include:
 - Two 1-inch x 2½ yards of adhesive tape rolls.
 - Twenty-four sterile gauze pads 3x3 inches.
 - One hundred- ¾ x 3 inches adhesive bandages.
 - Eight 2-inch bandage compress.
 - Ten 3-inch bandage compress.
 - Two 2-inch x 6 feet sterile gauze roller bandages.
 - Two non-sterile triangular bandages 39x35x54 inches minimum & 2 safety pins.
 - Three sterile gauze pads 36 x 36 inches.
 - Three sterile eye pads.
 - One rounded-end scissors.
 - One pair of medical examination gloves.
 - One mouth-to-mouth airway.

Body Fluid Cleanup Kit

- Each bus shall have a removable and moisture-proof body fluid cleanup kit accessible to the driver. It shall be mounted and identified as a body fluid cleanup kit. Contents of the body fluid cleanup kit shall be in compliance with state standards and should include the following contents:
 - One pair of medical examination gloves.
 - One packet of odor absorbent material.
 - Two water-resistant spatulas.
 - One paper bag with lining or one plastic bag.
 - At least 100 square inches of germicidal wiping cloths **OR**
 - One bottle of Environmental Protection Agency (EPA) registered hospital grade germicidal detergent & at least one plain wiping cloth.
 - One bottle containing at least ½ ounce of antiseptic hand rinse **OR**
 - One packet of antiseptic hand wipe towelettes. All items must be non- flammable.
 - One plastic final disposal bag with twist ties.
 - One step-by-step instruction sheet with corresponding photographs.
- Kit shall be properly secured, be as compact as possible and be conveniently mounted in the driver's area out of reach of seated students.

Highway Warning Kit

- Each school bus shall contain at least 3 retro-reflective triangle road-warning devices that meet the requirements of FMVSS No. 125, *Warning Devices*.
- Whenever possible, the highway warning kit shall be located in the driver's compartment readily accessible to the driver and secured.

Any piece of emergency equipment may be mounted in an enclosed compartment. The compartment shall be labeled in contrasting colored letters not less than 1 inch high identifying each piece of equipment contained therein. All emergency equipment located within the enclosed compartment must be secured and readily accessible. The compartment shall have a latch capable of securing contents therein.

Emergency Exits

- Emergency doors and emergency windows.
 - a. Any installed emergency exit shall comply with the design and performance requirements of FMVSS No. 217, *Bus Emergency Exits and Window Retention and Release*, applicable to that type of exit, regardless of whether or not that exit is required by FMVSS No. 217.
 - b. The upper portion of the emergency door shall be equipped with approved safety glazing, the exposed area of which shall be at least 400 square inches. If installed, the lower portion of the rear emergency door, or if the entire door is glass, the glass shall be approved safety glazing. There shall be no steps leading to the emergency door(s). If a rear-or side- emergency door sill extends above the floor

line, a ramp shall be provided covering all area over which a foot may pass as an individual exits through the door. This will also serve to cover heater hoses or other equipment located above the floor surface leading to any emergency door. If no sill exists and such equipment is recessed into the floor, there may be a removable access cover protruding no more than 1/4 inch above the floor surface in this same area.

- c. Emergency doors shall have a device to maintain a minimum 90-degree opening position. The device shall not require any action on the part of the user other than pushing the door to the specified position, or just beyond the specified position. This device shall be located so it will not impede egress or cause injury.
- d. The device shall be corrosion-resistant and hold the door at the specified opening position with the bus in any position unless the pull of gravity will cause the door to remain open to its fullest extent. The device shall permit the user to close the door from inside or outside of the bus.
- e. Emergency door(s) shall be equipped with padding at the top edge of each door opening. Pad shall be at least 3 inches wide, and 1 inch thick including the backing and extend the full width of the door opening. This may be accomplished with multiple sections with no more than 1 inch between sections.
- f. Each school bus emergency door, side emergency window, or rear emergency window shall have the designation "Emergency Door" (for emergency doors) or "Emergency Exit" (for emergency windows) in letters at least 2 inches high, of a color that contrasts with its background, located at the top of or directly above the door or window on the inside and outside surfaces of the bus. Lettering may be on the glass. Designations meeting the above requirements may be placed on or up to 4 inches below the glass of the emergency window or emergency door(s) (the upper glass for rear-emergency door) on the outside surface of the bus. Concise operating instructions describing the motions necessary to unlatch and open the door or window, in letters at least 3/8 inch high, of a color that contrasts with its background, shall be located within 6 inches of the release mechanism on the inside surface of the bus. An arrow shall be located as close as possible to the release mechanism on the inside to indicate direction of release. The color of the arrow shall be red.
- g. An arrow shall be located as close as possible to the release mechanism on the outside surface of each emergency door or window to indicate direction of release. The color of the arrow shall be black or red.
- h. When the release mechanism is not in the closed position and the vehicle ignition is in the "on" position with the engine running, a continuous warning sound shall be audible at the driver's seating position and in the vicinity of the emergency door having the unclosed mechanism. This warning sound shall also be required for the rear-emergency exit window when moved outward from the closed position no more than 1 inch measured at the bottom edge of the window.

- i. Guard(s) of metal or other material at least equal in strength to metal shall be placed over emergency door control(s) on the inside to reduce the chance of accidental opening.
- j. Provision for opening emergency doors and windows from outside shall consist of a non-detachable device so designed as to discourage hitching of rides but to permit opening when necessary. There shall be no handles on back of bus other than the manufacturer's standard handle(s) on emergency doors or emergency windows.
- k. Emergency door(s) or emergency window locks of any kind are prohibited unless they meet the ignition interlock requirements of FMVSS No. 217, Item S5.2.3, which states in part: "The engine starting system of a school bus shall not operate if any emergency door is locked from either inside or outside the bus." If a lock of any kind is placed in the locked position, with the vehicle ignition in the "on" position and with the engine running, a continuous warning sound shall be audible at the driver's seating position and in the vicinity of the emergency door or window having the locked device.
- l. All school buses with a rear-emergency door and an inside body length of 215 inches or more must also have a left-side emergency door. This measurement is to be made near the centerline of the bus from the rear side of the stepwell to the appropriate point at rear of passenger seating area. (*See Appendix, Page 72, Item 13, for proper measurement procedure.*)
- m. Rear door(s) must be equipped with a fastening device, which may be quickly released from both the inside and outside and designed so as to offer protection against accidental release.
- n. Emergency doors shall have minimum horizontal opening of 24 inches and minimum vertical opening of 45 inches measured from floor level.
- o. The upper portion of the emergency door(s) shall be equipped with glass of AS-3 grade or better. The exposed area shall be not less than 300 square inches for the left-side emergency door and not less than 400 square inches for the rear-emergency door.
- p. Emergency door(s) latch(s) shall be equipped with an interior red colored handle that will extend at least 9 inches from the door jamb toward the center of the emergency door and shall lift up to release the latch.
- q. All buses must have a standard rear-emergency door or a rear-emergency window.
- r. All Type C and D buses equipped with a rear-emergency window must have a left- and right-side emergency door.
- s. If equipped, the left-side emergency door shall be located forward of the rear axle at the approximate center of the usable passenger seating area. If also equipped with a right-side emergency door, then refer to item t. below.
- t. The right-side emergency door may be located behind or in front of the rear axle. If located in front of the rear axle, the door must be as close as practicable to the rear axle. Right and left side emergency doors shall not be directly across from each other.

- u. At a minimum, there shall be clear aisles and side-emergency door openings large enough to permit unobstructed passage of a rectangular parallelepiped 45 inches high, 12 inches wide, and shall extend from the outer edge of the door sill to the center aisle of the bus, keeping the 45 inch dimension vertical, the 12 inch dimension parallel to the opening, and the lower surface in contact with the floor of the bus, or if a sill exists at the side-emergency door, level with the top of the sill at all times.
- v. To achieve the requirements of Item u. above, automatic flip-up seats may be used at side-emergency doors only (See SEATS).
- w. No seat or restraining barrier may extend rearward of the forward most portion of the latch mechanism handle of a side-emergency door when it is in the latched position. (See Appendix, Page 73, Item 15.)
- x. The rear-emergency exit window shall be no smaller than 16 inches in height and 54 inches in width. The window shall be hinged from the top, shall be equipped with a device(s) to assist in opening and shall have a device to maintain a minimum 90-degree opening position. The device shall not require any action on the part of the user other than pushing the door to the specified position, or just beyond the specified position. This device shall be located so it will not impede egress or cause injury.
- y. Platforms or panels shall cover the space between the rear seats and emergency window. These platforms or panels shall be installed on a horizontal plane at a point no more than 4 inches below the bottom of the emergency window.
- Side emergency windows (optional).
 - May not be used to replace state-required emergency exits.
 - Limit of two per side.
 - Shall meet all labeling requirements of FMVSS No. 217.
- Emergency roof exit/ventilator(s). All buses shall be equipped with a minimum number of emergency roof exit/ventilator(s) according to maximum design capacity as follows:
 - ✓ Up to and including 45 passengers = 1 exit.
 - ✓ 46 passengers and above = 2 exits.
 - If the bus is equipped with one-emergency roof exit/ventilator, it shall be located at the approximate center of the usable passenger seating area. If the bus is equipped with two emergency roof exit/ventilators, one shall be in the approximate center of the forward one-half of the usable passenger seating area and one in the approximate center of the rear one-half of the usable passenger seating area.
 - If the bus is equipped with three emergency-roof exits/ventilators, they shall be in the approximate center of each one-third of the usable passenger seating area.
 - In all of the above situations, if locating a roof hatch in the approximate center of a seating area will intersect a roof bow, then placement shall provide maximum separation of the emergency exits.
 - There shall be an alarm on each emergency roof exit/ventilator that will give a continuous warning sound audible at the driver's seating position when any emergency roof exit/ventilator latching mechanism is moved to the emergency exit position.

- Each emergency roof exit/ventilator shall be capable of being opened to its emergency exit position from inside and outside the bus.
- Each emergency roof exit/ventilator shall meet all applicable requirements of FMVSS No. 217.

Engine Shutdown Devices

Devices that automatically shut the engine down completely during operation due to high temperature, low oil pressure, etc., are prohibited. Automatic idle shut down is only allowed with the transmission in park or neutral and the park brake set.

Exhaust System

- The exhaust pipe, after treatment system, and tailpipe shall be outside the bus body compartment and shall be attached to the chassis, so any other chassis component is not damaged.
- The tailpipe and after treatment system shall be constructed of a corrosion-resistant tubing material at least equal in strength and durability to 16-gauge steel tubing of equal diameter.
- The tailpipe may be flush with, or shall not extend more than 2 inches beyond, the perimeter of the body for side-exit pipe or the bumper for rear-exit pipe. The exhaust system shall be designed such that exhaust gas will not be trapped under the body of the bus. Tailpipe may extend through bumper.
- The tailpipe shall exit to the left or right of the emergency exit door in the rear of the vehicle or to the left side of the bus in front of or behind the rear drive axle. The tailpipe exit location on all Types A-1 or B-1 buses may be in accordance with the manufacturer's standards. The tailpipe shall not exit beneath any fuel filler location, emergency door, or lift door.
- The exhaust system shall be insulated in a manner to prevent any damage to any fuel system component.
- The design of the after-treatment systems shall not allow active (non-manual) regeneration of the particulate filter during the loading and unloading of passengers. Manual regeneration systems will be designed such that unintentional operation will not occur.
- For after treatment systems that require Diesel Exhaust Fluid (DEF) to meet federally mandated emissions:
 - a. The composition of DEF must comply with International Standard ISO 22241-1. Refer to engine manufacturer for any additional DEF requirements.
 - b. The DEF supply tank shall be sized to meet a minimum ratio of three diesel fills to one DEF fill.
- The exhaust system on gas-powered buses shall be properly insulated by a securely attached shield or shields at any point where it is 12 inches or less from the fuel tank or connections on the fuel tank.

Fenders, Front

- The total spread of the outer edges of the front fenders, measured at the fender line, shall exceed the total spread of the front tires when the front wheels are in the straight-ahead position.
- The front fenders shall be properly braced and free from any body attachment.

Fire Suppression System

When a fire suppression system is installed, nozzles for fire suppression systems shall be located in the engine compartment, under the bus, in the electrical panel, or under the dash, but shall not be located in the passenger compartment. The system must include a light or buzzer to alert the driver that the system has been activated.

Floor and Floor Covering

- The floor in the under-seat area, including tops of the wheel housings, driver's compartment, and toe board, shall be covered with an elastomer floor covering, having a minimum overall thickness of .125 inch. The calculated burn rate shall be no more than 0.1 mm per minute or less, using the test methods listed in FMVSS No. 302, *Flammability of Interior Materials* using the same test methods, procedures, and formulas. The driver's area and toe board area in all Type A buses may be the manufacturer's standard flooring and floor covering.
- Floor covering must be permanently bonded to the floor and must not crack when subjected to sudden changes in temperature. Bonding or adhesive material shall be waterproof and shall be of a type recommended by the manufacturer of the floor covering material. All seams must be sealed with waterproof sealer.
- The floor covering in the aisles shall be ribbed or other raised pattern elastomer and have a calculated burn rate of 0.1 mm per minute or less as listed in FMVSS No. 302, *Flammability of Interior Materials* using the same test methods, procedures, and formulas. Minimum overall thickness shall be .187 inch measured from the tops of the ribs or raised pattern.
- **Type B, C, and D** A flush-mounted, screw-down sealed inspection plate shall be provided in the floor of the bus for access to the diesel or gasoline fuel tank sending unit and/or fuel pump. This plate shall not be installed under flooring material.

Frame

- The frame or equivalent shall be of such design and strength as to correspond at least to standard practice for trucks of same general load characteristics, which are used for severe service.
- Any secondary manufacturer that modifies the original chassis frame shall provide a warranty at least equal to the warranty offered by the original equipment manufacturer (OEM) and shall certify that the modification and other parts or equipment affected by the modification shall be free from defects in material and workmanship under normal use and service intended by the OEM.

- Any after-market frame modification shall not be for the purpose of extending or shortening the wheelbase.
- Holes in the top or bottom flanges or frame side rails and welding to the frame shall not be permitted except as provided or accepted by the chassis manufacturer. (This does not prevent the use of a shear rubber-type suspension system.)
- Frame lengths shall be provided in accordance with SBMI Design Objectives Booklet, current edition. (*See Appendix, Page 69, Item 2.*)

Fuel Tank

Type A

- Single fuel tank shall be a minimum of 25-gallon capacity or the largest offered by the manufacturer.
- Multiple fuel tanks are permissible if installed by the chassis manufacturer.

Type B, C, D

- Each fuel tank shall be a minimum of 25-gallon capacity and be provided by the chassis manufacturer. The actual draw capacity of each fuel tank shall be a minimum of 83 percent of the tank capacity. Each fuel tank shall be filled from and vented to the outside of the body, the location of which shall prohibit accidental fuel spillage on any part of the exhaust system.
- No portion of the fuel system outside the engine compartment, except the filler tube, shall extend above the top of the chassis frame rail. Fuel lines shall be mounted to obtain maximum possible protection from the chassis frame.
- A fuel filter/water separator with replaceable element shall be installed according to the engine manufacturer's specifications. (Filter/separator shall be heated on diesel engines.)
- Fuel tank installation shall be in accordance with SBMI Design Objectives Booklet, current edition. (*See Appendix, Page 69, Item 2.*)
- If a tank size over 30-gallon capacity is supplied, the location of the front of the tank and filler spout must remain as specified by SBMI Design Objectives Booklet, current edition. (*See Appendix, Page 69, Item 2.*)
- Center-mount tanks meeting all requirements of FMVSS No. 301 are permissible.
- A flush-mounted, sealed inspection plate shall be provided in the floor of the bus for access to the fuel tank sending unit and/or fuel pump. This plate shall not be installed under flooring material.
- The fuel tank may be mounted on the left chassis frame rail or behind the rear wheels on buses equipped with a wheelchair/mobility aid lift.
- Installation of alternative fuel systems, including fuel tanks and piping from the tank to the engine, shall comply with all applicable fire codes in effect on the date of manufacture of the bus. Reference Washington Administrative Code (WAC) 212-50- 040.

Governor

- An engine speed limiter shall be provided and set to limit engine speed, not to exceed the maximum revolutions per minute, as recommended by the engine manufacturer.
- A road speed governor may be installed.

Handrails

At least 1 handrail not less than 20 inches in length shall be provided in an unobstructed location inside the doorway and shall be designed to prevent entanglement, as evidenced by the passing of the NHTSA string and nut test. The handrail shall be a minimum of 1-inch diameter and be constructed from corrosion resistant material(s).

Hand Throttle

Type C and D

All buses shall be equipped with an electric/electronic controlled fast idle.

Heating System—Provision For

The engine shall be capable of supplying water having a temperature of at least 170° Fahrenheit at a flow rate of 50 lbs., or greater, per minute at the return end of 30 feet of 1- inch inside diameter automotive hot water heater hose. (SBMI Standard No.001- Standard code for testing and rating automotive bus hot water heating and ventilating equipment. *See Appendix, Page 71, Item 11.*)

Heating And Air Conditioning Systems

Heating System

- Heaters shall be of hot water, combustion type, electric heating element, or heat pump.
- The front heater shall be of fresh air, or combination fresh air and re-circulating type.
- Portable heaters may not be used.
- Heater hoses and clamps shall be adequately supported and shielded to protect hoses against excessive wear due to vibration. Heater lines, cores, and elements on the interior of the bus shall be shielded to prevent scalding or burning of the driver or passengers. Heater hoses shall conform to SAE J20r3, *June 2006 Edition of the Standard*.
- Buses shall have a minimum of two heaters: one front and one rear.
- The heating system shall be capable of maintaining bus interior temperatures as specified in SAE test procedure J2233, *February 2011 Edition of the Standard*.
- Hot water system shall include a shutoff valve installed in the pressure and return lines at or near the engine in an accessible location.
- Accessible bleeder valves shall be installed in an appropriate place in the return lines of body company-installed heaters to remove air from the heater lines.
- Heater motors, cores and fans must be readily accessible for service. Access panels shall be provided as needed.

- Auxiliary fuel-fired heating systems may be installed, provided they meet the following requirements:
 - Heaters shall use commercially available grades of diesel only.
 - Heater(s) may be direct hot air or connected to the engine's cooling system.
 - Heater(s) shall be installed per the heater manufacturer's written instructions.
 - Heater exhaust shall exit on the left side or rear of the bus, at a location as described in Exhaust System, Items 3, 4, and 5, Page 18.
 - Heater manufacturer shall provide certification to OSPI that the unit complies with all applicable FMVSS.
 - Heater shall be equipped with a positive shut off, manual re-set rollover protection device. This device shall activate at any angle of 45° or greater from horizontal.
 - Heaters shall be protected by their own fuse or circuit breaker and have high and low voltage protection shutdown.
 - Auxiliary heating systems shall comply with FMVSS No. 301, *Fuel System Integrity*, and all other applicable FMVSS's, as well as with SAE J2233, *February 2011 Edition of the Standard*.
- Passenger heaters: All heaters in the passenger compartment shall be equipped with a device, installed in the hot water pressure line, which regulates the water flow to all passenger heaters. The device shall be able to be operated by the driver while seated. The driver and passenger heaters may operate independently of each other for maximum comfort.

Passenger Compartment Air Conditioning (Optional)

The following specifications are applicable to all types of school buses that may be equipped with air conditioning. This section is divided into two parts—Part A covers performance specifications and Part B covers other requirements applicable to all buses.

A. Performance Specifications

- (1) **Standard Performance:** The installed air conditioning system should cool the interior of the bus from 100 degrees to 80 degrees Fahrenheit, measured at three points (minimum) located four feet above the floor on the longitudinal centerline of the bus. The three required points shall be: three feet above the center point of the horizontal driver seat surface, (2) at the longitudinal midpoint of the body, and (3) three feet forward of the rear emergency door or, for Type D rear-engine buses, three feet forward of the end of the aisle. Note: for the Type A vehicles, placement of the rear thermocouple should be centered in the bus over the rear axle. The independent temperature reading of each temperature probe inside the bus shall be within a range of ± 3 degrees Fahrenheit of the average temperature at the conclusion of the test.
- (2) **High Performance:** The installed air conditioning system should cool the interior of the bus from 100 degrees Fahrenheit to 70 degrees Fahrenheit, measured at three points (minimum) located 4 feet above the floor on the longitudinal centerline of the bus. The three required points shall be: three feet above the center point of the horizontal driver seat surface, (2) at the longitudinal midpoint of the body, and (3) three feet forward of the emergency door or, for Type D rear-engine buses, three feet forward of the end of the aisle.

The independent temperature reading of each temperature probe inside the bus shall be within a range of + 3 degrees Fahrenheit of the average temperature at the conclusion of the test.

B. Test Conditions

The test conditions under which the above performance standards must be achieved shall consist of:

- (1) Placing the bus in a room (such as a paint booth) where ambient temperature can be maintained at 100 degrees Fahrenheit.
- (2) Heat-soaking the bus at 100 degrees Fahrenheit at a point measured 2 feet horizontally from the top of the windows on both sides of the bus, with windows open for two hours; and
- (3) Closing windows, turning on the air conditioner with the engine running at 1250 + 50 RPM, and cooling the interior of the bus to 80 degrees Fahrenheit, (standard performance) or 70 degrees Fahrenheit (high performance), within 30 minutes while maintaining 100 degrees Fahrenheit outside temperature.

The manufacturer shall provide test results that show compliance of standard systems. If the bid specifies, the manufacturer shall provide facilities for the user or user's representative to confirm that a pilot model of each bus design meets the above performance requirements.

C. Other Requirements

- (1) Evaporator cases, lines, and ducting (as equipped) shall be designed in such a manner that all condensation is effectively drained to the exterior of the bus below the floor level under all conditions of vehicle movement and without leakage on any interior portion of bus.
- (2) Evaporators and ducting systems shall be designed and installed to be free of projections or sharp edges. Ductwork shall be installed so that exposed edges face the front of the bus and do not present sharp edges. If separate components, the evaporators shall be installed in the front and/or rear bulkheads. Combination rooftop-mounted Evaporator/Condenser units with interior ducting for heat and air conditioning is acceptable. Interior ducting must be above the passenger window line.
On school buses equipped with Type-2 seatbelts having anchorages above the windows, the ducting (if used) shall be placed at a height sufficient to not obstruct occupant securement anchorages. This clearance shall be provided along the entire length (except at evaporator locations) of the passenger area on both sides of the bus interior.
- (3) The body may be equipped with insulation, including sidewalls, roof, firewall, rear, inside body bows and plywood or composite floor insulation to aid in heat dissipation and reflection.
- (4) All glass (windshield, service and emergency doors, side, and rear windows) may be equipped with maximum integral tinting allowed by federal, state or ANSI standards for the respective locations, except that window rear of the driver's compartment, if tinted, shall have approximately 28 percent light transmission. (Reference RCW 46.37.430.)
- (5) Electrical generating capacity shall be provided to accommodate the additional electrical demands imposed by the air conditioning system.

- (6) Roofs may be painted white to aid in heat dissipation. (See *Appendix*, Page 79, Item 19.) Air intake for any evaporator assembly(ies), except for front evaporator of Type A-1, shall be equipped with replaceable air filter(s) accessible without disassembly of evaporator case.
- (7) For all buses (except Type D rear engine transit) equipped with a rear evaporator assembly, evaporator shall not encroach upon head impact zone, but may occupy an area of less than 26.5 inches from the rear wall and 14 inches from the ceiling.
- (8) For Type D rear engine transit buses equipped with a rear evaporator over the davenport, the evaporator assembly may not interfere with rear exit window and may not extend above the rear-seating row.
- (9) The condenser unit for the passenger compartment may be installed on the top of the bus.

Hinges

All exterior metal door hinges shall be designed to allow lubrication to be channeled to the center 75% of each hinge loop without disassembly, unless they are constructed of stainless steel, brass or non-metallic hinge pins or other designs that prevent corrosion.

Horn

Buses shall be equipped with a horn or horns of standard make, with each horn capable of producing complex sound in bands of audio frequencies between 250 and 2,000 cycles per second and tested per SAE Standard J377, *December 2007 Edition of the Standard*. (See *Appendix*, Page 70, Item 9.)

Identification

1. The school bus body shall have the words "SCHOOL BUS" at least 8 inches high on both the front and rear of the body. Lettering shall be placed as high as possible without impairment of visibility. Lettering shall conform to "Series B" of Standard Alphabets for Highway Signs. (See *Retro-Reflective Material*, Page 35). MFSABs are exempt from these requirements.
2. District name and number shall be placed on each side of the bus below the window line with 4-inch minimum letters.
3. Contractor or Cooperative name shall be placed on each side of the bus below the window line with 4-inch minimum letters.
4. A reflective sign or decal shall be attached to the rear of the bus, shall measure a minimum of 400 square inches and bear the wording:

**Unlawful to Pass
When
Red Lights Flash**

The lettering of lines 1, 2, and 3 shall be 3 inches in height. The color of lines 1 and 2 shall be black. The color of line 3 shall be red. The background shall be silver, retro-directive reflex reflective sheeting. The material shall be automotive engineering grade or better, meeting initial reflectance value in FHWA FP 85 and retaining at least 50 percent of these values for a minimum of six years.

When it is necessary to split the sign to conform to the design of the rear door, the separation shall not be more than 1 inch.

Perforated window film may be used in the upper or lower window of the rear emergency exit and shall measure a minimum of 400 square inches (approximately 14" x 30") or be sized to fit the window. For best overall visibility and durability, it is recommended that the window film be 50/50, placed on a tint free window, and be laminated.

1. Only signs and lettering approved by state law, regulation, or authority shall appear on the bus.
2. The district name may be placed on the front and/or back of the bus below the window line in letters no larger than 3 inches in height.
3. Equipment identification numbers no larger than 6 inches may be placed on the front and/or rear of school bus and/or on or near one or more of the four corners of the bus.
4. The State Bus Number may be placed on the roof for identification. The lettering shall be black, approximately 24 inches high and located in the approximate center of the bus, as to not interfere with the roof hatch(s).
5. The battery location shall be identified near the battery on the exterior of the bus in black letters no less than 1 inch high and no more than 2 inches high.
6. A flag decal may be located on the belt line in front of or behind the district/contractor's name.
7. The flag decal shall be no larger than the height of the School District name.
8. The decal shall meet all Federal Flag Regulations. (Title 4, United States Code, Chapter 1, Section 1 and Section 2 and Executive Order 10834.)

Inside Height

Type A-1

The inside body height shall be a minimum of 62 inches.

Type A-2, B, C, and D

The inside body height shall be 72 inches or more, measured metal to metal, at any point on the longitudinal centerline from the front vertical bow to the rear vertical bow. Does not apply to air conditioning equipment.

Instruments and Instrument Panel

1. Instruments and gauges shall be mounted on the instrument panel in such a manner that each is clearly visible to the driver in a normal seated position.
2. All instruments shall be easily accessible for maintenance and repairs.
3. Instrument panel shall have lamps of sufficient candlepower to illuminate all instruments and gauges.
4. The chassis shall be equipped with the following instruments and gauges (indicator lights in lieu of gauges are not acceptable, except as noted):

- a. Speedometer
- b. Odometer
- c. Oil-pressure gauge
- d. Water-temperature gauge
- e. Fuel gauge
- f. Upper-beam headlight indicator
- g. Turn-signal indicator
- h. Glow-plug indicator, if appropriate.

Type A and B (Item i only)

- i. Ammeter or voltmeter with graduated scale indicating charge and discharge.

Type C and D (Items j through p)

- j. Voltmeter with graduated scale.
- k. Air pressure gauge/warning indicator; See Brakes, Page 4, Item 10.
- l. Vacuum gauge/warning indicator; See Brakes, Page 5, Item 2.
- m. Tachometer.
- n. Automatic transmission temperature gauge or warning light.
- o. An instrument indicating both MPH and RPM may be used in lieu of the separate speedometer and tachometer units.
- p. Multi-function gauge (MFG).
 - (1) The driver must be able to manually select any displayable function of the gauge on a MFG, whenever desired.
 - (2) Whenever an out-of-limits condition that would be displayed on one or more functions of a MFG occurs, the MFG controller should automatically display this condition on the instrument cluster. This should be in the form of an illuminated telltale warning lamp, as well as having the MFG automatically display the out-of-limits indications. If two or more functions displayed on the MFG go out of limits simultaneously, then the MFG should sequence automatically between those functions continuously until the condition(s) are corrected.
 - (3) The use of a MFG does not relieve the need for audible warning devices, were required.

Insulation

1. The body shall be insulated with suitable material for deadening sound. The roof shall be insulated with a minimum R-value of 5.5 and properly vented to prevent condensation. The rest of the body shall be insulated with fiberglass or equal material capable of maintaining the inside bus body temperatures at the required level for the area in which the bus is used. The Underwriters Laboratories must approve all materials used. (*See Appendix, Page 73, Item 14.*)
2. Floor insulation shall be either five-ply nominal 5/8 inch (1/2 inch for Type A-1 buses) thick plywood or material of equal or greater strength and insulation R value. The plywood shall equal or exceed properties of exterior-type softwood plywood, C-D Grade as specified in

standard issued by U.S. Department of Commerce. (See *Appendix*, Page 73, Item 14.) When plywood is used, all edges and seams of the floor shall be sealed.

3. If foam spray is applied to the underside of a school bus for insulation purposes, it must not cover any items needed to be inspected by the Washington State Patrol during an initial or routine inspection, including, but not limited to, body clips, fuel system parts, and air system parts.

Interior

1. The interior of the bus shall be free of all unnecessary projections, which include but are not limited to, luggage racks and attendant handrails, likely to cause injury. This standard requires inner lining on the ceiling and walls. All walls from the top of the seat rail to the bottom of the windows shall be covered with an unpainted durable finished material. If the ceiling is constructed so as to contain lapped joints, exposed edges shall be beaded, hemmed, flanged, or otherwise treated to minimize sharp edges. Securable storage areas are allowed in the rear floor of MFSABs.
2. Every school bus shall be constructed so that the noise level taken at the ear of the occupant nearest to the primary vehicle noise source shall not exceed 85dBA when tested according to the procedure found in *Appendix B*, Page 300 of the *2015 National School Transportation Specifications & Procedures Manual*.
3. The bus shall be equipped with two holders in which to display the operating permit and certificate of registration. Holders shall be 4 by 5-inches minimum, with a transparent covering and located in the driver's compartment for easy access.
4. WAC rules and/or district policy addressing student conduct and safety related issues may be displayed in the driver's compartment, securely fastened, in an area which will not obstruct the driver's view.
5. Individual student seating identification may be placed above windows in the passenger compartment.
 - Seating identification shall be securely fastened and placed on the surface immediately above the windows. Seat assignment identification shall not be placed on the ceiling.
 - Seating identification can be cardstock or index cards inserted in laminate pockets, dry erase cards, etc. The cardstock/paper/material used shall be plain and neutral in color e.g., white, beige, soft pastels, no neon colors.
 - If using multiple cards, these shall not exceed 30 square inches collectively.
 - If using removable ink markers like dry erase or soluble ink above the windows, total area used will not exceed 30 square inches.
 - MFSABs are exempt from this requirement.
6. Flammables such as aerosol cans and cleaners may be in an outside storage compartment. Fuel shall not be transported in outside storage compartment. A product, liquid, or gel, which stipulates "Hand Sanitizer," and is labeled flammable, will be allowed in the driver compartment as long as it is stored so as to not be a loose item. There shall be no more than one 16 oz. container. Sanitizer in towelette form that is labeled flammable, may be used in place of the liquid or gel hand sanitizer. One container is permitted and may not exceed 16 oz by weight.

Lamps and Signals

1. All lamps on the exterior of the vehicle shall be approved by OSPI and the Washington State Patrol, Equipment and Standards Division, and shall conform to design, construction and mounting requirements as specified in SAE J887a (*See Appendix, Page 70, Item 9.*) and/or FMVSS No. 108 as appropriate, or any subsequent standards thereof.
2. Interior lamps shall be provided which adequately illuminate the aisle and stepwell. Interior lights shall be able to illuminate with the ignition key in any position. Stepwell light shall be illuminated by a service door operated switch so as to illuminate only when the ignition switch or headlights and clearance lights are on, and the service door is opened.
3. Alternately flashing school bus warning lights (RCW 46.37.290) shall comply with all standards of Chapter 204-21 WAC. (*See Appendix, Page 77, Item 17.*) (Also see Washington State Patrol Inspection Procedures for Eight-light systems; *Appendix, Page 81, Item 22.*) MFSABs are exempt from this requirement.
4. Turn signals, stop, and tail lamps.
 - a. Each school bus shall be equipped with amber signal lamps mounted as high as practicable, front, and rear, and placed as wide apart as practicable but not less than 3 feet. These signal lamps must be connected to a hazard-warning switch to cause simultaneous flashing when needed as a vehicular traffic hazard warning. Front turn signal lamps may satisfy this requirement.
 - b. The rear turn signal lamps shall be at least 7 inches in diameter (or if a shape other than round, a minimum of 38 inches of illuminated area) and their center line shall be approximately 8 inches below the rearwindows.
 - c. The location of the front turn signal lamps shall be such that they can be clearly distinguished when the headlamps are lighted on the lower beam.
 - d. Buses shall be equipped with amber side-mounted turn signal lamps. The turn signal lamp on the left side shall be mounted rearward of the stop signal arm and the turn signal lamp on the right side shall be mounted rearward of the entrance door. Both lamps shall be mounted as high as practicable in the beltline area, but not more than 72 inches from ground level. No more than two additional amber turn signal lamps are allowed on each side of the bus, mounted as high as practicable in the beltline area, but not more than 72 inches from ground level.
 - e. The turn signal lamps shall flash at a rate from 60 to 120 times per minute and shall reach full brilliance during each cycle.
 - f. There shall be visible and/or audible means of giving a clear indication to the driver when the signal lamps are on.
5. Buses shall be equipped with four combination red stop and tail lamps. The upper set shall consist of two combination lamps with a minimum diameter of 7 inches (or if a shape other than round, a minimum 38 square inches of illuminated area) and shall be mounted on the rear of the bus just inside the turn signals.
6. The lower set shall consist of two combination lamps with a minimum diameter of 4 inches (or if a shape other than round, a minimum of 12 square inches of illuminated area) and shall be placed on the rear of the body between the beltline and the floor line. The rear license plate lamp may be combined with one lower tail lamp. Stop lamps shall be activated by the service brakes and shall emit a steady light when illuminated, while the

bus is in operation.

7. Backup lamps.

The bus body shall be equipped with at least two but not more than four white rear backup lamp signals. Minimum lamp size shall be four 4 inches in diameter, maximum lamp size shall be 7 inches in diameter. If a shape other than round, there shall be a minimum of 13 square inches of illuminated area, meeting FMVSS No. 108. If backup lamps are placed on the same horizontal line as the brake lamps and turn signal lamps, they shall be inboard.

8. Strobe lamp.

If installed, the strobe shall comply with WAC 204-21-210 and be subject to the following requirements:

- a. Polarity protected.
- b. Clear white lens only.
- c. Maximum height above bus roof, less than 8 inches; and
- d. Radio frequency interference and electromagnetic interference filtering required. (Light must not be capable of activating emergency traffic control light switches.)

9. Auxiliary Fog Lamps (Optional). If used, fog lamps shall be installed in accordance with current law.

10. An overhead map light shall be provided in the driver's compartment with a separate switch.

Type C & D

11. The rearmost dome light in the row(s) shall be operable by a separate switch or switch position.

12. Curb/Loading lighting shall not be located above the window line or above the service door and shall be flood lighting.

13. Headlight may be Halogen (white or blue) or L.E.D.

Metal Treatment

1. All metal, except high grade stainless steel or aluminum, used in construction of the bus body shall be zinc or aluminum-coated or treated by equivalent process before the bus is constructed. (Included are such items as structural members, inside and outside panels, floor panels and floor sills; excluded are door handles, grab handles, stanchions, interior decorative parts, and other interior plated parts.)
2. All metal parts that will be painted, in addition to the above requirements, shall be chemically cleaned, etched, zinc phosphate-coated and zinc chromate or epoxy- primed to improve paint adhesion. This includes, but is not limited to, such items as crossing control arm and stop arm.
3. In providing for these requirements, particular attention shall be given to lapped surfaces, welded connections of structural members, cut edges, punched, or drilled hole areas in sheet metal, closed or box sections, unvented or un-drained areas, and surfaces subjected to abrasion during vehicle operation.
4. As evidence that the above requirements have been met, samples of materials and sections used in the construction of the bus body shall be subjected to a cyclic corrosion

testing as outlined in SAE J1563, *October 1993 Edition of the Standard*.

Mirrors

1. All mirrors shall be easily adjustable, but shall be rigidly braced, so as to reduce vibration.
2. The interior glass mirror shall be either laminated or tempered and shall have rounded corners and protected edges. Mirrors shall be 6 x 16 inches minimum for Type A buses and shall be 6 x 30 inches minimum for Types C and D buses.
3. One additional interior rearview mirror may be placed in the driver's compartment to allow the driver more vision of the students immediately behind them. This mirror may be of unit magnification or convex. This mirror must be no larger than 35 square inches and must be mounted as stated in Item 2.
4. The rear-view mirrors shall provide the driver clear views of the following areas:
 - a. The left and right sides of the bus and to the rear of the bus for a distance of at least 200 feet.
 - b. The rear tires at ground level and at least 12 feet perpendicular to the left and right side of the bus at a point 32 feet back from the front bumper.

NOTE: It may be possible to satisfy the requirement of Item 4.b for the left side with the exterior rearview mirror described in Item 4; however, this mirror must continue to meet the requirements of Item 4.a.

5. Additional mirrors, if required to meet Item 4.b., shall be either of unit magnification or have an average radius of curvature no less than 40 inches.
6. All rear-view mirror systems shall be heated and power remote controlled.
7. The Original Equipment Manufacturer (O.E.M.), in design considerations, shall make every effort to lessen the blind spot(s) behind all rear-view mirror systems (driver and passenger side) by using overhead mounting configurations or maximum separation of mirrors on single-point or loop brackets.
8. The right side, rear-view mirror system shall not be obscured by the unwiped portion of the windshield.
9. Cross-view mirror system: The cross-view mirror system shall be heated and shall provide the driver indirect vision of the following areas not observable by direct vision:
 - a. From ground level directly below the full width of the front bumper, vertical and forward, to points where direct vision occurs.
 - b. From ground level around the left- and right-front corners of the bus, vertical and to the sides, to points where direct vision occurs.
 - c. The left and right sides of the bus, to include the front tires at ground level, the service entrance and rearward on each side to a point where indirect vision overlaps with the rearview mirror system.
 - d. Reduction in apparent image size in cross-view mirrors shall be no greater than necessary to show the view described.

Mobile Data Terminal (MDT) (Optional Equipment)

1. The Mobile Data Terminal (MDT) shall be installed in an area that will not block the view of

- the driver out the windshield, of any gauges, mirrors, indicator lights or controls.
2. The MDT shall be mounted as to not be a snagging hazard in the student loading area of the service door.
3. Audio and/or visual turn-by-turn instructions from the MDT system are allowed while the bus is being operated. Audible directions shall not use the speakers within the passenger compartment.

Mounting

1. The chassis frame shall extend to the rear edge of the rear body cross member. The bus body shall be attached to the chassis frame in such a manner as to prevent shifting or separation of the body from the chassis under all operating conditions.
2. The body front shall be attached and sealed to the chassis cowl in such a manner as to prevent entry of water, dust, and fumes through the joint between the chassis, cowl, and body.
3. Isolating material shall be placed at all contact points between the body and chassis frame and shall be so attached to the chassis frame or body member that it will not move under all operating conditions.

Mud Flaps

Mud flaps shall be rubber and meet requirements of RCW 46.37.500. (See *Appendix*, Page 77, Item 17.)

Noise Suppression Switch

Each bus shall be equipped with an on/off (not momentary) switch mounted in the driver's compartment to turn off all noise-producing accessories simultaneously, including, but not limited to, heater/air conditioning blowers, defroster fans, auxiliary fans, and radios, if so equipped. This switch shall not disable the emergency exit buzzers. This does not apply to two-way communication systems. In addition, a red light may be activated by the switch to alert students.

Oil Filter

Full-flow oil filter shall be provided. The oil filter shall have a capacity in accordance with the engine manufacturer's recommendation.

Openings

All openings in the floorboard and firewall between the chassis and passenger-carrying compartment shall be sealed, to prevent fumes or moisture from engine compartment or beneath the chassis from entering the passenger compartment. Where plates are used to cover openings, they shall have gaskets and be fastened securely.

Overall Length

Maximum length for school buses shall be limited to 43 feet. If over 40.5 feet, there may not be

more than 14 rows of seats.

Power And Gradeability

(See *Appendix*, Page 74, Item 16.)

Public Address System

1. Buses may be equipped with an AM/FM/audio and/or public address system having interior and exterior speakers.
2. No internal speakers, other than the driver's communication systems, may be installed within 4 feet of the driver's seat back on its rearmost upright position.

Racks

The use of any type of racks inside or outside of the bus is prohibited.

Retarder System (Optional)

Retarder system, if installed, shall limit the speed of a fully loaded school bus to 19 mph on a 7 percent grade for no less than 3.6 miles.

Retro-Reflective Material

1. **Effective September 1, 2005:** Reflective material shall be installed on the following areas of the bus. (See *Appendix*, Page 79, Item 19, for a diagram defining locations of markings referred to below.)
 - a. The rear of the bus body shall be marked with a strip of reflective National School Bus Yellow material no greater than 2 inches in width to be applied to the back of the bus, extending from the left lower corner of the "SCHOOL BUS" lettering, across to the left side of the bus, then vertically down to the top of the bumper, across the bus on a line immediately above the bumper to the right side, then vertically up to a point even with the strip placement on the left side, and concluding with a horizontal strip terminating at the right lower corner of the "SCHOOL BUS" lettering.
 - b. "SCHOOL BUS" signs, if not a lighted design, shall be marked with reflective National School Bus Yellow material comprising background for lettering of the front and/or rear "SCHOOL BUS" signs.
 - c. The sides of the bus body shall be marked with reflective National School Bus Yellow material at least 1 3/4 inches in width, extending the length of the bus body and located (vertically) as close as practicable to the beltline. Marking not required on emergency or lift doors.
2. The front and/or rear bumper may be marked diagonally 45 degrees down toward the left side of the bus with 2-inch-wide strips of non-contrasting reflective material.

Route Identifier (Optional)

1. External

- a. Shall not be larger than 75 square inches.
- b. May not be placed in the windshield or any windows.
- c. May be symbols and/or letters.
- d. Must be of quality construction with no snagging hazard and/or sharp edges.

2. Internal

- a. Shall not be larger than 75 square inches.
- b. Must be displayed in the first right-side passenger window.
- c. May be symbols and/or letters.
- d. Must be mounted on transparent material.

Rub Rails

1. External

- a. There shall be one rub rail located on each side of the bus body, approximately at seat level, which shall extend from the rear side of the entrance door to the radius of the rear corner on the right side, except at the emergency door and from the radius of the front corner, cowl, or rear of the driver's door to the radius of the rear corner on the left side, except at the electrical access panel or emergency door.
- b. There shall be one rub rail on each side of the bus located approximately at floor line which shall cover the same longitudinal area as the upper rub rails, except at the wheel housings and side emergency doors.
- c. Both rub rails shall be attached at each body post and all other upright structural members.
- d. All rub rails shall be 4 inches or more in width, shall be of 16-gauge steel or other material of equal strength and shall be constructed in corrugated or ribbed fashion.
- e. All rub rails shall be applied outside the body or outside body posts. Snap-on rub rails do not satisfy this requirement.
- f. All rub rails shall be provided with a sufficient number of drain holes to reduce the chance of body rust.
- g. Other rub rails may be added. Optional rub rails must meet the requirements of through f. above.

2. Internal

- a. Internal body side structure may be substituted for external rub rails, provided they meet the following requirements:
 - (1) There shall be no less than three internal rails located on each side of the bus, one at shoulder level, one at seat level and one at floor level.
 - (2) The internal rails on the right side shall extend from the rear side of the entrance door to the radius of the right-rear corner, and from the radius of the left-front corner to the radius of the left-rear corner.
 - (3) Internal rails may be constructed of round tubing, angle or channel metal, or other

material providing the equivalent strength and durability of 10- gauge or heavier, 1-1/2 by 3-inch rectangular steel tubing.

- (4) The rails may be one piece, welded to each body post and all other upright structural members, or they may be segmented and welded between each body post and all other upright structural members.
- b. A letter from the manufacturer certifying that the body side structure of their bus meets or exceeds the above criteria shall be required by the Superintendent of Public Instruction prior to initial sale in Washington State of this type of bus.

Seat and Seatbelt for Driver

1. A Type 2 lap/shoulder belt shall be provided for the driver. The assembly shall be equipped with an emergency locking retractor (ELR) for the continuous belt system. The lap portion of the belt shall be guided or anchored where practicable so as to prevent the driver from sliding sideways under it.
2. The driver's seat shall be of the high-back type with a minimum seat back adjustment of 15 degrees and with a head restraint to accommodate a 95-percentile adult male as defined in FMVSS 208. When the seat is at its fullest extension from the steering wheel, the minimum distance between the steering wheel and backrest of driver's seat shall be 11 inches. The driver's seat shall have vertical adjustment and shall have fore-and-aft adjustment of not less than 4 inches.
3. Type A buses may be manufacturer's standard seat.

Seats

1. All seats shall have a minimum cushion depth of 15 inches, a seat back height of 24 inches above the seating reference point and must comply with all other requirements of FMVSS No. 222.
2. No bus shall be equipped with jump or portable seats.
3. The forward-most pupil seat on the right side of the bus shall be located so as not to interfere with the driver's vision.
4. In determining seat width, allowable average rump width shall be:
 - a. Thirteen inches where the 3-3 seating plan is used.
 - b. Fifteen inches where the 3-2 seating plan is used.
5. There shall be a minimum of 36 inches headroom for sitting positions from the un-depressed seat cushion line to the ceiling of the bus. Measurement shall be made vertically not more than 7 inches from the sidewall at the cushion height and fore-and-aft center of the seat cushion,
6. If seats are track seating mounted, spacing between seats or seats and crash barriers shall not exceed FMVSS No. 222 maximum permissible distance. Manufacturers shall provide written instructions to the end user that details seat placement procedures that comply with FMVSS No. 222.
7. All restraining barriers and passenger seats shall be covered with a material that meets the criteria contained in the School Bus Seat Upholstery Fire Block Test, or ASTM E2574/E2574M—12a Standard Test Method for Fire Testing of School Bus Seat Assemblies. (*Appendix B, Page*

302 of the *2015 National School Transportation Specifications & Procedures Manual*.)

8. Seat sleeves for the purpose of storage may be placed over the seat back or barrier. Material must meet School Bus Seat Upholstery Fire Block Test. (*Appendix B, Page 302 of the 2015 National School Transportation Specifications & Procedures Manual*.) Must have a closure device, or flap with closure device to secure contents.
9. Effective September 1, 2018, all Type A buses ordered after 9/1/2018 shall be equipped with lap/shoulder belts for all seating positions.
10. Lap belts shall not be installed on passenger seats in large school buses (over 10,000 pounds GVWR) except in conjunction with child safety restraint systems that comply with the requirements of FMVSS No. 213. Lap/shoulder systems are allowed.
11. Automatic flip-up seats shall be placed at the maximum seat spacing permitted by FMVSS No. 222 of 24 inches from the seating reference point (SRP).
12. Automatic flip-up seats shall be constructed to prohibit passenger limbs from becoming entrapped between the seat back and the seat cushion when in the upright, or seated position.
13. The bottom of the flip-up seat shall be covered with sheet metal or other material of equal strength and durability to prevent lacerations, puncture wounds, or the snagging of clothing.
14. The seat cushion shall be designed to rise to a vertical position automatically when not occupied.
15. Each seat leg shall be secured to the floor by bolts, washers, and nuts in order to meet the performance requirements of FMVSS No. 222. Flange head nuts may be used in lieu of nuts and washers. All seat frames attached to the seat rail shall be fastened with 2 or more bolts, washers, and nuts, or with flange head nuts. Seats may be track mounted in conformance with FMVSS No. 222.

Security

Camera recording systems may be installed but shall be mounted so as to minimize the potential for injury. (See Cameras, Page 6.)

Shock Absorbers

The bus shall be equipped with heavy-duty front and rear double-acting shock absorbers compatible with the manufacturer's rated axle capacity.

Springs

1. Springs or other types of suspension assemblies shall be of ample resiliency under all load conditions and of adequate strength to sustain a loaded bus without evidence of overload.
2. Springs or other types of suspension assemblies shall be designed to carry their proportional share of gross vehicleweight.
3. If leaf springs are used in the rear, they shall be parabolic- or progressive-type.

Type C and D

1. If multi-leaf front springs are used, stationary eyes shall be protected by a full wrapper leaf in addition to the main leaf. Parabolic springs are exempt from this requirement.

Steering Gear

1. Steering gear shall be approved by the chassis manufacturer and designed to assure safe and accurate performance when the vehicle is operated with maximum load and at maximum speed.
2. The steering mechanism shall provide for easy adjustment for lost motion.
3. No changes shall be made in the steering apparatus, which are not approved by the chassis manufacturer.
4. There shall be clearance of at least 2 inches between the steering wheel and cowl instrument panel, windshield, or any other surface.
5. Power steering is required.
6. The steering system shall be designed to provide a means for lubrication of all wear-points if wear-points are not permanently lubricated.
7. Power steering hoses shall be protected from excessive heat and vibration and be so installed as to prevent chafing.

Steps

1. The service door entrance may be equipped with two-step or three-step stairwell. Risers in each case shall be approximately equal to and shall not exceed a height of 10 inches. When plywood floor is used on steel, the height of the top step may be increased by the thickness of the plywood used.
2. Steps shall be enclosed to prevent accumulation of ice and snow.
3. Steps shall not protrude beyond the side bodyline while the bus is in motion.

Type A and B

4. The first step at the service door shall be not less than 10 inches and not more than 14 inches from the ground when the bus is empty.

Type C and D

5. The first step at the service door shall be not less than 10 inches and not more than 16 inches from the ground when the bus is empty.
6. On chassis modifications which may result in increased ground clearance (such as four-wheel drive), an auxiliary step may be provided to compensate for the increase in ground-to-first-step clearance. Such steps shall meet the requirements of Items 1–4 below, in Step Treads. These steps need not be enclosed.

Step Treads

1. All steps, including the floor line platform area, shall be covered with an elastomer floor covering having a minimum overall thickness of 0.187 inch.
2. The step covering shall be permanently bonded to a durable backing material that is resistant to corrosion.
3. Steps, including the floor line platform area, shall have a 1 ½ inch nosing that contrasts in color by at least 70% measured in accordance with the contrasting color specification in 36 CFR, part 1192, ADA, *Accessibility Guideline for Transportation Vehicles*.

4. The rubber portion of the step treads shall have the following characteristics:
 - a. Abrasion resistance: Step tread material weight loss shall not exceed 0.40 percent, as tested under ASTM D-4060, *Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser*, (CS-17 Wheel, 1000 gram, 1000 cycle).
 - b. Weathering resistance: Step treads shall not break, crack, or check after ozone exposure (7 days at 50 phm at 40 degrees C) and Weatherometer exposure (ASTM D-750, *Standard Test Method for Rubber Deterioration in Carbon-Arc Weathering Apparatus*, 7 days); and
 - c. Flame resistance: Step treads shall have a calculated burn rate of .01 mm per minute or less, using the test methods, procedures and formulas listed in FMVSS No. 302, *Flammability of Interior Materials*.
 - d. Nonskid/nonslip material shall be used on the nose of the step treads. This does not include the floor level step.
 - e. A spray on application type material may be used in lieu of item a. that meets the requirements of items b. through d. The material shall be applied not only to the interior surfaces of the service doorstep treads but the exterior as well if not covered by undercoating.
5. All areas between the step treads and the vertical risers shall be sealed with a waterproof sealer.

Stirrup Steps

1. There shall be one stirrup step and a suitably located handle on each side of the front body for easy accessibility for cleaning the windshield and lamps.
2. A step, in lieu of the stirrup steps, is permitted in or on the front bumper.

Stop Sign (Single Arm)

MFSABs are exempt from this requirement.

1. All school buses shall be equipped with one octagonal stop sign meeting the applicable requirements of FMVSS No. 131. **The stop sign may be backlit.** The sign shall be mounted so as not to interfere with the driver's vision to the rear when the sign is extended. The standard octagonal sign shall contain two flashing red lamps, which are visible from both sides of the extended sign. These lamps shall be connected to the alternately red flashing signal lamp circuit.
2. The signal shall be manual, vacuum, electric or air power controlled and so constructed as to lock in the extended and closed position.
3. The control for the "STOP" sign shall be mounted within view and easy access of the driver, but not readily accessible to students.
4. The control for the "STOP" sign and red warning lights shall be manually operable before or after opening of the service door. (See *Appendix*, Page 69, Item 3, WAC 204-21-190.) (Also see *Appendix*, Page 22, Item 18, Washington State Patrol Inspection Procedures for Eight-light systems.)

Storage Compartment

1. Buses shall have a metal container of adequate strength and capacity for storage of tire chains and/or tow chains and such tools as may be necessary for minor emergency repairs while the bus is enroute.
2. The storage container shall be located either inside or outside the passenger compartment. If inside, it shall be located under the first or last row of passenger seats, be fastened to the floor and have a separate cover (seat cushion may not serve for this purpose) that can be securely latched. If outside, it shall be dust- proof and watertight.
3. Buses equipped with luggage compartments need not meet the requirements of Item 1 and Item 2 above.
4. The storage container may be located in the engine compartment on Type D rear- engine buses.

Sun Visor

Type A-1 and A-2

The sun visor may be manufacturer's standard.

Type B, C, and D

1. An interior adjustable sun visor not less than 6- inches wide and 30 inches long shall be so installed that it can be turned up when not in use. The visor shall be mounted so that it will maintain any position in which it is placed. The visor may pivot to the left or an additional left side visor may be added.
2. When the visor is in a turned-up position, it will be securely held so that the un- mounted edge will be in such a position that it will not endanger the driver. It shall be supported by two brackets and shall be transparent.

Tires and Rims

1. Tires and rims of proper size and load rating, commensurate with the chassis manufacturer's GVWR, shall be provided. (*See Appendix, Page 77, Item 18.*)
2. All tires on any given axle shall be of the same size, ply, and load rating.
3. Combination of rims and tires shall allow for tire chain installation.
4. Recapped or retread tires are not permitted on front axles.
5. Re-grooved tires are not permitted.
6. Section repairs are not permitted in the front tires.
7. Spare tire, if carried, shall be appropriately mounted in an accessible location outside the passenger compartment.

Type D

Rear tandem suspension shall have a minimum of six tires.

Towing Attachments, Front

Type B, C, and D

Each chassis shall be equipped with two tow hooks or tow eyes mounted or capable of immediate mounting on the forward portion of the frame and they shall be of sufficient strength to pull or be pulled by another vehicle of the same GVW. Tow eyes or hooks shall be attached so they do not project beyond the front bumper.

Towing Attachments, Rear

Busesshall be equipped with two rear tow hooks or tow eyes, secured or capable of immediate securing to the chassis frame and be sufficiently strong to tow the GVW of the bus. Permanently attached tow hooks shall not protrude beyond the bumper. If rear tow hooks or tow eyes are attached to each frame side member, the frame and frame cross members must be of sufficient strength to take the GVW of the bus in tow without distortion. Holes are allowed in the bumper to access tow attachments.

Traction Assisting Devices

- A. Where required or used, sanders shall:
 - 1. Be of hopper cartridge-valve type.
 - 2. Have a metal hopper with all interior surfaces treated to prevent corrosion from moisture.
 - 3. Have a cover on filler opening of hopper, which screws into place, sealing the unit airtight.
 - 4. Have discharge tubes extending to the front of each rear wheel under the fender.
 - 5. Have no-clogging discharge tubes with slush-proof, nonfreezing rubber nozzles.
 - 6. Be operated by an electric switch with a pilot light mounted on the instrument panel.
 - 7. Be exclusively driver-controlled; and,
 - 8. Be of at least 100-pound (grit) capacity on each side.
- B. Automatic traction chains may be installed.

Transmission

- 1. Manual or automatic transmissions shall provide not less than three forward speeds and one reverse speed.
- 2. When the automatic transmission is controlled by a shift lever, there shall be a detent between each gear position.
- 3. Buses equipped with manual transmissions shall have a transmission shift diagram affixed to the dash immediately ahead of the shift lever.

Type C and D

4. Transmission shall have an externally accessible filter.
5. Automatic transmissions incorporating a parking pawl shall have a transmission shifter interlock controlled by the application of the service brake to prohibit accidental engagement of the transmission. All non-park pawl transmissions shall incorporate a park brake interlock that requires the service brake to be applied to allow release of the parking brake.

Trash Container and Holding Device (Optional)

When requested or used, the trash container shall be secured by a holding device that is designed to prevent movement and to allow easy removal and replacement. It shall be installed in an accessible location in the driver's compartment, not obstructing passenger access to the entrance door.

Turning Radius

1. A chassis with a wheelbase of 264 inches or less shall have a right and left turning radius of not more than 42-1/2 feet, curb-to-curb measurement.
2. A chassis with a wheelbase of 265 inches or more shall have a right and left turning radius of not more than 44-1/2 feet, curb-to-curb measurement.

Undercoating

1. The chassis manufacturer or agent thereof shall coat the undersides of steel or metallic-constructed front fenders with rust-proofing compound for which compound manufacturer has issued notarized certification of compliance to the chassis builder that the compound meets or exceeds all performance requirements of SAE J1959, *September 2003 Edition of the Standard*.
2. The entire underside of the bus body, including floor sections, cross members, below the floor line side panels, and outer bottom and vertical surfaces of the luggage compartments shall be coated with rust-proofing compound for which the compound manufacturer has issued notarized certification or compliance to the bus body manufacturer that the compound meets or exceeds all performance requirements of SAE J1959.
3. Type A buses may have restrictions for undercoating around exhaust systems. If so, plywood and/or bare metal must be protected against corrosion.
4. If Foam Spray is applied to the underside of a school bus for sealing or insulation purposes, it must not cover any items that need to be inspected by the Washington State Patrol during an initial or routine inspection, including, but not limited to, body clips, fuel system parts, and air system parts. Seat fasteners may be covered.
5. Undercoating compound shall be applied with suitable airless or conventional spray equipment to recommended film thickness and shall show no evidence of voids in the cured film. Undercoating is expected to prevent rust under all bus service conditions.

Type A-1 and A-2

6. Floor section(s) between the frame rails need not be undercoated, provided that the underside of the floor section(s) are covered with a durable finished material, which may include material with a painted surface, under which shall be placed fiberglass or equal insulating material capable of holding bus body temperatures at the required level for the area in which the bus is used. This insulating material shall be completely covered and held in place by non-rusting metal or material other than metal having equivalent strength and durability.

Ventilation

1. The body shall be equipped with a suitable, controlled ventilating system of sufficient capacity to maintain proper quantity of air under operating conditions without opening of windows except in extremely warm weather.
2. A static-type exhaust ventilator shall be installed in the low-pressure area of the roof.
3. An emergency roof exit/ventilator may serve requirements of Item 1 and Item 2 above.
4. A power ventilator may be used in place of or in addition to the static vent.
5. Auxiliary fans, if installed, shall meet the following requirements.
 - a. The fans for the left and/or right sides shall be placed in a location where the flow is not obstructed.
 - b. Fans shall be in a location where they can be adjusted to their maximum effectiveness, without blocking driver's view of the mirrors.
 - c. Shall be no larger than 6 inches in diameter.
 - d. Blades shall be covered with a protective cage. A separate switch shall control each of the fans.
 - e. Auxiliary fans are not to be considered as a defrosting and defogging system.

Wheelhousings

1. Wheelhouse openings shall allow for easy tire removal and service.
2. Wheelhousings shall be attached to floor sheets in such a manner as to prevent dust, water, or fumes from entering the body. Wheelhousings shall be constructed of 16-gauge steel or other material of equal strength.
3. Wheelhousings shall provide clearance for installation and use of tire chains.
4. Inside height of wheelhousings above the floor line shall not exceed 12 inches.
5. No part of a raised wheelhousing shall extend into the emergency door opening.

Wheels and Hubs

Type A and B

1. Wheels shall be disc-type.
2. Hubs shall be not less than five studs.
3. Dual rear wheels shall be provided for all buses over 10,500 lbs. GVWR.

Type C and D

4. Wheels shall be disc-type and may be hub or stud-piloted when flange or cone- type nuts are used.
5. Type C and D buses equipped with hydraulic brakes shall have no less than six stud hubs. (See Brakes, Page 5, Item 4.)
6. Type C and D buses equipped with air brakes and stud-piloted wheels shall have ten stud hubs, front and rear and a separate set of Budd-type, ball seat lug nuts for both the inside and outside rear dual wheels.
7. Type C and D buses equipped with air brakes and hub-piloted wheels may have 8 or 10 stud hubs, front, and rear.

Windshield and Side Windows

1. The glass in the windshield shall be AS-1 safety glass, mounted so that its identification mark is legible, of a quality of laminated glass preventing distortion of view in any direction and shall be in compliance with FMVSS No. 205.
2. The windshield shall be large enough to permit the operator to see the highway clearly, shall be slanted to reduce glare, and shall be installed between the front corner posts that are so designed and located as to afford a minimum obstruction of the operator's view of the highway.
3. Glazing in all side windows behind the driver, doors, and rear windows shall be AS-3 grade or better. Windows beside the driver shall be AS-2 grade or better.

Type A

4. Each passenger-side window, excluding the rear-side quarter windows, shall have an unobstructed opening of at least 9 inches in height and 22 inches in width, when lowered, to provide emergency egress.

Type C and D

5. Each passenger-side window, excluding any door windows and the rear side quarter windows, shall have an unobstructed opening of at least 12 inches in height and 22 inches in width, when lowered, to provide emergency egress. There may be one additional window on each side of the bus that measures less than 22 inches in width. These windows are not required to open.

Windshield Washers

An electric, air, or vacuum-powered windshield washer which will effectively clean the entire area covered by both windshield wipers shall be provided. Windshield washer equipment shall meet FMVSS No. 104.

Windshield Wipers

1. A two-speed or variable speed windshield wiping system, with intermittent feature, shall be

provided. Windshield wiper equipment shall meet FMVSS No. 104.

2. The wipers shall be operated by one or more air or electric motors of sufficient power to effectively operate the wiper system. If one motor is used, the wipers shall be designed to give full sweep of the windshield.

SECTION II: SPECIAL NEEDS SPECIFICATIONS

SPECIFICATIONS FOR SCHOOL BUSES TO TRANSPORT STUDENTS WITH SPECIAL NEEDS. (Reference WAC 392-143-010, in *Appendix*, Page 84, Item 20.)

The classification for any school bus used to transport students with special needs will be determined as if the bus was equipped with a standard seating arrangement. As an example: A bus that would be rated as a 48-passenger bus could be constructed or modified to transport 21 students with special needs. This bus will be classified as a 48- passenger bus on the operating permit with a reference to its reduced capacity.

This section lists, with respect to vehicles constructed or modified for transportation of students with special needs:

1. Standards for special equipment.
2. Exceptions in standards for school buses.

Aisle

All school buses equipped with a power lift shall provide a minimum 30-inch pathway leading from any wheelchair position to at least one 30-inch-wide emergency exit door. A wheelchair securement position shall never be located directly in front of (blocking) a power lift door location. The "pathway" is defined as being between any object, including wheelchairs. For buses delivered after September 1, 2021, fixed, or track mounted seats located beside a wheelchair position shall not be greater than 30 inches in width.

Alternator

Buses equipped with lifts, shall have alternators of sufficient amperage output to maintain battery(ies) at a charge level adequate to fulfill total current demand of all systems.

Minimum idle output shall be 50 percent of the output rating.

Battery

Buses equipped with lifts shall have a battery that will provide a minimum reserve capacity of 180 minutes at 25 amps draw and the highest CCA performance available.

Identification

Buses with power lifts shall display the International Symbol of Accessibility located below the window-line on the rear and/or right side. Such emblem(s) shall be white on blue background, shall not exceed 12 inches in size, and shall be of high intensity reflective material meeting Federal Highway Administration (FHWA) FP-85 standards.

Lift, Power

Vehicle Lift

- a. Power lift shall be right side mounted and stored within or under the vehicle.
- b. Lifting mechanism and platform shall meet a minimum 2,400 lbs. static load test and be capable of lifting a minimum payload of 800 lbs.
- c. Lift travel shall allow the lift platform to rest securely on the ground.
- d. Lift design shall prevent excessive pressure that could damage the lift system when the platform is fully lowered or raised, or that could jack up the vehicle.
- e. Lift shall be designed so as to prevent accidental lowering while in storage.
- f. Lift shall be able to operate with ignition key in any position.

Controls

- g. Power lifts shall be so equipped that they may be lowered and raised in the event of power failure of the lift mechanism. There shall be a means of preventing the lift platform from falling while in operation due to a power failure.
- h. A switch shall be installed so that the lifting mechanism will not operate when the lift platform door(s) is closed.
- i. Power unit for lift shall be located so as not to restrict or impair center aisle space or foot and legroom between seats.
- j. On electric power lifts a circuit breaker or fuse shall be installed between the power source and lift motor as close to the power source as possible.
- k. Electrical cable between power source and lift motor shall be of a gauge heavy enough to operate the lift continuously with no more than one volt drop. There shall be no splices in the cable. Solenoids, cable ends, and breakers/fuses must be enclosed for protection from the elements and road splash or spray.
- l. Controls shall be provided that enable the operator to activate the lift mechanism from either inside or outside the bus. The controls may be interlocked with the vehicle brakes, transmission, or door, or they may provide other appropriate mechanisms or systems to ensure the vehicle cannot be moved when the lift is not stowed and so the lift cannot be deployed unless the interlocks or systems are engaged. The lift shall deploy to all levels (e.g., ground, curb, and intermediate positions) normally encountered in the operating environment.
- m. Where provided, each control for deploying, lowering, raising, and stowing the lift and lowering the roll-off barrier shall be of a momentary contact type requiring continuous manual pressure by the operator and shall not allow improper lift sequencing when the lift platform is occupied. The controls shall allow reversal of the lift operation sequence, such as raising or lowering a platform that is part way down, without allowing an occupied platform to fold or retract into the stowed position.

Platform

- n. The lift platform shall have a minimum clear width of 28 1/2 inches at the surface of the platform, and a minimum clear width of 30 inches measured from

- 2 inches above the platform surface to 30 inches above the surface of the platform. The minimum clear length of the platform between the outer edge barrier and inner edge shall be 48 inches.
- o. The lift platform shall be equipped with barriers to prevent any of the wheels of a wheelchair or mobility aid from rolling off the platform during its operation. A movable barrier or inherent design feature shall prevent a wheelchair or mobility aid from rolling off the edge closest to the vehicle until the platform is in its fully raised position. Each side of the lift platform, which extends beyond the vehicle in its raised position, shall have a barrier a minimum 1 1/2-inch high. Such barriers shall not interfere with maneuvering into or out of the aisle. The loading-edge barrier (outer barrier), which functions as a loading ramp when the lift is at ground level, shall be sufficient when raised or closed, or a supplementary system shall be provided, to prevent a power wheelchair or mobility aid from riding over or defeating it. The outer barrier of the lift shall automatically raise or close, or a supplementary system shall automatically engage, and remain raised, closed, or engaged at all times that the platform is more than 3-inches above the roadway or sidewalk and the platform is occupied.
 - p. Alternatively, a barrier or system may be raised, lowered, opened, closed, engaged, or disengaged by the lift operator, provided an interlock or inherent design feature prevents the lift from rising unless the barrier is raised or closed, or the supplementary system is engaged.
 - q. The lift platform (not including the entrance ramp) shall not deflect more than three degrees (exclusive of vehicle roll or pitch) in any direction between its unloaded position and its position when loaded with 600 pounds applied through a 26 inch by 26-inch test pallet at the center of the platform.
 - r. Power-lift platform and ramp shall be covered with nonskid materials.

Handrail

Platforms on lifts shall be equipped with handrails on two sides, which move in tandem with the lift, and which shall be graspable and provide support to standees throughout the entire lift operation. Handrails shall have a usable component at least 8-inches long with the lowest portion at approximately 30 inches above the platform and the highest portion a maximum 38 inches above the platform. The handrails shall be capable of withstanding a force of 100 pounds concentrated at any point on the handrail without permanent deformation of the rail or its supporting structure. The handrail shall have a cross-sectional diameter between 1 1/4 inches and 1 1/2 inches or shall provide an equivalent grasping surface and have eased edges with corner radii of not less than 1/8 inch. Handrails shall be placed to provide a minimum 1 1/2- inch knuckle clearance from the nearest adjacent surface. Handrails shall not interfere with wheelchair or mobility aid maneuverability when entering or leaving the vehicle.

Padding

On fold-out type lifts, all stationary frame members and potentially dangerous edges or surfaces, such as sharp corner angles and sharp or jagged edges which might result in lacerations or puncture wounds while the lift is in storage, must be covered with impact padding material. Padding shall be a closed-cell urethane foam, rubber, or vinyl type of material a minimum of 3/16-inch thick.

Elevator lifts

If elevator-type lift is used, guard panels shall be installed at both the rear and front edges of the lift opening extending into the bus. The height of the guard panels must be within 2 inches of the lower sill of the side windows. The guard panels and any potentially dangerous edges or surfaces on or adjacent to the lift shall be padded with material as described in Item 5 above. A removable, padded guard chain or cable shall be installed to separate the lift opening in floor from the passenger area.

Light

A light located on the inside of the bus over the lift door shall illuminate the lift loading area and be activated when the door latch has been moved to the open position. This requirement will also serve as a warning indication to the driver that the door is in a jarred position. The light shall operate with the ignition key in any position.

Ramps

When a power-lift system is not adequate to meet an individual student's need, as specified in the student's Individualized Education Program (IEP), a ramp device may be used.

1. If a ramp is used, it shall be of sufficient strength and rigidity to support the special device, occupant, and attendant(s). It shall be equipped with a protective flange on each longitudinal side to keep special device on the ramp.
2. Floor of ramp shall be of nonskid construction.
3. Ramp shall be of weight and design, and equipped with handle(s), to permit one person to put ramp in place and return it to its storage place.

Seat, Seating, and Wheelchair/Mobility Aid Positions

1. **Effective December 31, 2006:** There shall be no side-facing wheelchair/mobility aid positions.
2. There shall be an FMVSS No. 222 restraining barrier immediately behind the stepwell.
3. Every bus that is lift equipped shall have at least one school bus seat no less than 15 inches in width.
4. Any passenger seat that has a child safety seat attached thereto, shall be equipped with seat belts that meet the requirements of FMVSS Nos. 208, 209, and 210.
5. All child safety seats transported in any school bus shall meet the requirements of FMVSS No. 213.
6. Child safety seats shall be secured to the bus seat in a manner prescribed and approved by the manufacturer.

7. Infant seats (for children under 12 months) shall be attached to the bus seat rearward facing.
8. Type A-1 buses shall be limited to three wheelchair/mobility aid positions.
9. Type A-2 and B buses shall be limited to four wheelchair/mobility aid positions.
10. Type C and D buses shall be limited to six wheelchair/mobility aid positions.
11. A wheelchair/mobility aid position shall never be located to block a power lift door location.

Securement And Restraint System for Wheelchair/Mobility Aid and Occupant

For the purpose of this section, the term "securement" or phrase "securement system" is used exclusively in reference to the device(s), which secure the wheelchair/mobility aid. The term "restraint" or phrase "restraint system" is used exclusively in reference to the device(s) used to restrain the occupant of the wheelchair/mobility aid. The phrase "securement and restraint system" is used to refer to the total system, which secures and restrains both the wheelchair/mobility aid and the occupant.

Securement and restraint system general

- a. The Wheelchair/Mobility Aid Securement and Occupant Restraint System shall be designed, installed, and operated to accommodate passengers in a forward-facing orientation within the bus and shall comply with all applicable requirements of FMVSS No. 222. Gurney-type devices shall be secured parallel to the side of the bus.
- b. The bus body floor and sidewall structures where the securement and restraint system anchorages are attached, shall have equal or greater strength than the load requirements of the system(s) being installed.
- c. Grade 5 bolts or better shall be used to secure inserts or cargo track to bus floor or wall. Bolts shall not restrict the incremental adjustment positions of the cargo track.
- d. all belt-end fittings used to attach belts to the floor or wall inserts or cargo track, shall be a positive lock type to prevent accidental disconnecting and be made of metal and designed for quick attachment and detachment without the use of tools.
- e. The wheelchair/mobility aid securement system belts and the occupant restraint system belts shall be color coded with black for the occupant.
- f. Belt systems shall be made of a material that can be cut with shears or other sharp cutting instrument.
- g. All securement and restraint systems shall be fully adjustable and of such design to accommodate various sizes of wheelchair/mobility aids and occupants.
- h. Adjusters and belt tension devices shall be a positive mechanical locking type.
- i. Where the term "metal to metal" is used, the intent is to have the vendor supply industry standard devices, which may have a combination of metal, plastic, or other materials in the buckle assembly that meet or exceed the strength requirements outlined in FMVSS No.209.
- j. The following information shall be provided with each vehicle equipped with a securement and restraint system:
 - (1) Detailed instructions, including a parts list, regarding installation and use

- of the system; and
- (2) Detailed instructions, including a diagram, regarding the proper placement and positioning of the system, including correct belt angles.
- k. A device for storage of the securement and restraint system (webbing or strap assemblies) shall be provided. When the system is not in use, the storage device shall allow for clean storage of the system, shall keep the system securely contained within the passenger compartment, shall provide reasonable protection from vandalism, and shall enable the system to be readily accessed for use.

Wheelchair/mobility aid securement system

- l. Wheelchair/mobility aids shall be securely anchored in a fixed position.
- m. Wheelchair/mobility aids shall be secured through the use of separate floor inserts or aircraft quality cargo track securement devices. The cargo track may be aircraft cargo track. If cargo track is used, incremental adjustments shall not exceed 2 inches.
- n. There shall be sufficient floor inserts or cargo track to provide four points of attachment (two forward and two rear) for each wheelchair/mobility aid position.
- o. Belts between wheelchair/mobility aid and floor inserts or cargo track shall be secured at a 45-degree angle plus or minus 15 degrees. The rear belts shall slope downward from the wheelchair/mobility aid to the floor toward the rear of the bus. The front belts shall slope downward from the wheelchair/mobility aid to the floor toward the front of the bus.
- p. As installed, each securement anchorage shall be capable of withstanding a minimum force of 3,000 pounds when applied as specified in FMVSS No. 222. When more than one securement device shares a common anchorage, the anchorage shall be capable of withstanding the force indicated above, multiplied by the number of securement devices sharing that anchorage.
- q. Each securement device (webbing or strap assembly) shall be capable of withstanding a minimum force of 2,500 pounds when tested in accordance with FMVSS No. 209.

Occupant restraint system

- r. The occupant restraint system shall be designed to be attached to the bus body either directly or in combination with the wheelchair/mobility aid securement system, by a method, which prohibits the transfer of weight or force from the wheelchair/mobility aid to the occupant in the event of an impact.
- s. The occupant restraint belts, and attachment hardware shall meet or exceed FMVSS Nos. 209 and 210.
- t. Occupant belt systems may consist of three or four attachment points. The lap belt shall attach directly or indirectly to inserts or cargo track on the bus floor. The upper torso belt(s) or harness shall attach to inserts or cargo track on the bus floor or bus wall (occupants of gurney-type devices shall be secured to the gurney device).
- u. The upper torso belt(s) or harness shall be separate from the lap belt assembly.
- v. The buckle or attachment device joining the lap and upper torso belt(s) or harness at the lap position shall be of the quick release type and have metal-to-metal attaching devices on all ends.

- w. The occupant restraint system shall be capable of allowing the removal of the occupant from the wheelchair/mobility aid without disturbing the securement of the wheelchair/mobility aid.
- x. When the occupant upper torso restraint belt(s) or harness is attached to the floor, a stanchion at least 36 inches in height shall be provided. The stanchion shall be placed to the rear of the occupant and be secured directly to the floor or by use of floor inserts or cargo track. The stanchion shall serve to maintain, in a fixed position, horizontal and vertical movement of the restraint belt(s). This may be accomplished by the use of a device or devices built into or attached to the stanchion, which the restraint belt(s) may be placed over or threaded through. The stanchion shall be covered with impact padding material at least 3/16-inch thick down to within 3 inches of the floor. The impact padding shall meet flammability requirements of FMVSS No. 302. The stanchion shall provide a padded, adjustable headrest, either removable from or built into the stanchion whenever the occupant's head is 18 inches or less from the stanchion.

Dynamic testing

- y. The wheelchair/mobility aid securement and occupant restraint system shall be subjected to and successfully pass a dynamic sled test at a minimum impact speed/deceleration of 30 mph/20g's.
- z. Experienced personnel using an impact simulator with proven ability to provide reliable, accurate test results that can be replicated shall perform the dynamic test.
- aa. The dynamic test shall be performed in accordance with the procedures set forth in *Appendix A* of SAE J2249: Test for Frontal Impact Crash Worthiness.
- bb. The wheelchair/mobility aid used for testing purposes shall be a rigid, reusable surrogate wheelchair that complies with the requirements of *Appendix D* of SAE J2249: Specification for Surrogate Wheelchair.
- cc. The dynamic test shall be performed using system assemblies, components and attaching hardware that are identical to the final installation in type, configuration, and positioning. The body structure at the anchorage points may be simulated for the purpose of the sled test.
- dd. When tested, the wheelchair/mobility aid securement and occupant restraint system shall pass the criteria specified in Section 6.2 of SAE J2249: Performance Requirements of Frontal Sled Impact Test. Following is an abridged summary of the criteria presented in *Appendix D*.
 - (1) Retain the test dummy in the test wheelchair and on the test sled with the test wheelchair in an upright position.
 - (2) Do not show any fragmentation or complete separation of any load carrying part.
 - (3) Do not allow the horizontal excursions of the test dummy and the test wheelchair to exceed specified limits.
 - (4) Prevent the test wheelchair from imposing forward loads on the test dummy.
 - (5) Allow removal of the test dummy and the test wheelchair subsequent to the test, without the use of tools.

Special Service Lift Entrance

1. Bus bodies may have a special service lift entrance constructed in the body to accommodate a wheelchair/mobility aid lift for the loading and unloading of passengers.
2. The opening to accommodate the special service lift entrance shall be at any convenient point on the right (curb side) of the bus and far enough to the rear to prevent the door(s), when open, from obstructing the right front regular service door (except in the case of a regular-front service doorlift).
3. The opening may extend below the floor through the bottom of the body skirt. If such an opening is used, reinforcements shall be installed at the front and rear of the floor opening to support the floor and give the same strength as other floor openings.
4. The opening, with doors open, shall be of sufficient width to allow the passage of wheelchair/mobility aid. The minimum clear opening through the door and the lift mechanism shall be 52 inches in height and shall accommodate a 30-inch-wide wheelchair/mobility aid.
5. A drip molding shall be installed above the opening to effectively divert water from entrance.
6. Entrance shall be of sufficient width and depth to accommodate various mechanical lifts and related accessories as well as the lifting platform.
7. Door posts and headers of entrance shall be reinforced sufficiently to provide support and strength equivalent to the areas of the side of the bus not used for service doors.
8. Special service lift entrance shall be equipped with padding at the top edge of the inside opening. Pad shall be at least 3-inches wide and 1-inch thick, including the backing, and extend the full width of the inside opening. This may be accomplished with multiple sections with no more than 1 inch between sections.
9. A single door or double doors may be used for the special service entrance.
10. All doors shall open outwardly.
11. All doors shall have positive fastening devices to hold doors in the open position. All doors shall be weather sealed, and on buses with double doors they shall be so constructed that a flange on the forward door overlaps the edge of the rear door when closed.
12. When manually operated dual doors are provided, the rear door shall have at least one-point fastening device to the header. The forward mounted door shall have at least three-point fastening devices. One shall be to the header, one to the floor line of the body, and the other shall be into the rear door. These locking devices shall afford maximum safety when the doors are in the closed position. The door and hinge mechanism shall be of a strength that will provide for the same type of use as that of a standard entrance door. The fastening point at floor line of body does not apply to elevator type lifts.
13. Door materials, panels and structural strength shall be equivalent to the conventional service and emergency doors. Color, rub rail extensions, lettering and other exterior features shall match adjacent sections of the body.
14. Door(s) shall be equipped with a device that will actuate an audible or visible signal located in the driver's compartment when door(s) is not securely closed, and ignition is in "on" position. When double doors are provided, the forward door shall activate the

device.

Support Equipment and Accessories

Any support equipment and/or accessories required for transportation, including those required in the IEP, that deviate from these specifications must be reviewed and approved by OSPI.

1. Such special items, if used, shall be secured at the mounting location to withstand a pulling force of five times the weight of the item, or shall be retained in an enclosed, latched compartment. Including, but not limited to, the following: crutches, walkers, canes, oxygen bottles, ventilators, or similar devices.
2. Electric powered wheelchair/mobility aids, transported on school buses shall be equipped with sealed lead acid batteries or batteries containing dry or gel- type electrolyte. Batteries shall be effectively secured to the wheelchair/mobility aid.
3. Oxygen and Breathing Aid Apparatus.
 - a. Breathing aid apparatus shall be securely mounted or fastened to a mobile seating device, a bus seat, or the bus if the apparatus is in use during transit. If the apparatus is not in use during transit, it shall be secured in a storage cabinet or secured to the bus in a positive manner. (See Item 1 above.)
 - b. Oxygen bottles transported in a school bus shall be no larger than 5 inches in diameter and 30 inches high, or the cubic inch equivalent, if a shape other than cylindrical.
 - c. Oxygen bottles shall have valves and regulators that are protected.

SECTION III: ALTERNATIVE POWER SPECIFICATIONS

General Requirements

Alternative power school buses shall meet all the specifications in this manual and the specific requirements for the type of alternate power systems listed below:

1. The bus shall meet all applicable Federal Motor Vehicle Safety Standards (FMVSS).
2. Original equipment manufacturers (OEMs) and conversion systems using compressed natural gas (CNG) shall comply with National Fire Protection Association (NFPA) Specification 52 A, "Compressed Natural Gas Vehicular Fuel Systems," in effect at the time of installation. Fuel systems using liquefied petroleum gas (LPG) shall comply with NFPA Specification 58 A "Liquefied Petroleum Gases Engine Fuel Systems" in effect at the time of installation.
3. Fuel tank(s) for vehicles of less than 54 passenger capacity powered by LPG or CNG shall have a minimum 40-gallon capacity. Fuel tank(s) for vehicles of 54 or more passenger capacity powered by LPG or CNG shall have a minimum 60- gallon capacity.
4. All materials and assemblies used to transfer or store alternative fuels shall be installed outside the passenger/driver compartment.
5. The total weight shall not exceed the GVWR when loaded to rated capacity.
6. All fueling equipment shall be designed specifically for fueling motor vehicles and shall be certified by the manufacturer as meeting all applicable federal, state, and industry standards.
7. All on-board fuel supply containers shall meet all appropriate requirements of the American Society for Mechanical Engineering (ASME) code, DOT regulations or applicable FMVSSs and NFPA standards.
8. All safety devices that discharge to the atmosphere shall be vented to the outside of the vehicle. The discharge line from the safety relief valve on all school buses shall be located in a manner appropriate to the characteristics of the alternative fuel. Discharge lines shall not pass through the passenger compartment.
9. On CNG buses only a positive, quick-acting (1/4 turn) shut-off control valve shall be installed in each gaseous fuel supply line, as close as possible to the fuel supply containers. The valve controls shall be placed in a location easily operable from the exterior of the vehicle. The location of the valve controls shall be clearly marked on the exterior surface of the bus.
10. An electrical grounding system shall be required for grounding of the fuel system during maintenance-related venting.
11. Fuel systems identified as compatible with biodiesel must be provided with components compatible with biodiesel conforming to the specifications as of ASTM 6751, Biodiesel Standard.

High voltage-powered vehicles

Alternator

The alternator shall meet the applicable state specifications. Alternately, the

alternator functions may be performed by the Hybrid Drive System Batteries.

Battery(ies)

Low Voltage Battery

The Low Voltage Battery shall meet the applicable state specifications. Alternately, the Low Voltage Battery functions may be performed by the Hybrid Drive System Batteries.

Hybrid Drive System Batteries

- a. Energy storage for the Hybrid Drive System shall be protected from crash impacts and shall be encased in a non-conductive, acid-resistant compartment. This compartment must be well ventilated to preclude the possibility of hydrogen gas buildup. Energy storage shall be located in an area and in such a way as to provide ease of service.
- b. Batteries shall require automatic electrical isolation in the case of a vehicle crash.
- c. The Hybrid Drive System Batteries shall allow for a minimum storage of 28 kWh for charge depletion.
- d. The high voltage battery system integrity shall meet the specified spillage performance standards in accordance with test conditions specified in FMVSS No. 305 as applicable.

Battery Management System

- a. The Hybrid Drive System Batteries may be equipped with a system that allows the batteries to be charged via connection to the local electric utility, otherwise known as a Plug-in Hybrid Electric system. The plug connector shall make a conductive electrical connection and shall be an Apollo 200 AMP connector by BIW Connector Systems or approved equal.
- b. The Hybrid School Bus shall have equipment for monitoring the status of the batteries while the batteries remain on the vehicle. This equipment shall include the capability to balance the state of charge and monitor temperature of individual battery modules (if appropriate).

Brakes, Service

The Hybrid School Bus shall include a regenerative braking system that uses the motor and/or generator to slow the vehicle in conjunction with the service brakes while returning electrical energy to the Hybrid Drive System Batteries.

Differential Ratio

The Differential shall be compatible with the Transmission/Hybrid Drive System and provide for a minimum of 60 mph in highest gear. (Also See *Appendix, Power and Gradeability*, Page 74, Item 16.)

Engine Equipment

1. The hybrid system shall include a system that deactivates the engine when not in use, such as, at red lights, and reactivates the engine when needed for acceleration.
2. The engine shall be equipped with system that electrically heats the engine to maintain minimum starting temperature. This system should be integrated with the Plug-in Battery Management System, if so equipped, and not require a separate electrical grid connection.

The engine heater shall also heat the fuel filtration system. The engine heater shall be switched to allow this heating to be optional.

Fuel System Capability

The diesel fuel system shall be capable of operating with a 20 percent biodiesel blend (B20).

High Voltage System

1. High Voltage-Powered Vehicles: Buses utilizing a high voltage propulsion system (more than 48 normal volts) shall meet the requirements of FMVSS No. 305, *Electric Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection*, except for the following:
 - a. The propulsion power source (batteries, fuel cells, etc.) shall be located outside the passenger compartment.
 - b. The propulsion power source enclosure shall be constructed to conform to the power source manufacturer's requirements and recommendations.
 - c. Due to the much larger size and quantities of the propulsion power sources on larger vehicles, buses over 10,000 lbs. are permitted to exceed the 5.0-liter spillage constraint of Section S5.1, *Electrolyte damage from propulsion batteries* and the requirements to statically rotate the vehicle on its longitudinal axis posttest.
2. Wire, cable, and conductor insulation in the High Voltage System shall provide adequate insulation for the voltage used and for ambient temperatures ranging from - 15°F to 120°F. All high voltage circuits shall be bright orange in color or otherwise labeled as HIGH VOLTAGE. All high voltage circuits shall provide adequate and automatic protection against electrical overloads caused by short circuits or other excessive current conditions through the use of fuses, circuit breakers, and ground fault interruption.
3. Each door, cover, or other panel that affords immediate access to any high voltage area shall be plainly marked with a hazard warning label which shall read WARNING—HIGH VOLTAGE or DANGER—HIGH VOLTAGE. This label shall be located in a highly conspicuous place. All high voltage access areas shall be equipped with a lock or otherwise secured to prevent unauthorized access.
4. The High Voltage System should be designed so that when the ignition switch is off, the propulsion motor is positively disconnected. All other accessories powered by the main propulsion battery circuit shall remain operable when the ignition switch is off.
5. All buses shall be equipped with an additional manual or automatic switch or device independent of the propulsion motor disconnect controls that permits the positive disconnection of all circuits from the Hybrid Drive System Batteries. This switch shall be operable from outside the vehicle. Each door or panel providing access to this switch shall be plainly marked to indicate that it is a main-power-disconnect switch or device.

Ignition System

The ignition switch circuit shall be linked to the Battery Management System and will prevent driving the vehicle while it is connected to an external battery charging source.

Transmission/Hybrid Drive System

1. The Hybrid Drive System shall work in conjunction with the chassis engine to provide motive power to the bus. This system shall be automatically controlled requiring no intervention by the driver after it has been put in forward or reverse gear. Systems that require the use of a manual clutch or require the driver to shift through a progression of gears will not be accepted.
2. The Hybrid drive controller/converter system shall incorporate a Ground Fault Interrupt (GFI) system that protects passengers and others from electrical shock if a shorted circuit or water intrusion situation occurs.
3. The bus dash shall have an indicator light that indicates whether the bus is operating in Charge Depleting or Charge Sustaining mode. Charge Depleting is an operating mode in which the state of charge of the Hybrid Drive System Battery decreases as the bus operates. At a certain minimum state of charge, the bus becomes Charge Sustaining. Charge Sustaining is an operating mode in which the Battery Management System seeks to maintain or increase the state of charge of the Hybrid Drive System Battery. The Hybrid School Bus shall have the capability to operate in both modes.
4. The Hybrid Drive System shall have a system for protecting system components from thermal damage due to electrical overload. This system should include temperature sensors at critical points and be capable of reducing Hybrid Drive System electrical power when necessary. The bus dash shall have a warning light that indicates when a Hybrid Drive System component exceeds a safe temperature.
5. The warning light should illuminate prior to critical temperature to allow sufficient time to safely stop the bus.

Battery electric vehicles (BEV)

Back-up Alarm

BEVs will be equipped with a back-up alarm to warn other vehicles and pedestrians when the school bus drive is placed in Reverse.

Battery(ies)

Low Voltage Battery(ies)

- a. The low voltage battery) shall meet the applicable state specifications.
- b. At least one (1) low voltage battery will be installed to provide power to 12VDC circuits.
- c. A low voltage battery shutoff switch shall be installed in the vicinity of the low voltage battery compartment in an area not easily accessible to the driver or passengers. If behind an access door or panel, the location of the low voltage battery shutoff switch must be clearly labeled on the exterior of the door or access panel.

High Voltage Battery(ies)

- a. High voltage battery assemblies shall be located in between or under chassis frame rails protected by a steel cradle.
- b. High voltage batteries shall have a main service disconnect that isolates the batteries and

does not allow high voltage outside the battery pack.

Battery Management System

1. The high voltage batteries shall be equipped with a system that allows the batteries to be charged via a connection to the local electric utility grid. This connection shall be a Combined Charging System (CCS) or SAE J1772, compatible with the charging equipment.
2. The charging receptacle/port shall be mounted/located in accordance with manufacturer standards. The receptacle shall accommodate the minimum requirements for Level II AC charging DC fast charging.
3. If the charging port is behind a door or an access panel, the door or access panel will be clearly labeled with the location of the charging port.
4. Vehicles shall have on-board equipment to monitor and display battery health. This displayed information shall include but is not limited to:
 - a. High voltage battery state of charge
 - b. Motor temp
 - c. Battery available range in miles
 - d. Battery discharge and regeneration rates
 - e. Battery health (temperature, battery cell balancing (as applicable), etc.)

Brakes, Service

In addition to service brake specifications for combustion engine buses, BEVs will be equipped with a regenerative braking that utilizes the electric drive system in concert with the service brakes to slow the vehicle and return electrical energy to the battery system.

DC-DC Converter

1. A DC-DC converter shall be provided and deliver a minimum of 200 amps at 12VDC.
2. The converter system shall incorporate a Ground Fault Interrupt (GFI) that disconnects/isolates the high voltage batteries in the event of a shorted circuit or water intrusion.

Exterior Marking

In addition to the marking/labeling specified this manual, BEVs will have clear markings/labeling, with the word "Electric" indicating that the school bus is electric powered.

1. Image graphics may be used in combination with words.
2. Lettering will be a minimum of two inches high, blue in color.
3. Lettering to include imagery shall be located on both sides of the school bus along the roof cap starting above the service door and ending no further than the forward edge of the second passenger window. Additional marking/labeling shall be added to the rear of the bus but shall not be placed in any windows or crowd/encroach on any required emergency/standard markings.

High Voltage System

High Voltage-Powered Vehicles: Buses utilizing a high voltage propulsion system (60 VDC or 30 VAC) shall comply with the following:

- a. The propulsion power source (batteries, fuel cells, etc.) shall be located outside the passenger compartment.
- b. The propulsion power source enclosure shall be constructed to conform to the power source manufacturer's requirements and recommendations.

Wire, cable, and conductor insulation in the High Voltage System shall provide adequate insulation for the voltage used and for ambient temperatures ranging from - 15°F to 120°F. All high voltage wiring/cabling shall be covered with bright orange loom or otherwise labeled as HIGH VOLTAGE. All high voltage circuits shall provide adequate and automatic protection against electrical overloads caused by short circuits or other excessive current conditions through the use of fuses, circuit breakers, and ground fault interruption.

Each door, cover, or other panel that affords immediate access to any high voltage area shall be plainly marked with a hazard warning label which shall read WARNING—HIGH VOLTAGE or DANGER—HIGH VOLTAGE. This label shall be located in a highly conspicuous place. All high voltage access areas shall be equipped with a lock or otherwise secured to prevent unauthorized access.

Ignition System

1. The ignition switch circuit shall be linked to the Battery Management System and will prevent the driving of the vehicle while it is connected to an external battery charging source.
2. The high voltage system shall be designed so that when the ignition switch is off, the high voltage is positively disconnected.

Low Speed Sound Generator

1. BEVs will be equipped with a low-speed sound generator to warn other vehicles and pedestrians of the school bus's approach i.e., when approaching an intersections and crosswalks. The sound generator will remain on when the school bus is in any drive gear except reverse.
2. The low-speed sound generator shall not emit sound while the bus is completely stopped, with the transmission in Neutral or Park, and with the parking brake set e.g., while loading and unloading.

System Protection

1. As part of the Battery Management System, the BEV will be equipped with an automatic shutdown to protect system components from damage caused by malfunctions such as charging/discharging faults, battery overheating, electrical overheating, degraded battery health, etc.
2. Prior to automatic shutdown, a warning or maintenance indicator shall display in the driver console to notify the driver of impending shutdown or the need for immediate maintenance and allow enough time to safely reposition and stop the bus. Gradual derating of propulsion prior to complete automatic shutdown.

SECTION IV: APPENDIX

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Chapter 204-21 WAC Standards for Bus Hazard Warning Strobe Lamp		4
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Defrosters, Heaters, Horn, Lamps & Signals, Wiring		9
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Item 1

Alternator: The term “heavy duty” as used anywhere in these specifications shall mean that the item to which the term is applied shall exceed the usual quantity, quality, or capacity supplied with standard production vehicles and it shall be able to withstand unusual strain, exposure, temperature, wear, and use.

Estimating Method for Suggested Alternator Capacity

Constant Load

Equipment	Units	Current Draw (Amperes)
Ignition	1	2.5
Head lamps (Type 2 dual lower)	2	8.4
Taillights	2	1.2
Clearance lights	4	1.2
Cluster light	6	1.8
Intermediate marker lamps	20	0.6
Body instrument panel	1	0.3
Primary front heater	1	24.0
Primary defroster	1	9.5
Supplementary front heater	1	9.5
Supplementary defroster	1	9.5
Under seat heater, large	1	12.2
Under seat heater, small	1	6.1
Defroster fan	1	3.0
Windshield wiper motor	2	12.0
Fuel pump	1	3.0

Intermittent Load

Equipment	Units	Current Draw (Amperes)
Emergency door buzzer	1	1.0
Flashing warning signal system (lamps and motor)	2	4.4
Stepwell and six interior dome lights	7	2.1
Individual additional dome lights	1	0.3
Stop (brake) lights	4	2.8
Turn signals	3	2.1
Windshield washers	1	0.9
Backup lamps	2	1.4

To determine the electrical load (in amperes) for a typical school bus, the following formula is recommended:

- Constant load + 35% of intermittent load = total load

Item 2

Battery, Construction, Frame and Fuel Tank: Obtainable from School Bus Manufacturer's Technical Council, *Design Objectives Booklet*, August 1990 Edition and School Bus Manufacturer's Technical Council, *School Bus Technical Reference Booklet*, August 2005 Edition.

Item 3

Chapter 204-21 WAC Lighting Requirements

[WAC 204-21-190 School bus warning lamps](#)

[WAC 204-21-210 Bus hazard warning strobe lamp](#)

Item 4

Chapter 212-50 WAC

IDENTIFICATION FOR ALTERNATIVE FUEL SOURCE MOTOR VEHICLE

WAC Sections	
<u>212-50-010</u>	Administration, authority
<u>212-50-020</u>	Application and scope
<u>212-50-030</u>	Definitions
<u>212-50-040</u>	Placard issuance
<u>212-50-050</u>	Placard design and size
<u>212-50-060</u>	Placard designations
<u>212-50-070</u>	Placement of vehicle
<u>212-50-080</u>	Severability

Item 5

CHAPTER 392-143 WAC

TRANSPORTATION SPECIFICATIONS FOR SCHOOL BUSES

WAC Sections	
<u>392-143-001</u>	Authority and purpose
<u>392-143-010</u>	Definitions
<u>392-143-015</u>	School bus specifications manual
<u>392-143-031</u>	School bus inspection/School bus operation permit
<u>392-143-032</u>	School bus operation permit
<u>392-143-035</u>	Routine inspection of school buses
<u>392-143-040</u>	Other required inspections of school buses
<u>392-143-050</u>	Resold school buses
<u>392-143-055</u>	Responsibility for compliance with school bus specification rules

WAC Sections	
<u>392-143-060</u>	School bus specifications continued compliance
<u>392-143-070</u>	Other vehicles used to transport students
<u>392-143-080</u>	Signs and marking for school buses/Exterior/Interior

Item 6

Color: National School Bus Yellow. Refer to *Appendix B*, in the *2010 National School Transportation Specifications & Procedures Manual*.

Item 7

Color: Federal Standard No. 595a, black enamel No. 17038 (gloss).

Item 8

Color: Federal Standard No. 595a, black enamel No. 37038 (matte).

Item 9

Defrosters, Heaters, Horn, Lamps and Signals, Electrical System/Wiring, at [Society of Automotive Engineers' website](#).

Item 10

First Aid Kit-Contents of 24 Unit First Aid Kit

1. Two 1-inch x 2 ½-yards adhesive tape rolls.
2. Twenty-four sterile gauze pads 3 x 3 inches.
3. One hundred ¾ x 3-inch adhesive bandages.
4. Eight 2-inch bandage compress.
5. Ten 3-inch bandage compress.
6. Two 2-inch x 6-feet sterile gauze roller bandages.
7. Two non-sterile triangular bandages approximately 39 x 35 x 54-inches minimum and two safety pins.
8. Three sterile gauze pads 36 x 36 inches.
9. Three sterile eye pads.
10. One rounded-end scissors.
11. One pair of medical examination gloves.
12. One mouth-to-mouth airway.

Item 11

Heaters, Provision for Heating System: Refer to *Appendix B*, in the *2015 National School Transportation Specifications & Procedures Manual*.

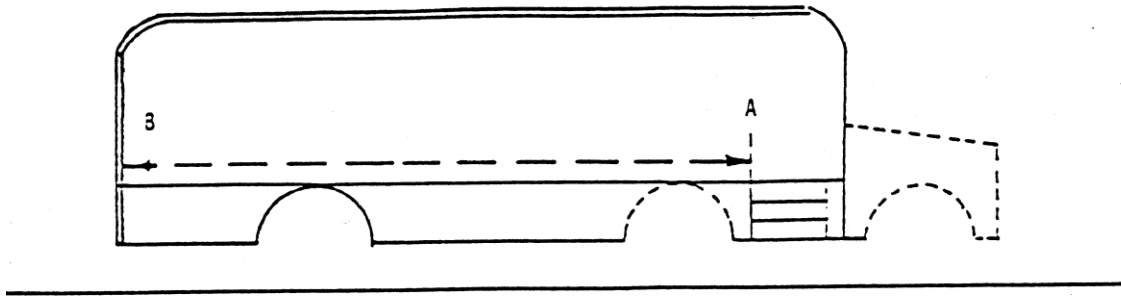
Item 12

Identification: Available at [Federal Highway Administration's \(FHWA\) website](#)

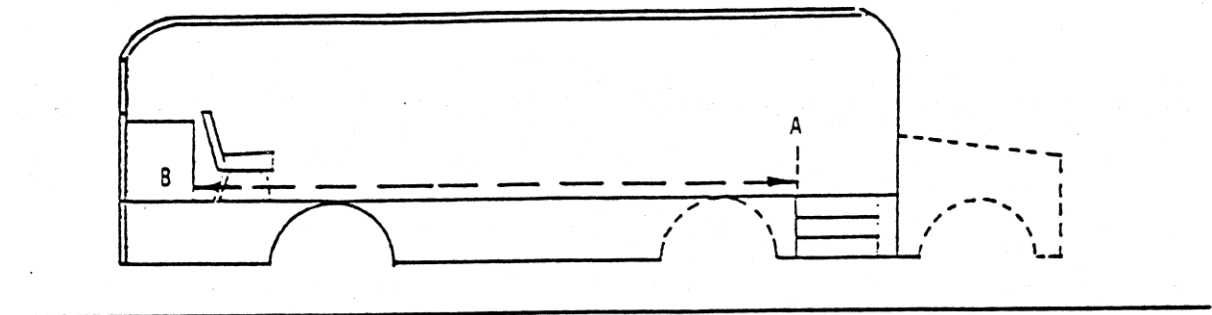
Item 13

Interior Body Measurement Procedures

Forward engine transit or conventional with rear emergency door. Measure from rear of stepwell to inside of emergency door at floor level.

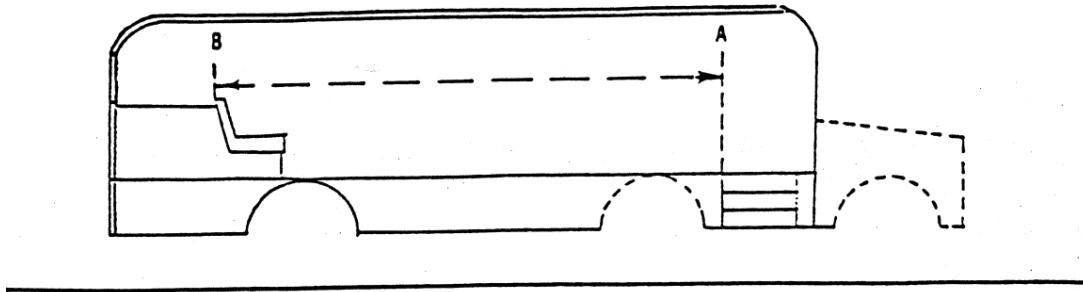


Forward engine transit or conventional with rear luggage compartment and standard rear seat. Measure from rear of stepwell to inside face of luggage compartment at floor level.



Rear engine transit or conventional with rear luggage compartment and davenport seat.

Measure from rear of stepwell to top rear most point of davenport seat back.

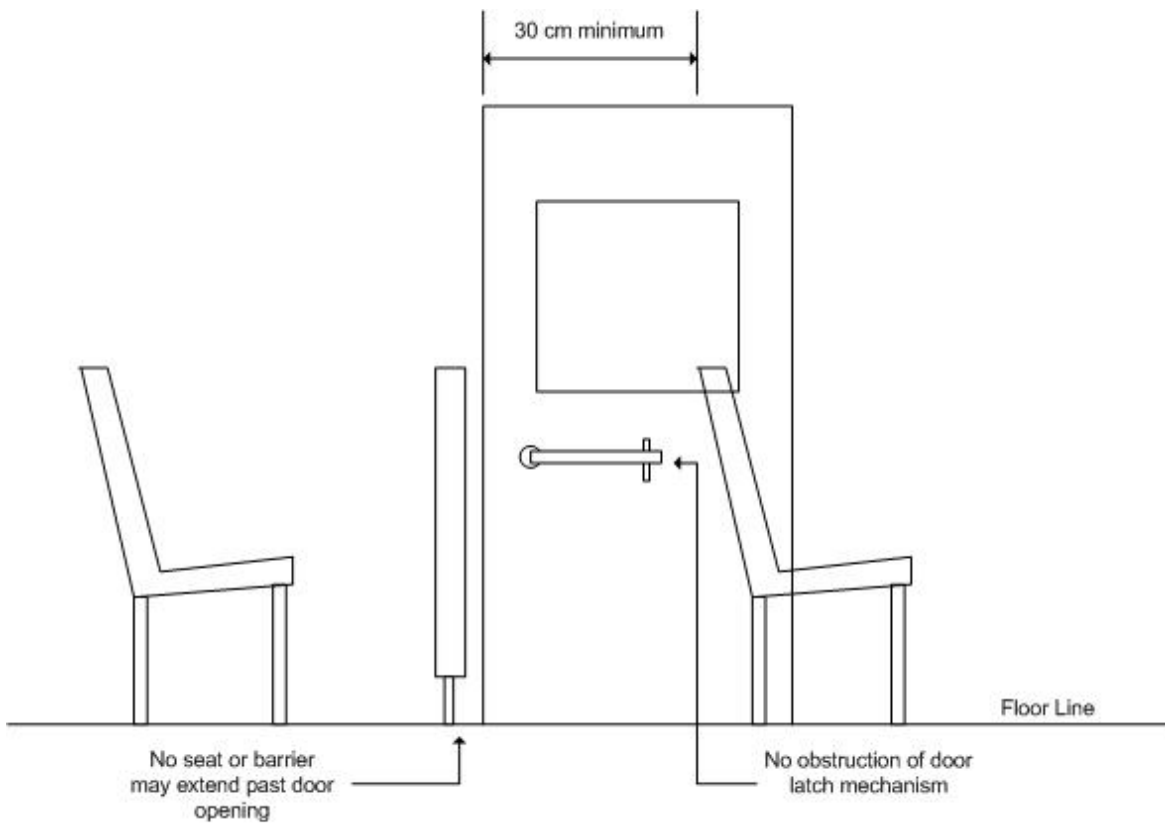


Item 14

Insulation: Underwriters Laboratories, Inc., 2600 N.W. Lake Rd., Camas, WA 98607.

Item 15

Minimum Side Emergency Exit Clearance Specifications 49 CFR CH. V, §571.217.



Item 16

Buses with bodies manufactured after April 1, 1977, must meet all criteria for power and gradeability under Items c., d., and e. below.

1. GVW (gross vehicle weight) shall be the sum of (1), (2), (3), and (4) below. The appropriate manufacturer shall furnish these weights to the Superintendent of Public Instruction in such form as he/she may prescribe:
 - a. Manufacturers published chassisweight.
 - b. Manufacturers published bodyweight.
 - c. Total seated pupil weight (passenger capacity) x 120 pounds per pupil.
 - d. 150 pounds of driver's weight.
2. The manufacturer of the chassis shall furnish to the Superintendent of Public Instruction in such form as he/she may prescribe:
 - a. The certified published horsepower of diesel and gas engines.
 - b. The certified published maximum lbs. ft. torque of diesel and gas engines.
 - c. The certified published C.I.D. of diesel and gas engines.
3. GVW as described in Items a. (1)– (4) above of any school bus shall not exceed:
 - a. 55 lbs. per certified published horsepower for diesel engine units.
 - b. 67 lbs. per certified published cubic inch displacement for gas engine units.
4. Gradeability shall be calculated using the following formula with a minimum G of 8 percent required.
5. $G = \frac{(\text{Torque}) (.85) (12) (\text{Axle Ratio}) (\text{Trans. 1st Gear Ratio})}{12\% \text{ GVW} \times \text{Tire Radius}}$
6. Item 1. GVW applied to the formula shall be as described in Items a. (1)– (4) above.
7. Item 2. Transmission first gear ratio applied to the formula for automatics shall be the product of the lowest gear times the converter stall ratio.
8. School buses shall be limited to 60 MPH + or - 4 MPH in the fastest gear with the engine operating at 85 percent of governed RPM (maximum 90 percent for diesel engines governed below 2800 RPM; obtain engine manufacturer's recommended cruising RPM) using the following formula:
9. $\text{MPH} = \frac{(\text{Engine RPM}) (60)}{\text{Mile Transmission} \times \text{Axle Ratio}} \div \text{Tire Revolutions per}$
10. See below for examples.

POWER AND GRADEABILITY EXAMPLES

HP or CID to GVW Example

Diesel engine 65-Passenger Conventional

- (1) Manufacturer's Published Chassis Weight = 9190
- (2) Manufacturer's Published Body Weight = 7300
- (3) Total Seated pupil Weight (65 x 120 lbs.) = 7800
- (4) Driver's Weight = 150

TOTAL GVW = 24440

- (5) $24440/155 = 157$ Minimum HP Engine Required

Gas Engine 65-Pasenger Conventional

- (1) Manufacturer's Published Chassis Weight – 7536
- (2) Manufacturer's Published Body Weight = 8043
- (3) Total Seated Pupil Weight (65 x 120 lbs.) = 7800
- (4) Driver's Weight = 150

TOTAL GVW = 23529

- (5) $23529/67 = 351$ Minimum CID Engine Required

Gradeability Example (Minimum G of 8 percent)

$G = (\text{Torque } (85) (\text{12}) (\text{Axle Ratio}) (\text{Trans 1st Gear Ratio}) - 12\%$

$\text{GVW} \times \text{Tire Radius}$

$$G = \frac{345 \times .85 \times 12 \times 6.5 \times 6.99}{23,529 \times 18.6} = 36\% - 12\% = 24\%$$

MPH Example

(60 MPH + or - 4 MPH in the fastest gear at 85 percent of governed RPM (maximum 90 percent for diesel engines governed under 2800 RPM; obtain manufacturer's recommended cruising RPM)).

$\text{MPH} = \frac{(\text{Engine RPM}) (60)}{\text{Transmission} \times \text{Axle Ratio}}$

Transmission x Axle Ratio

- a. Engine governed at 3600 RPM, 10.00 x 20 bias ply tires, 5.83 axle ratio.

$$.85 \times 3600 = 3060 \text{ RPM}$$

$$\text{MPH} = \frac{3060 \times 60}{1 \times 5.83} = 31492.28 \div 504 = 62.48 \text{ MPH Cruising Speed}$$

$$\text{MPH} = \frac{3600 \times 60}{1 \times 5.83} = 37049.74 \div 504 = 73.51 \text{ MPH Top Speed}$$

- b. Engine governed at 2800 RPM, 10.00 x 20 bias ply tires, 4.53 axle ratio.

$$.85 \times 2800 = 2380 \text{ RPM}$$

$$\text{MPH} = \frac{2380 \times 60}{1 \times 4.53} = 31523.17 \div 504 = 62.54 \text{ MPH Cruising Speed}$$

$$\text{MPH} = \frac{2800 \times 60}{1 \times 4.53} = 37086.09 \div 504 = 73.58 \text{ MPH Top Speed}$$

- c. Engine governed at 2100 RPM, 12 x 22.5 radial tires, 3.69 axle ratio.

$$.90 \times 2100 = 1890 \text{ RPM}$$

$$\text{MPH} = \frac{1890 \times 60}{1 \times 3.69} = 30731.70 \div 487 = 63.10 \text{ MPH Cruising Speed}$$

$$\text{MPH} = \frac{2100 \times 60}{1 \times 3.69} = 34146.34 \div 487 = 70.11 \text{ MPH Top Speed}$$

$$1 \times 3.69$$

Method of Selecting Approximate Axle Ratio

(Use 85 percent or maximum 90 percent of governed RPM and 60 MPH)

$$R = \frac{(\text{RPM}) (\text{Tire Radius}) *}{168 \times \text{MPH}}$$

$$\text{a. } R = \frac{3060 \times 19.2}{168 \times 60} = 5.83 \text{ Axle Ratio}$$

$$\text{b. } R = \frac{2380 \times 19.2}{168 \times 60} = 4.53 \text{ Axle Ratio}$$

$$\text{c. } R = \frac{1890 \times 19.7}{168 \times 60} = 3.69 \text{ Axle Ratio}$$

*Tire radius and tire revolutions per mile measurements will vary between tire manufacturers. When using the above formulas, measurements for the brand, type, and size tires to be used on the vehicle should be obtained from the manufacturer.

Item 17

Chapter 46.37 RCW Vehicle Lighting and Other Equipment

RCW 46.37.290 Special lighting equipment on school buses and private carrier buses.

RCW 46.37.500 Fenders or splash aprons.

Item 18

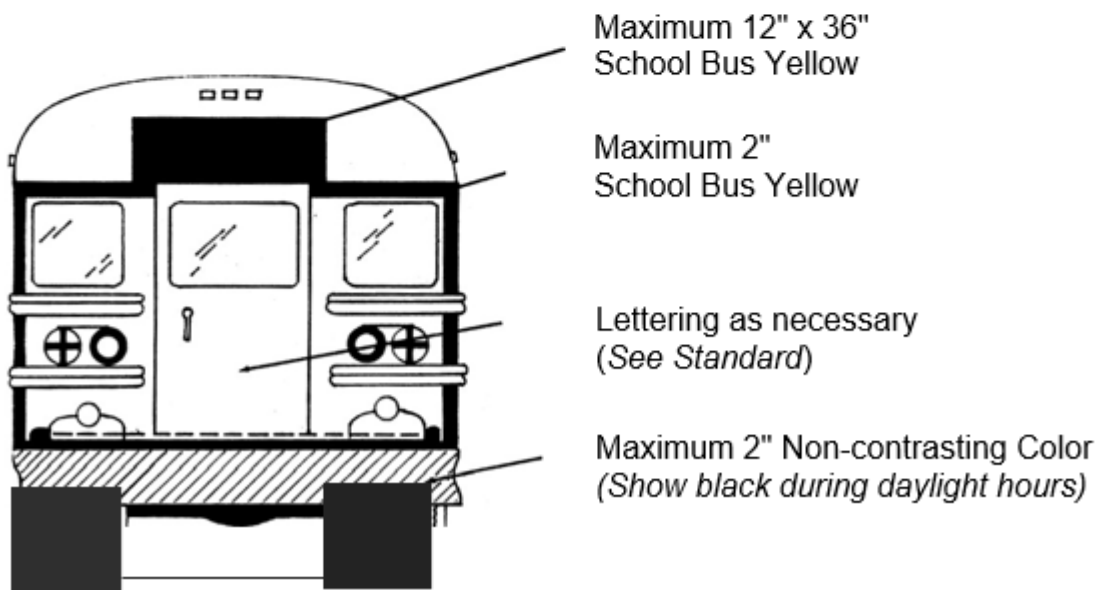
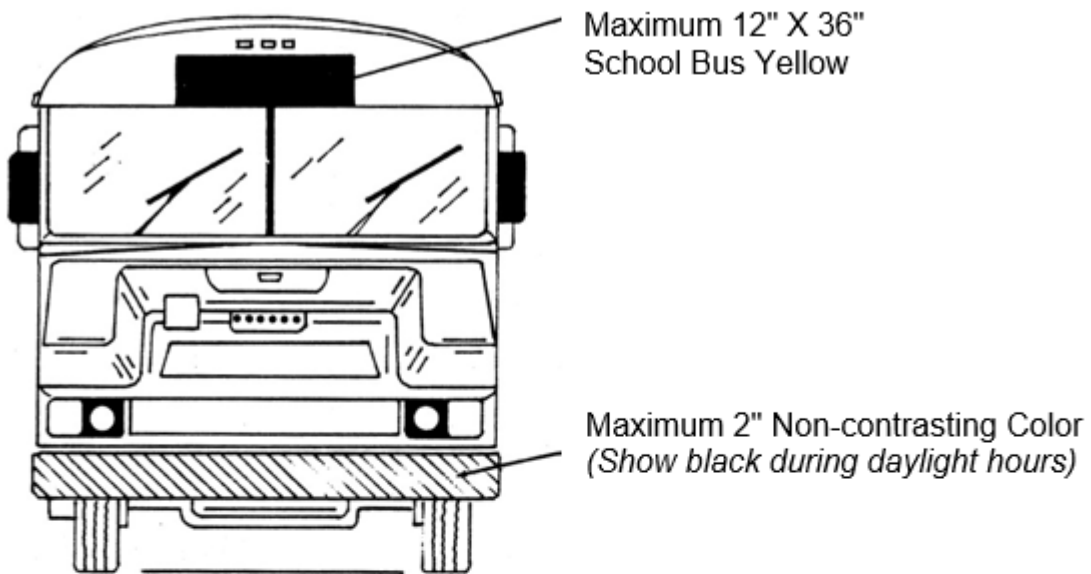
Chapter 46.44 RCW Size, Weight, Load

RCW 46.44.041 Maximum gross weights—Wheelbase and axle factors.

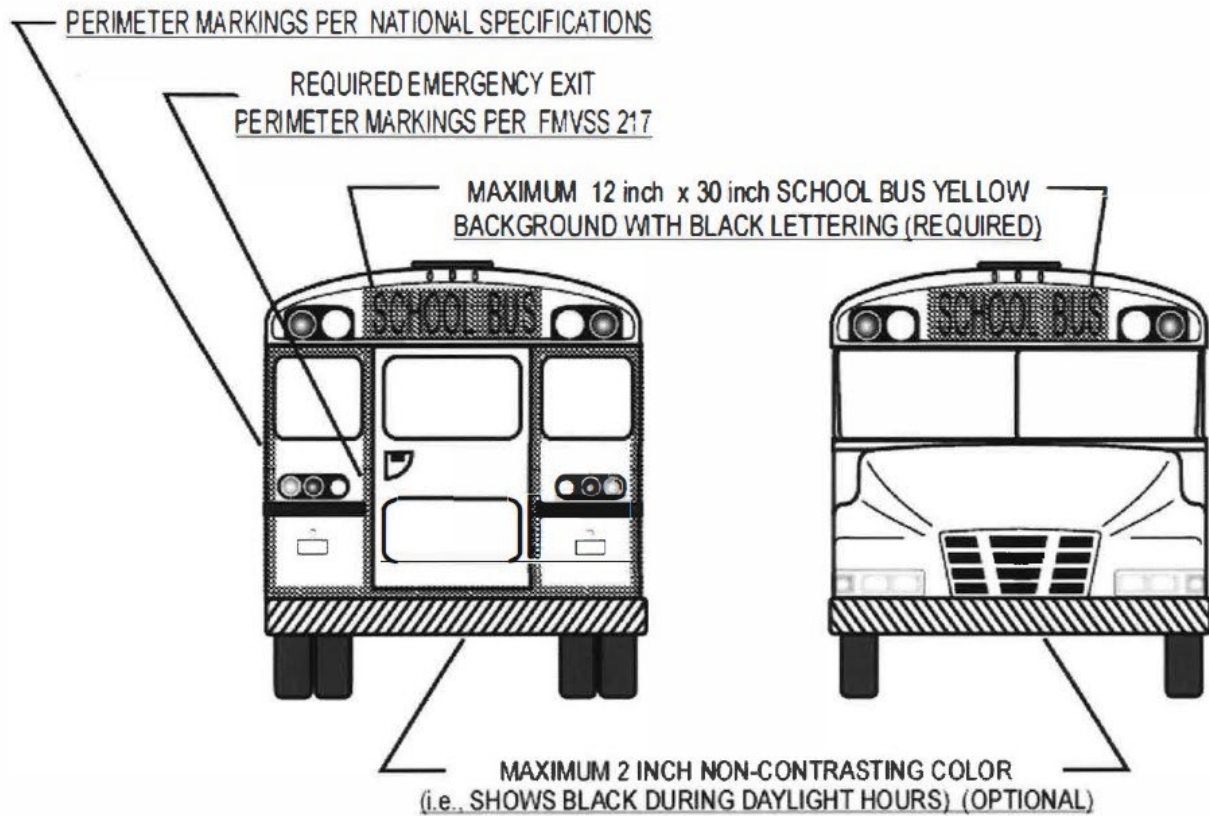
RCW 46.44.042 Maximum gross weights—Axle and tire factors.

Item 19

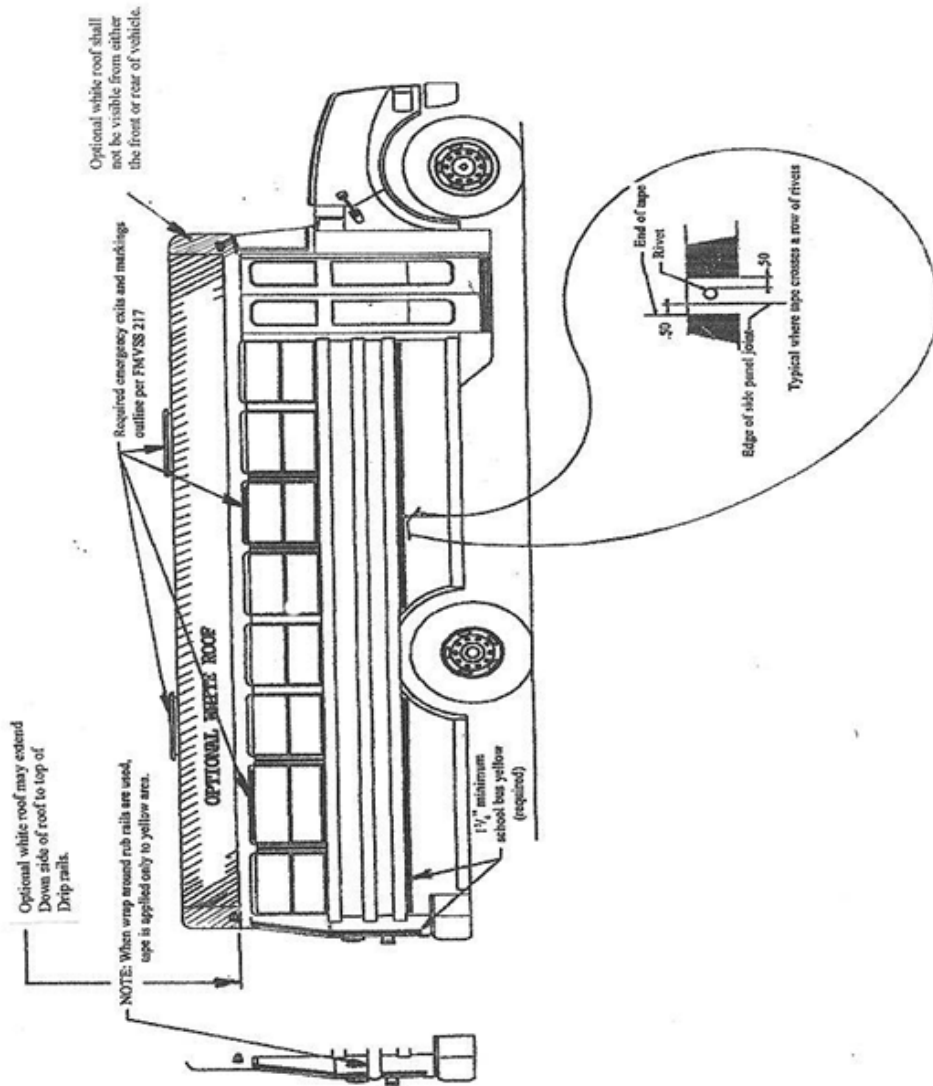
Placement of Reflective Markings



Placement of Reflective Markings (continued)



Placement of Reflective Markings and White Roof



Item 20

Tire Radius	
7.50 x 20	= 17.0
8 x 22.5	= 17.1
8.25 x 20	= 17.6
9 x 22.5	= 17.9
9.00 x 20	= 18.6
10.00 x 22.5	= 18.6
10.00 x 20	= 19.2
11 x 22.5	= 19.2
11.00 x 20	= 19.7
12 x 22.5	= 19.7
12.00 x 20	= 20.4

Item 21

Tire Revolutions per Mile	
7.50 x 20	= 568
8 x 22.5	= 563
8.25 x 20	= 549
9 x 22.5	= 543
9.00 x 20	= 520
10.00 x 22.5	= 529
10.00 x 20	= 504
11 x 22.5	= 501
11.00 x 20	= 487
12 x 22.5	= 487
12.00 x 20	= 470

Item 22

WASHINGTON STATE PATROL INSPECTION PROCEDURE: Stop signal arm, Crossing control arm, and Eight-light warning lamp system

General Requirements

1. The crossing control arm must extend at any time the red lights flash.
2. During lamp operation, the amber and red lights shall flash at a rate between 60 and 120 times per minute and reach full brilliance during each cycle.
3. Red and amber indicator lights shall flash in the driver's compartment at any time the respective lights flash on the outside of the bus.

Step A. (Power and manually operated systems)

1. Extend stop signal arm; red lights should flash.
2. Open and close service door; red lights should continue to flash and stop signal arm should remain extended.
3. Retract stop signal arm; red lights should cancel.

Step B. (Power and manually operated systems)

1. Turn master switch on, if so equipped.
2. Turn sequencing switch on; amber lights should flash.
3. Extend stop signal arm; amber lights should cancel, and red lights should flash.
4. Open and close service door; stop signal arm should remain extended, and red lights should continue to flash.
5. Retract stop signal arm; red lights should cancel.

Step C. (Power operated systems only)

1. Turn master switch on, if so equipped.
2. Turn sequencing switch on; amber lights should flash.
3. Open service door: amber lights should cancel, stop arm should extend, and red lights should flash.
4. Close service door: stop arm should retract, and red lights should cancel.
5. Open service door. If stop arm extends, and red lights flash, turn master switch off.

Step D. (Manually operated systems only)

1. Turn master switch on, if so equipped.
2. Turn sequencing switch on; amber lights should flash.
3. Open service door: amber lights should cancel, and red lights should flash.
4. Close service door: red lights should cancel.
5. Open service door. If red lights flash, turn master switch off.

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