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*Sept 1, 1986 to*  
*Jan. 21, 1989*

TITLE 126  
LEGISLATIVE RULE  
BOARD OF EDUCATION

SERIES 89  
MINIMUM REQUIREMENT FOR DESIGN  
AND EQUIPMENT OF SCHOOL BUSES (4334)

§126-89-1. General

1.1. Scope - This legislative rule establishes minimum requirements for nd equipment of school buses for the transportation of pupils.

1.2. Authority. -- W. Va. Code §§18-2-5; 18-5-13(6); 17C-14-12

1.3. Filing Date - July 15, 1986

1.4. Effective Date - September 1, 1986

1.5. Repeal of Former Rule - None - This is a revision of rule

§126-89-2. Incorporation by Reference

2.1. Copy of rules and regulations are attached. Copies may be obtained eof the Secretary of State and in the West Virginia Department of Education, Bureau of Finance and Services.

2.2. Summary of rules and regulations below:  
SUMMARY OF RULES AND REGULATIONS

The intent of the West Virginia Board of Education is that these requirements shall meet or exceed Fed-

eral Highway Safety Standards and National Minimum Standards for School Buses now in effect. Federal standards and West Vehicle laws shall govern instances not specifically covered in these requirements.

The West Virginia Board of Education is authorized to adopt these requirements under the provisions of Chapter 18, Article 2, Section 5, and Chapter 17C, Article 14, Section 12 of the West Virginia Code.

These requirements represent a revision of the present requirements, bringing them into compliance with new federal standards, and technological developments. Recommendations for this revision were made by the State Director of School Transportation, with the assistance and cooperation of county superintendents, county transportation directors and representatives from manufacturers of school bus chassis and bodies.

There is on file in the office of the Division of School Transportation a letter of approval of the revised requirements from the Commissioner of Motor Vehicles. These requirements were also reviewed and endorsed by the West Virginia Department of Public Safety.

**WEST VIRGINIA  
MINIMUM REQUIREMENTS FOR DESIGN  
AND  
EQUIPMENT OF SCHOOL BUSES**

*Series 89*

1986 REVISED EDITION

EFFECTIVE SEPTEMBER 1, 1986



Tom McNeel  
State Superintendent of Schools

Promulgation Procedure

In accordance with State law the policies herein (Rule #4334) have been submitted according to the following schedule:

1. Submission Date (Agenda mailed to State Board of Education)  
May 9, 1986
2. Promulgation Date (Approved by the State Board of Education)  
July 12, 1986
3. Filing Date (Legislative Rule-Making Review Committee)  
July 15, 1986
4. Filing Date (Secretary of State's Office) July 15, 1986
5. Effective Date -- September 1, 1986
6. Rule - #4334 (Supersedes Those Previously Filed)

Tom McNeel  
State Superintendent of Schools

July 12, 1986

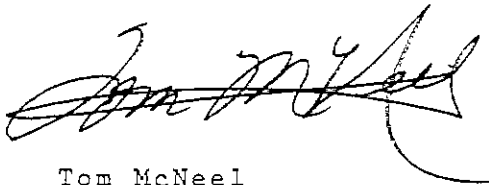
## Foreword

This publication establishes Minimum Requirements for Design and Equipment of School Buses for the transportation of pupils in compliance with Chapter 18, Article 5, Section 13, Subsection 6 of the School Laws of West Virginia. Careful consideration has been given to the selection of components and construction procedures which contribute to the safety, welfare and comfort of those transported. The school buses are designed and equipped to extend educational opportunities to nearly all segments of society from early childhood to elderly and handicapped persons.

Student transportation is an integral part of a comprehensive educational program. It is a very significant part of the challenge to provide a thorough and efficient system of education.

West Virginia has consistently exercised national leadership in school transportation safety. Our school buses are second to none in their design for the safety and convenience of those transported. Nationally, 22 million pupils are transported daily in 340,000 buses for an annual mileage in excess of 3 billion miles. About 300,000 West Virginia pupils are transported daily in 3,000 buses for an annual mileage of 37 million miles at a cost of \$74 million annually. A safe and effective accomplishment of this task is no small achievement.

On behalf of the State Board of Education and the West Virginia Department of Education, I commend the members of the Revision Committee and all who assisted directly or indirectly in developing these requirements. Your efforts will contribute to the health, safety and welfare of all those who ride West Virginia school buses.



Tom McNeel  
State Superintendent of Schools

## Preface

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APPENDIX C - LPG Minimum Requirements for Installation/Conversion

## DEFINITIONS, SCHOOL BUS

### TYPE A -

A Type "A" school bus is a conversion or body constructed upon a van-type compact truck or a front-section vehicle, with a gross weight rating of 10,000 pounds or less, designed for carrying more than 10 persons.

### TYPE B -

A Type "B" school bus is a conversion or body constructed and installed upon a van or front-section vehicle chassis, or stripped chassis, with a vehicle weight rating of more than 10,000 pounds, designed for carrying more than 10 persons. Part of the engine is beneath and/or behind the windshield and beside the driver's seat. The entrance door is behind the front wheels.

### TYPE C -

A Type "C" school bus is a body installed upon a flat back cowl chassis with a gross vehicle weight rating of more than 10,000 pounds, designed for carrying more than 10 persons. All of the engine is in front of the windshield and the entrance door is behind the front wheels.

### TYPE D -

A Type "D" school bus is a body installed upon a chassis, with the engine mounted in the front, midship, or rear, with a gross vehicle weight rating of more than 10,000 pounds, designed for carrying more than 10 persons. The engine may be behind the windshield and beside the driver's seat; it may be at the rear of the bus, behind the rear wheels, or midship between the front and rear axles. The entrance door is ahead of the front wheels.

Welfare

Transportation

School Bus Equipment

MINIMUM REQUIREMENTS FOR DESIGN AND EQUIPMENT OF SCHOOL BUSES  
1986 REVISED EDITION

NOTE: ANY ITEM SUPPLIED AS AN "EQUIVALENT" MUST HAVE PRIOR APPROVAL, IN WRITING, FROM THE STATE DIRECTOR OF SCHOOL TRANSPORTATION.

(Any changes in design or equipment by counties after receipt of bus must have prior approval in writing, from the State Director of School Transportation.)

BUS CHASSIS

AIR CLEANER

1. The engine intake air cleaner shall be dry element type and properly installed by the chassis manufacturer to meet engine specifications.

AXLES OR OTHER TYPES OF SUSPENSION

1. The front and rear axles including suspension assemblies, and all frame to ground components, shall have a gross axle weight rating at ground at least equal to that portion of the load as would be imposed by the chassis manufacturer's maximum gross vehicle weight rating. In no case shall capacities be less than those listed below:

<u>MANUFACTURER'S RATED PUPIL CAPACITY</u>	<u>FRONT AXLE OR OTHER FRONT SUSPENSION CAPACITY</u>	<u>REAR AXLE OR OTHER REAR SUSPENSION CAPACITY</u>
Type A - 10-16	3,400 lbs. at ground	5,300 lbs. at ground
Type B - 16-23	4,000 lbs. at ground	7,900 lbs. at ground
24-32	4,500 lbs. at ground	11,000 lbs. at ground
Type C - 16-35	5,000 lbs. at ground	12,000 lbs. at ground
47-53	6,000 lbs. at ground	15,000 lbs. at ground
59	7,000 lbs. at ground	17,000 lbs. at ground
65	9,000 lbs. at ground	17,500 lbs. at ground
71-77	9,000 lbs. at ground	19,000 lbs. at ground
Type D - 65-77 (FC)	13,000 lbs. at ground	19,000 lbs. at ground
83-89 (FC)	13,000 lbs. at ground	22,000 lbs. at ground
65-89 (RE)	13,000 lbs. at ground	23,000 lbs. at ground

2. All vehicles shall be equipped with appropriate GAWR axles or suspension systems and tires by chassis manufacturer.
3. Front axle shall be wide-track, heavy duty bus type. Oil bath wheel bearings on front axle are required.

4. New design two-speed axle is permissible for evaluation upon written permission from State Director of School Transportation.

## BRAKES

1. A braking system including service brake and parking brake, shall be provided.
2. Buses using air or vacuum in the operation of the brake system shall be equipped with warning signals, readily audible and visible to the driver, that will give a continuous warning when the air pressure available in the system for braking is 60 psi (pounds per square inch) or less, or the vacuum in the system available for braking is eight (8) inches of mercury or less. An illuminated gauge that will indicate to the driver the air pressure in pounds per square inch or the inches of mercury vacuum available for the operation of the brakes shall be provided.
  - a. Air brakes shall be installed on all chassis, 59 passenger and above. EXCEPTION: 59 through 77 passenger conventional chassis may be equipped with the new Ford Hydraulic System, with disc front, drum rear, and spring-loaded emergency and parking brake, if written permission is first obtained from the State Director of School Transportation.
  - b. Brake lining shall be non-asbestos material.
  - c. All air-operated brake systems:
    - (1) Shall have automatic front wheel limiting valves when necessary to provide a balanced system, without premature front axle lockup on wet or slippery roads.
    - (2) Shall be S-Cam type on all wheels.
    - (3) Shall be equipped with Bendix Heavy Vehicle Systems Group automatic slack adjusters ASA2, or equivalent slack adjuster that cannot over-adjust and will operate to maintain a shoe to drum clearance not to exceed .035 inches and that will not over-adjust in the defect mode. Slack lengths shall be 5 1/2 inches, front axle, and 5 1/2 or 6 inches on rear axle. A rear slack length of 6 1/2 inches is acceptable, if necessary, to achieve a 23,000 GAWR of the rear axle.
    - (4) Shall have at least 12 CFM air compressor, mounted on the ATA-TMC mounting bracket.
    - (5) Shall be protected by Bendix Westinghouse Model #AD4 air dryer, or equivalent desiccant bed dryer.
    - (6) Shall be equipped with a spring-loaded parking and emergency brake. A manual control, clearly identified, shall be within easy reach of the driver, in addition to a modulated control through the brake treadle valve.

- (7) Shall have at least 6" X 16 1/2" brake blocks on a 17,000 pound axle.
- (8) Shall be equipped with the largest size brake chamber compatible with companion axle components. Minimum chamber sizes shall be:

FRONT AXLES

REAR AXLES

Type 16- up to 9,000 lbs  
 Type 20-10,000 lbs. and above

Type 30/30  
 Type 30/30

If manufacturer's engineers anticipate that these minimum requirements for brake chamber type will result in any brake imbalance between axles, the chambers on the other axle shall be increased in size to result in a proper balance between axles.

- d. Vacuum-assist brake systems shall have a reservoir used exclusively for brakes that shall be adequate to ensure loss in vacuum at full stroke application of not more than 30 percent with the engine not running. Gas powered engines shall include suitable and convenient connections for the installation of separate vacuum reservoir.
    - (1) Hydraulic drum type brakes shall have at least 7" X 15" lining on 17,000 pound axle.
  - e. Any brake system dry reservoir shall be safeguarded by a check valve or equivalent device, that in the event of failure or leakage in its connection to the source of compressed air or vacuum, the stored dry air or vacuum shall not be depleted by the leakage or failure.
3. Buses using a hydraulic assist-booster in the operation of the brake system shall:
- a. be equipped with warning signals, readily audible and visible to the driver, that will provide continuous warning in the event of a loss of fluid flow from the primary source, or loss of electric source powering the back-up system. EXCEPTION: Class A vehicle is not required to have an audible warning signal.
  - b. be equipped with source of hydraulic pressure, automatically initiated upon loss of power from primary source, and operating independently of the primary power source.
4. All brake lines, power and booster-assist lines shall be protected from excessive heat and vibration, and be installed to prevent chafing.
5. All brake systems shall be designed to permit visual inspection of brake lining wear without removal of any chassis components.
6. Disc type brakes installed by chassis manufacturers are permissible.

7. Wig-wag type low air or low vacuum indicators are permissible.
8. Electric or hydraulic retarders are approved, and are recommended for buses operating on hilly or mountainous routes. Installation of such retarders must be made by, or under the supervision of manufacturer.

#### BRAKE, PARKING

1. All chassis, equipped with hydraulic brakes, shall be equipped with Orschelin type hand brake lever, easily accessible from the driver's seat. EXCEPTION: Type A vehicle - manufacturer's standard.
2. Parking brake, when applied, shall remain in applied position despite exhaustion of source of energy used for application or leakage of any kind.

#### BUMPER, FRONT

1. Front bumper shall be furnished by chassis manufacturer as part of the chassis.
2. Front bumper must be pressed steel channel at least 3/16 inch thick, or equivalent strength, seven (7) inches wide (high) and shall be of one-piece construction. Bumper or bumper brackets shall be bolted to chassis frame for convenience in maintenance.
3. Front bumper shall extend beyond forward-most part of body, grille, hood and fenders and shall extend to outer edge of fenders at bumper top line.
4. Bumper shall be of sufficient strength to permit pushing a vehicle of equal gross vehicle weight without permanent distortion to bumper, chassis, or body.

EXCEPTION: Type A vehicle - bumper shall be manufacturer's standard; Type D vehicle - front bumper shall be furnished by body manufacturer.

#### BUMPER, REAR

See Bumper, body requirements, page 17.

#### CERTIFICATION

1. Chassis manufacturer shall certify to the State Director of School Transportation that product meets all applicable federal and state requirements.

#### CLUTCH

1. Clutch torque capacity shall not be less than ten percent (10%) in excess of maximum net torque output of the engine.

#### COLOR

1. Chassis, including front bumper, shall be black. (Grille may be manufacturer's standard.)

2. Hood, cowl, and fenders shall be National School Bus Yellow.  
(SBMI-008) EXCEPTION: Hood may be painted low-luster yellow.

#### DIFFERENTIAL

1. If no-spin differential is used for equal distribution of power to rear wheels, the Eaton Cab Controlled Traction Differential, or equivalent, will be supplied on axles of 19,000 or greater capacity.
2. Purchaser shall specify differential ratios when order is submitted to chassis dealer.
3. Sanders - See body requirements.

#### DRIVE SHAFT

1. Torque capacity of the drive shaft assembly shall exceed maximum engine torque as developed through lowest transmission gear reduction.
2. Each drive shaft section shall be protected by a metal guard or guards around circumference of drive shaft to prevent whipping through the floor or dropping to the ground if broken.

#### ELECTRICAL SYSTEM

##### 1. Battery

- a. Gasoline Power: Battery shall have a rating of not less than Group 8D-900, with 430 reserve minutes measured per SAE 2-537H at 25 ampere rate. EXCEPTION: Type A vehicle - Manufacturer's standard; Type B vehicle - At least 475 CCA at 0 degrees F with 130 reserve minutes measured as per above.  
Diesel Power: Two 8D-900, as described above, shall be provided.
- b. One piece battery cables shall be provided by the chassis manufacturer.
  - (1) All cables shall conform to SAE Standard J541 with respect to electrical resistance.
  - (2) All cable assemblies shall conform to American Trucking Association-Truck Maintenance Council (ATA-TMC) RP105.
  - (3) Chassis 53 passenger and above, with diesel engine, shall have dual path, copper wire circuit to and from starter.
- c. Batteries for type B, C and D vehicles shall be mounted in the body skirt by the body manufacturer. In this case the chassis manufacturer shall temporarily mount the battery on the chassis frame, with proper cables of appropriate length for mounting in final location by body manufacturer. All cables, mounting, etc., shall conform to the SBMI Design Objectives Booklet, January 1985 edition. EXCEPTION: Type D, rear engine may have battery(ies) mounted in engine compartment.

2. Alternator

- a. Type A vehicle shall have a minimum 80 amperes per hour alternator. On buses equipped with power lift, alternator minimum shall be 100 amperes. Minimum charging rate at manufacturer's recommended engine idle speed shall be 50% of alternator capacity.
- b. Type B vehicle shall have a minimum 105 amperes per hour alternator with a minimum charging rate of 50 amperes at manufacturer's recommended engine idle speed.
- c. Type C and D vehicles shall have an alternator with a minimum charging rate of at least 140 amperes (in accordance with SAE rating) with a minimum charging rate of 50 amperes at manufacturer's recommended engine idle speed (12 volt system), and shall be ventilated and voltage controlled and, if necessary, current-controlled. Alternator shall have at least a 7/8 inch diameter shaft, be mounted on a bracket that conforms to ATA-TMC RP101, heavy duty truck alternator mounting and be accessible from top side of engine compartment for servicing. Dual belt drive shall be used with the alternator.
- d. Belt drive shall be capable of handling the rated capacity of the alternator with no detrimental effect on other driven components.
- e. For estimated electrical current draw see Appendix B.

3. Lamps and Signals - See pages 25-29.

4. Wiring

- a. All wiring shall conform to current applicable recommended practices of the Society of Automotive Engineers, with the capability of carrying a 10% overload without damage to wiring circuits.
  - (1) All wiring shall use a standard color coding and each chassis shall be delivered with a wiring diagram that coincides with the wiring of the chassis.
- b. Chassis manufacturer shall install a readily accessible terminal so that body and chassis electrical load can be recorded through the chassis ammeter without dismantling or disassembling chassis component(s).
- c. Chassis voltmeter and wiring shall be compatible with generating capacity. Type A vehicle may have ammeter in lieu of voltmeter.
- d. In addition to the main 100 amperes body circuit terminal, chassis manufacturer shall provide the following terminals for body connections:

- (1) Tail lamps.
- (2) Right turn signal.
- (3) Left turn signal.
- (4) Stop lamps.
- (5) Back-up lamps.
- (6) Instrument panel lights. (Rheostat controlled by headlamp switch.)

e. See page 38 also.

EXHAUST SYSTEM

1. Exhaust pipe, muffler and tailpipe shall be outside the bus body and attached to the chassis, with hangers designed to accommodate expansion and contraction of the system without damage to the system or hanger(s).
2. Tailpipe shall be constructed of a corrosion-resistant tubing material at least equal in strength and durability to 16 gauge steel tubing.
3. Tailpipe shall:
  - a. extend beyond the rear axle and shall extend at least five (5) inches beyond chassis frame and be mounted outside of chassis frame rail at end points, or
  - b. extend to, but not beyond, the body limits on the left side of bus, behind the driver's compartment, outboard of chassis centerline and shall terminate from chassis centerline as follows:
 

Type A Vehicles	-	Manufacturer's standard
Type B, C and D Vehicles	-	48.5 inches

EXCEPTION: The exhaust system on vehicles designed for the transportation of special education pupils shall be routed to the left of the right frame rail to allow for the installation of a lift on the right side of the vehicle.

4. Size of tailpipe shall not be reduced after it leaves the muffler.
5. Exhaust system on gas powered chassis shall be properly insulated from fuel tank and fittings by a securely attached metal shield.
6. Muffler shall be constructed of aluminized or equivalent corrosion-resistant material.

7. Exhaust pipe to muffler connection shall be expandable, accordion-type stainless steel tubing, unless designed to adequately compensate for expansion and contraction. Two pieces of equal diameter banded together are not acceptable unless improved design and/or materials prevent leakage at connections. EXCEPTION: Type A vehicle.

#### FENDERS, FRONT

1. Type A and B vehicles shall be manufacturer's standard.
2. Type C vehicle:
  - a. Total spread of outer edges of front fenders, measured at fender line, shall exceed total spread of front tires when front wheels are in straight-ahead position. Rubber fender extender shall be provided.
  - b. Front fenders shall be properly braced and free from any body attachment.
  - c. Fiberglass tilt hood shall be provided with wiring quick-disconnect in engine compartment.
  - d. Mud flaps shall be furnished by body manufacturer. See body requirements, page 31.
  - e. Fender/bumper design must prevent direct road spray between fender and bumper, or a flap must be installed to prevent such spray.

#### FRAME

1. Frame or equivalent shall have design and strength characteristics to correspond at least to standard practice for trucks of same general load characteristics which are used for highway service.
2. Any secondary manufacturer that modifies the original chassis frame shall guarantee the performance of workmanship and materials resulting from such modification.
3. Any frame modification shall not be for the purpose of extending the wheelbase.
4. Holes in top or bottom flanges of frame side rail shall not be permitted except as provided in original chassis frame. There shall be no welding to frame side rails except by chassis or body manufacturers. (This requirement does not prevent the installation and use of Mor-Ryde suspension systems, or frame repair by a certified welder.)
5. Frame lengths shall be provided in accordance with SBMI Design Objectives, January 1985 edition.

6. Any framē welding necessary for maintenance, shall be performed by a certified welder.

#### FUEL TANK

1. Fuel tank shall have a minimum capacity of 60 gallons with a 55 gallon actual draw, on all buses 47 passenger and above. It shall be filled and vented outside of the body. Construction will prevent the spillage or drainage of fuel on any part of the exhaust system. EXCEPTION: Type A vehicle - Fuel tank shall be manufacturer's standard. Type B vehicle - Fuel tank shall be 30 gallon, with 25 gallon actual draw, otherwise shall meet requirements of Type C and D vehicles.
2. No portion of the fuel system located to the rear of the engine compartment, except the filler tube, shall extend above the top of the chassis frame rail. EXCEPTION: Type B vehicle.
3. Fuel lines shall be mounted to obtain maximum protection from the chassis frame. Engine supply line shall be taken from top of tank.
4. Fuel filter with replaceable element shall be installed between fuel tank and injector pump. Flexible gasoline-and-oil-proof connection shall be provided at engine end of fuel line.
5. A water separator shall be installed between fuel tank and all diesel engine fuel and/or fuel injector pumps.
6. Drain plug of at least 1/4 inch pipe thread shall be located in center of bottom of tank. EXCEPTION: Type A vehicle.
7. Fill-pipe cap shall be designed to minimize spillage of fuel when bus turns corner in either direction. If venting of fuel tank is done other than through fill-pipe cap, cap shall be of non-vented type. (See provision for fuel systems in current Motor Carrier Safety Regulations.)
8. Fuel tank installation shall be in accordance with SBMI Design Objectives, January 1985 edition.

EXCEPTION: On a vehicle constructed for transporting handicapped pupils, the fuel tank may be mounted on left chassis frame rail or behind rear wheel.

#### FUEL, ALTERNATE

1. Alternate fuels are permissible provided they have been adequately tested for installation and use, both in the vehicle and in storage facilities, and meet all federal, state and industry safety requirements, regulations and standards.
2. Liquified Petroleum Gas (LPG) - See appendix.
3. Compressed Natural Gas (CNG) - Subject to temporary approval by State Director of School Transportation until adequate requirements are developed and approved by West Virginia Board of Education.

## GOVERNOR

1. Chassis engine shall be provided with an Engine RPM Governor. The governor shall be set at the manufacturer's recommended maximum engine speed. It shall not be used to control road speed. Combination engine and road speed governor is optional. EXCEPTION: Type A and B vehicles.
2. If chassis is powered by diesel engine, or engine is remotely located from driver, a tachometer shall be installed so engine speed may be known to the driver.
3. An audible and visible warning device is recommended to give a continuous warning at a speed above 58 mph., designed so bus operator cannot change setting and device shall record number of times pre-set speed was exceeded.

## HEATING SYSTEM, PROVISION FOR

1. The chassis engine shall have plugged openings for the purpose of supplying hot water for the bus heater system. The opening shall be suitable for attaching 3/4 inch pipe thread/nose connector. The engine shall be capable of supplying water having a temperature of at least 170 degrees F, at a flow rate of 50 pounds per minute at the return end of 30 feet of one inch diameter automotive hot water heater hose. (SBMI Standard #001 - Standard Code for Testing and Rating Automotive Bus Hot Water Heating Ventilating Equipment.)
2. SAE 20R3 - Class D2 hose shall be used throughout the bus heating systems. Engine cooling system hose shall meet applicable SAE Standard.
3. Chassis manufacturers shall supply "heater bit" connection for bus body supply and return lines. Connection will accept one inch inside diameter hose.

## HORN(S)

1. Bus shall be equipped with dual horns of standard make, capable of producing complex sound in bands of audio frequencies between 250 and 2000 cycles per second with a sound level of 110 db at 3 feet, per SAE Standard J-377. (Measurement shall be made with meter set at flat response - C weighting.)
2. Air horns are permissible. See body requirements, page 25.
3. Horn(s) shall be located above chassis frame rail.
4. All buses shall be equipped with audible electrical warning device, automatically actuated when bus is in reverse gear. Device shall be "Translectric, Inc., #T107" or equivalent, meeting SAE-J9946. Device shall be mounted behind rear axle, between frame rails, and shall emit intermittent sound.
5. Ohio-Type backing light is permissible. See body requirements, page 28.

## INSTRUMENTS AND INSTRUMENT PANEL

1. Chassis shall be equipped with the following instruments and gauges. (Lights in lieu of gauges are not acceptable.)
  - a. Speedometer.
  - b. Odometer which will give accrued mileage including tenths of miles.
  - c. Voltmeter with graduated scale to 16 volts. EXCEPTION: Ammeter may be substituted on Type A vehicle.
  - d. Oil pressure gauge, with red warning light to warn of low pressure.
  - e. Water temperature gauge, with red warning light to indicate overheating.
  - f. Fuel gauge.
  - g. Upper beam headlamp indicator.
  - h. Brake indicator gauge (air or vacuum).
    - (1) Light indicator in lieu of gauge is permissible on vehicle equipped with hydraulic-assist power brake.
  - i. Turn signal indicator.
  - j. Automatic transmission temperature gauge. EXCEPTION: Type A and B vehicles.
  - k. Tachometer or tachograph is permissible. (Tachometer is required with diesel or rear engine chassis.)
  - l. Glow plug indicator light where appropriate.
2. All instruments shall be easily accessible for maintenance and repair.
3. The above instruments and gauges shall be mounted on instrument panel clearly visible to driver while in normal seated position in accordance with SBMI Design Objectives, January 1985 edition.
4. Instrument panel shall have lamps of sufficient candlepower to illuminate all instruments and gauges, and shift selector indicator for automatic transmission.

## LENGTH, OVERALL

1. Overall length shall not exceed 40 feet.

## OIL FILTER

1. Oil filter of replaceable element or cartridge type shall be

provided, and shall be connected by flexible oil lines if it is not of built-in or engine-mounted design. Oil filter shall have a capacity of approximately one (1) quart.

OPENINGS

1. All openings in floorboard or firewall between chassis and passenger carrying compartment, such as gear shift lever and parking brake lever, shall be sealed.

PASSENGER LOAD

1. Actual gross vehicle weight (GVW) is the sum of the chassis weight, plus the body weight, plus the driver's weight, plus total seated pupil weight.
  - a. For purposes of calculation, the driver's weight is 150 pounds.
  - b. For purposes of calculation, pupil weight is 120 pounds per pupil.
2. Actual gross vehicle weight (GVW) shall not exceed the chassis manufacturer's gross vehicle weight rating (GVWR) for the chassis.
3. Manufacturer's gross vehicle weight rating shall be furnished in duplicate to the State Director of School Transportation.

POWER AND GRADEABILITY

1. Gross vehicle weight (GVW) shall not exceed 185 pounds per certified net published horsepower of the engine at the manufacturer's recommended maximum number of revolutions per minute.
2. Heavy duty engine shall be furnished instead of standard-type engine of equal or approximate displacement. The following chart presents the minimum horsepower and/or torque requirements for engines to be used in chassis accommodating bus bodies of the respective capacities.

GASOLINE POWER

<u>Passenger Capacity</u>	<u>Minimum Net HP</u>	<u>Minimum Net Torque</u>
Type A Vehicle	Manufacturer's Standard	
up to 23	124	225
23 - 35	145	250
47 - 53	160	275
59 - 77	175	290
71 - 77 Optional	185	300
83 - 89	195	340

### DIESEL POWER

<u>Passenger Capacity</u>	<u>Net Horsepower Range</u>
up to 35	130 - 155
47 - 59	155 - 165
65 - 77 Conventional	165 - 230
65 - 77 Transit	165 - 230
83 - 89 Transit	205 - 230

- a. All Type C and D vehicles shall be equipped with positive locking hand throttle.
- b. All engines shall be equipped with an automatic engine cooling fan. Automatic shutters may be used if coordinated to cycle properly with automatic fan.
- c. Block heaters shall be installed on all diesel engines with appropriately mounted socket readily accessible for plug in.
- d. All available warranty information must be provided to the purchaser.

### SHOCK ABSORBERS

1. Bus shall be equipped with front and rear double-action shock absorbers compatible with manufacturer's rated axle capacity, at each wheel location.

### SPRINGS

1. Capacity of springs or suspension assemblies shall be equal to or exceed axle rating, except when otherwise specified in bid invitation.
2. Springs or suspension assemblies shall be designed to carry not more than 75 percent of gross vehicle weight on rear tires and not more than 40 percent of gross vehicle weight on front tires.
3. If rear springs are used, they shall be of progressive type.
4. If leaf-type springs are used, stationary eyes shall be protected by full wrapper leaf in addition to main leaf.
5. Wrapper leaves on rear springs are permissible.
6. Clearance between springs and tire, and between tires, shall provide ample space for use of tripleside dual chains.
7. Air suspension systems are permissible.

STEERING GEAR

1. All chassis shall be equipped with heavy duty power steering of integral type with integral valves. Design shall provide a means of lubrication for all wear points, if wear points are not permanently lubricated.
2. Steering mechanism shall provide for easy adjustment for lost motion.
3. No changes shall be made in steering apparatus which are not approved by chassis manufacturer.
4. There shall be clearance of at least two (2) inches between steering wheel and cowl instrument panel, windshield, or any other surface.
5. All chassis accommodating 53 passenger bodies and above shall be equipped with a steering wheel having a minimum diameter of eighteen (18) inches.

TIRES AND RIMS

1. Tubeless tires, rims of proper size and tires with load rating commensurate with chassis manufacturer's gross vehicle weight rating shall be provided. In no case shall the tire and rim sizes be less than those shown below: (TYPE A VEHICLE - MFGR'S. STANDARD)

TYPE B AND C VEHICLES

<u>MFGR'S RATED PUPIL CAPACITY</u>	<u>SIZE</u>	<u>PLY</u>	<u>RIM SIZE</u>
16 - 23 (Type B)	8 X R19.5	8	6.0
29 - 35	8 X R22.5	10	6.0
47 - 53	9 X R22.5	10	6.0
59	10 X R22.5	10	7.5
65 - 77	11 X R22.5	14	7.5

TYPE D VEHICLES

- |         |            |    |     |
|---------|------------|----|-----|
| 71 - 91 | 11 X R22.5 | 14 | 7.5 |
|---------|------------|----|-----|
2. Dual rear tires shall be provided on all Type B, C and D vehicles.
  3. All tires on each vehicle shall be of same size and ply rating.
  4. If tire carrier is required, it shall be suitably mounted outside passenger compartment.
  5. First line steel belted radial tires are required.

#### TOW HOOKS

1. Front tow hooks shall be installed by chassis manufacturer and shall be at least 200 degrees spiral, have a minimum inside diameter of 2 1/2 inches and mounted parallel to bus frame rail.  
EXCEPTION: Type A vehicle shall be equipped with tow hooks adequate for towing vehicle.

#### TRANSMISSION

1. Automatic transmission shall be required on all vehicles except where local school authorities request that a manual-type transmission be furnished.
2. All automatic transmissions shall be equipped with an external oil filter. A temperature gauge shall be installed on the instrument panel. EXCEPTION: Type A and B vehicles.
3. Automatic transmissions shall be equivalent to the AT-545, four speed for buses of 47 to 65 passenger capacity inclusive. Buses of 71 passenger capacity and above shall be equipped with the MT-643 or equivalent. (The MT-643 is available with built in retarder.)
4. Manual-type transmission shall be synchromesh except in first and reverse gears. Its design shall provide not less than five (5) forward speeds and one (1) reverse speed for all buses of 47 passenger capacity and above. A choice of transmissions will be available for matching power train ratios for fuel efficiency. (Use of six-speed transmission is recommended on vehicles of 65 passenger capacity and above.)
5. All transmissions, on vehicles equipped with hydraulic brakes, shall be equipped with heavy duty, positive locking hand brake equivalent to the Orschelin brake. EXCEPTION: Type A vehicle.
6. Torque rating of transmission shall exceed torque output of engine by at least five (5) percent.

#### TURNING RADIUS

1. 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. 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. Chassis manufacturer shall coat undersides of front fenders with rustproofing compound which meets or exceeds Federal Specifications TT-C-520a, using modified test procedures as defined under "Undercoating" of body requirements.

WEIGHT DISTRIBUTION

1. Weight distribution of fully loaded bus on level surface shall not exceed the manufacturer's gross axle weight rating on any axle.

## BUS BODY

### AISLE

1. Minimum clearance of all aisles shall be 12 inches.
2. The seat backs shall be slanted sufficiently to give aisle clearance of 15 inches at tops of seat backs.

### AX

1. Bus shall be equipped with a sturdy hand ax that can be effectively used to remove safety glass. It shall be securely mounted in a conspicuous place, with a sheath for the blade, readily accessible in case of emergency.

### BATTERY

1. Battery shall be furnished by chassis manufacturer.
2. When battery is mounted as described in Electrical System, 1, Battery, of chassis requirements, the body manufacturer shall securely attach battery on a slide-out tray in a closed, vented compartment in the body skirt, whereby battery may be exposed to outside for convenient servicing. Cable length and routing, including travel of tray, shall permit the battery to slide completely outside of body limits for convenient removal and installation. Battery compartment door or cover shall be hinged at front or top, and secured by adequate and conveniently operated latch or fastener. (Battery tray shall have a safety stop to prevent dropping battery at outer extremity of tray travel.) Battery may be located in the engine compartment in rear engine buses. (When two Group D Batteries are used, connecting cables shall permit either or both battery tray(s) to slide to the full "OUT" position without damage to, or disconnecting, cables.

### BODY SIZES

1. Manufacturers rated pupil capacity and relative cowl to rear axle and end of frame measurements shall meet SBMI Design Objectives January 1985.

### BOOK RACKS

1. Book racks, if installed, shall meet the requirements of FMVSS 222.

### BUMPER, FRONT

1. Type D vehicle, see Bumper, Rear, 1, 2 and 3, pages 17-18.
2. Chassis, see chassis requirements, Bumper, Front, page 4.

### BUMPER, REAR

1. Bumper shall be of pressed steel channel at least 3/16 inch thick and nine (9) inches wide (high) and of sufficient strength to permit

pushing fully loaded bus by another vehicle without permanent distortion. EXCEPTION: Type A bumper may be 8" wide (high).

2. Bumper shall be wrapped around back corners of the bus, and shall extend forward at least 12 inches, measured from rear-most point of body at floor line.
3. Bumper shall be attached to chassis frame in such a manner that it may be easily removed, and braced to develop full strength of bumper section from rear or side impact, and shall be attached to prevent hitching of rides, or permanent distortion when rear of bus is lifted by attaching lifting device to bumper.
4. Bumper shall extend at least one (1) inch beyond rear-most part of body surface, measured at floor line. EXCEPTION: Type A vehicle.

#### CEILING

See Insulation and Interior, page 25.

#### CHAINS

1. Automatic tire chains are strongly recommended.
2. See Wheel Housings, page 37.

#### COLOR

1. The school bus body shall be painted uniform "National School Bus Yellow - Color Standard SBMI-008," in compliance with 1985 National Standards.
2. Primer shall be 3/4 - 1 mil and 1 1/2 - 2 mils of yellow paint.

#### CONSTRUCTION

1. Construction shall be of prime commercial quality steel or other metal, or material with strength at least equivalent to all-steel as certified by body manufacturer.
2. Construction shall provide reasonably dustproof and water-tight unit.
3. Floor shall be of prime commercial quality steel of at least 14 gauge or other material equivalent in strength to 14 gauge steel. (Type A, van conversion, manufacturer's standard) Floor shall be covered with approximately 5/8 inch thickness plywood, at least five (5) ply, and shall equal or exceed properties of exterior type Douglas fir plywood, B-B Grade, as specified in standard issued by Department of Commerce (Commercial Standard CS45-60, Douglas Fir Plywood: A Recorded Voluntary Standard At The Trade as amended.) Floor shall be level from front to back and from side to side, except in wheel housing, toeboard and driver's seat platform areas.
4. All openings between chassis and passenger-carrying compartment made due to alterations by body manufacturer must be sealed. See Openings, page 12.

5. Floor covering - see pages 22-23.

#### DEFROSTERS

1. Two (2) defrosters are required, one for each side of the bus. They shall be of sufficient capacity to keep windshield, window to left of driver, and glass area in entrance door clear of fog, frost and snow. Each defroster must draw heat from its own heater core or coil. The defroster for the right side of the bus shall be designed and mounted to not interfere with the operation of the service door. EXCEPTION: Type A and D vehicles may draw heat from a single source, if design accomplishes above defrosting requirements.
2. The defrosting system shall conform to Society of Automotive Engineers Standards J-381 and 382.
3. Combustion-type defrosters are permissible if installed by the body manufacturer, or by an authorized dealer.
4. At least two (2) auxiliary fans, six (6) inches in diameter shall be installed, suspended from above, one at each side of the windshield, where they can be adjusted for maximum effectiveness. Fan blades shall be covered with a protective cage. Each fan shall be controlled by a separate switch. EXCEPTION: Type A vehicle may use one (1) fan. Location, manufacturer's standard.
5. Auxiliary fans are not to be considered as part of the primary defrosting and defogging system.

#### DOORS

1. Service Door
  - a. Service door shall be under control of driver, and designed to afford easy release and prevent accidental opening. When hand lever is used, no part shall come together to shear or crush fingers.
  - b. Service door shall be located on right side of bus opposite driver and within direct view of driver.
  - c. Service door shall have minimum horizontal opening of 24 inches and minimum vertical opening of 68 inches. Type A vehicles shall have a minimum opening area of 1200 square inches.
  - d. Service door shall be jack-knife type. EXCEPTION: Type A and B vehicles and on models that cannot be equipped with jack-knife door (with three (3) step risers).
  - e. Lower as well as upper panels shall be of approved safety glass. Bottom of lower glass panel shall not be more than 35 inches from ground when bus is unloaded. Top of upper glass panel shall not be more than 6 inches from top of door. Type A vehicle shall have upper panel window(s) of safety glass with an area of at least 350 square inches.

- f. There shall be no door to left of driver on Type C or D vehicles. Type A and B vehicles may be equipped with chassis manufacturer's standard door.
- g. All doors 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 and extend the full width of the door opening.

2. Emergency Door

- a. Emergency door shall be hinged on right side if in rear end of bus and on front side if on left side of bus. It shall open outward and shall be labeled inside to indicate how it is to be opened. (Decals are not acceptable.) EXCEPTION: Type A vehicle - manufacturer's standard hinge.
- b. Upper and lower portions of emergency door shall be equipped with approved safety glazing. Exposed area of upper glazing shall not be less than 400 square inches and lower glazing shall not be less than 300 square inches. (See item 1, Windshield and Windows) EXCEPTION: Type A vehicle.
- c. There shall be no steps leading to the emergency door.
- d. Words, "EMERGENCY DOOR", both inside and outside in letters two (2) inches high shall be placed at the top of, or directly above the emergency door.
- e. If emergency door is located on left side of bus:
  - (1) Window across rear shall be designed as emergency exit and shall be no less than 16 inches high and 54 inches wide on buses 80 or more inches wide. It shall be equipped with latch (or latches) on inside, and outside, connected with an electrical buzzer that will actuate when released. Outside control of latches shall be non-detachable and designed to prevent hitching rides.
  - (2) Paneling is required to cover space between top of rear divan seat and inside surface of emergency window at rear.
  - (3) Aisle to door clearance shall be maximum possible in context of FMVSS-222. A "flip up" seat shall be provided to maximize clearance during emergency exit.
- f. Emergency door shall be designed to open from inside and outside of bus, and shall be equipped with fastening device which may be quickly released, but designed to offer protection against accidental release. Control from driver's seat shall not be permitted. Provisions for opening from outside shall consist of non-detachable device designed to prevent hitching-to, but to permit opening when necessary.
- g. Emergency door shall be equipped with a heavy duty web strap door stop to prevent door from striking lamps when open.

- h. Emergency door shall be equipped with a slidebar cam-operated latch. The slidebar shall be approximately 1 1/4 inches wide and 3/8 inch thick, and shall have a minimum stroke of 1 1/4 inches. The slidebar shall be spring loaded and have a bearing surface of a minimum of one (1) inch with the door closed and the latch in a closed position. The latch shall be equipped with a suitable electric plunger-type switch and connected with a buzzer located in the driver's compartment. The switch shall be enclosed in a metal case, and wires leading from the switch shall be concealed in the bus body. The switch shall be installed to contact the farthest edge of the door latch plunger in such a manner that a maximum movement of 5/16 inch of the door latch plunger will close the circuit and activate the buzzer. Both the switch and buzzer shall be approved by Underwriters Laboratories, Inc.
- i. Door latch shall be equipped with interior handle that extends to at least the center of the door. It shall lift up to release the latch, be protected by a metal guide and have printed instructions on its operation. (Decals not acceptable.)
- j. The outside handle shall be of such length to provide sufficient leverage to open door easily.
- k. If vandal lock is utilized, it shall be wired into the ignition and/or starting circuit to prevent starting of the engine with the door locked.

#### ELECTRICAL SYSTEM

- 1. Battery - See page 5 of chassis requirements and page 17 of body requirements.
- 2. Alternator - See chassis requirements.
- 3. Lamps and Signals - See pages 25-29.
- 4. Wiring - See pages 38-39.

#### FIRE EXTINGUISHER

- 1. Each bus shall be equipped with at least one (1) pressurized, dry chemical-type fire extinguisher of total metal construction, refillable, securely mounted in a durable bracket in driver's compartment in full view of, and readily accessible to driver. A pressure gauge shall be mounted on the extinguisher to be easily read without removing the extinguisher from its mounted position.
- 2. The fire extinguisher shall be of a type approved by the Underwriters Laboratories, Inc., with a total rating of not less than 2A-10-BC. The operating mechanism shall be sealed with a type of seal which will not interfere with use of the fire extinguisher.
- 3. Halon #1211 extinguishers with equivalent capacity for extinguishing fires are permissible.

FIRST AID KIT -

1. Bus shall have a removable, moisture and dustproof first aid kit mounted in full view in an accessible place within the driver's compartment. This place shall be identified by marking and may be locked with an ignition interlock.
2. The minimum requirement is a 36 unit kit with contents as designated below:

Bandage Compress, (sterile gauze pads) 4 inch	5 units
Bandage Compress, (sterile gauze pads) 2 inch	6 units
Adhesive Absorbent Bandage (adhesive tape) 1 inch	4 units
Triangular Bandage, 40 inch	4 units
Gauze Bandage, 4 inch	5 units
Absorbent-Gauze Compress	6 units
Wire Splints	2 units
Tourniquet and Forceps	2 units
Kindergarten Scissors	1 unit
Ammonia Inhalants	1 unit

FLOOR -

See Construction, page 18.

FLOOR COVERING -

1. Floor covering shall be of high quality, heavy duty, fire-resistant rubber material and shall meet Federal Specifications ZZ-M-71b. Covering shall have a smooth sanded back with burlap removed.
2. Floor covering shall be permanently bonded to the floor and must not blister, crack or grow with reasonable use and maintenance. Bonding of adhesive material shall be waterproof and shall be of type recommended by the manufacturer of floor covering material. All seams or joints in flooring shall be neat and sealed with waterproof sealer.
3. Floor covering, including aisle area, shall be ribbed, non-skid type. Minimum overall thickness shall be 0.187 inch.
4. Covering for underseat area, top of wheel housing, driver's compartment and toeboard shall be smooth non-skid type and shall have a minimum thickness overall of 0.125 inch. Covering shall be securely bonded to contour of wheel housing.

5. Cove molding shall be used along side walls and rear corners. Metal or equivalent aisle joint strips shall be used to protect joints of flooring. However, painstaking care must be exercised to assure joints are properly fitted and sealed prior to fitting strips or molding to floor. Aisle strips shall be so shaped that the edges of same shall be drawn and held firmly to the flooring material.
6. Floor construction shall provide a properly sealed opening for access to fuel gauge sending unit and/or in-tank fuel pump for all buses 35 passenger and above.

FUEL PORT DOOR

1. Body manufacturer shall furnish a fuel port door on Type C and D vehicles.
2. "Diesel" or "Gasoline" shall be appropriately labeled on or within six inches of fuel port door.
3. Locking device for door optional.

HEATERS

1. Heaters shall be of hot-water or combustion type. All combustion type heaters shall be approved by Underwriters Laboratories, Inc.
2. When more than one heater is used, additional heaters may be of re-circulated air type.
3. The heating system shall be capable of maintaining throughout the bus temperature of not less than 50 degrees F at average minimum January temperature as established by the U.S. Department of Commerce, Weather Bureau, for the area in which the vehicle is to be operated.
4. Type B, C and D vehicles shall be equipped with a minimum of three (3) heaters with a minimum rating of:
 

Type B Vehicle	-	165,000 BTU (Right front heater, driver's toe warmer and rear heater meeting total BTU requirement are acceptable.)
Type C and D Vehicles	-	178,000 BTU.
Type A Vehicle	-	must have two (2) heaters, capable of at least 100,000 BTU output.
5. Heaters shall be located as follows:
  - a. In Type A vehicle, one heater shall be mounted in front and one in rear of bus.
  - b. Type B, C and D vehicles, one heater shall be on each side at front, and the third heater behind rear wheel housing. All heater cores shall be protected by a housing.

- c. Size of heaters for the above locations shall relate to configuration of bus interior and available space at each location. Provided, however, that total output requirements are met and a relatively even distribution of heat throughout the bus interior is achieved.
6. All heaters installed by body manufacturer shall bear a name plate that shall indicate the heater rating in accordance with SBMI Code 001, with said plate to be affixed by the heater manufacturer which shall constitute certification that the heater performance is as shown on the plate.
7. Heater Lines and Hose
  - a. Heater lines (pipe) shall be a minimum of 3/4 inch inside diameter.
  - b. All hose must be one (1) inch. EXCEPTION: Type A vehicle.
  - c. Hose clamps shall be "collar screw type."
  - d. Hose shall be adequately supported to guard against excessive wear due to vibration.
  - e. Hose shall not dangle or rub against sharp edges, nor interfere with or restrict the operation of any engine function.
  - f. All hose shall conform to SAE 20R3 - Class D2.
  - g. Heater lines on the interior of bus shall be shielded to prevent scalding of passengers.
  - h. Any heater line or hose routed outside of bus body shall be insulated for the entire length of hose exposed to outside temperature.
8. Each hot water system shall have a shut-off valve installed in the pressure and return lines at the firewall (cowl). There shall be a water flow regulating valve installed for convenient operation by the driver. EXCEPTION: Type A vehicle - located at or near the engine.
9. An accessible service entrance to heaters shall be provided by an outside removable body panel or removable heater cover. Type C vehicle shall provide access to heater components on driver's side through outside access panel, if not readily accessible from interior of bus.
10. Accessible air bleeder valves shall be installed with all heaters.
11. Each heater motor shall be attached to a separate circuit breaker.

HEIGHT, INSIDE

1. Inside body height shall be nominal 72 inches or more, measured metal to metal, at any point on longitudinal center line from front vertical bow to rear vertical bow. EXCEPTION: Type A and B vehicles.

#### HORNS

1. If air horn(s) is used, it shall be mounted above driver's window on left side of bus.

#### IDENTIFICATION

1. Body shall bear words "SCHOOL BUS" in black letters at least eight (8) inches high on both front and rear of body. Lettering shall be placed as high as possible without impairment of its visibility. Lettering shall conform to "Series B" of Standard Alphabets for Highway Signs.
2. Every bus shall be lettered "\_\_\_\_\_ COUNTY SCHOOLS", on both sides of bus, and numbered on both sides and rear (front numbers to be affixed by county). Numbers on both sides shall be near front, in line with lettering. Lettering and numbering on sides of bus shall be at least five (5) inches high.

#### INSULATION

1. Ceiling and walls shall be fully insulated with proper material applied inside of outside panels by spray to deaden the sound and to reduce vibrations to a minimum.
2. Ceiling and walls shall be fully insulated with fiberglass or equivalent having a thickness of 1 1/2 inches.  
EXCEPTION: Fiberglass insulation of two (2) inch thickness may be used where it can be accommodated without being depressed. However, special attention must be given this factor of tolerance. Such thermal insulation shall be fire-resistant material of type approved by Underwriters Laboratories, Inc.

#### INTERIOR

1. Interior of bus shall be free of all unnecessary projections likely to cause injury. This standard requires inner lining on ceilings and walls. If ceiling is constructed so as to contain lapped joints, forward panel shall be lapped by rear panel and exposed edges shall be beaded, hemmed, flanged, or otherwise treated to minimize sharp edges.
2. An access panel shall be provided for servicing the eight-light system without removing ceiling panel.
3. Cowl shall not be modified, or accessories installed, to interfere with driver's visibility of gauges on instrument panel.
4. Flammability of interior materials shall meet FMVSS 302.

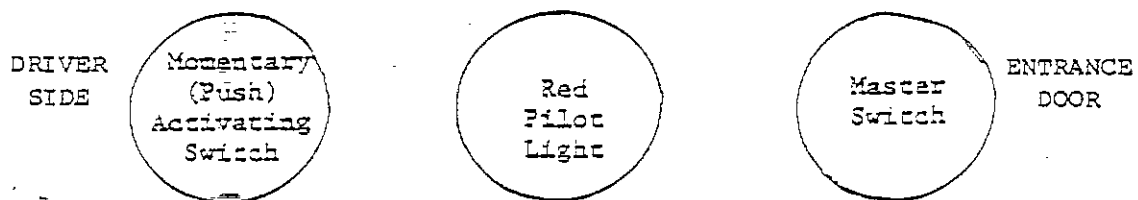
#### LAMPS AND SIGNALS

1. All lamps, including installation shall conform to current standards and recommendations of SAE, West Virginia Motor Vehicle Law and FMVSS 108.
2. Head Lamps

- a. Head and tail lamps shall be combined on a single circuit, served by a separate circuit breaker. There shall be no other electrical load added to the head lamp circuit.
3. Clearance and Side-Marker Lamps
    - a. Clearance and side-marker lamps shall be armored type, combined in a circuit controlled by the same switch.
4. Tail and Stop (Brake) Lamps
    - a. In addition to the two (2) tail and stop combination lamps in the head lamp circuit, bus shall be equipped with two (2) seven (7) inch stop (brake) lamps, capable of emitting a red light plainly visible for distance of 500 feet to the rear. (These lamps may be combination stop/tail lamps.) The light intensity of these lamps shall at least equal that of Class A turn signal lamps as established by the Society of Automotive Engineers.
    - b. Tail lamps shall be mounted at least 40 inches from surface on which vehicle stands. Stop (brake) lamps, in "a" above, shall be as high as practicable, but below window line; spaced as far apart laterally as practicable, but not less than three (3) feet. Measurements shall be taken from lamp centers.
5. Back-Up Lights
    - a. Two (2) are required, one on each side of rear door. Bulb shall be 32 candlepower, with lens and/or reflector capable of lighting roadway and objects to rear of bus for safe backing, during darkness.
6. License Plate Lamp
    - a. License plate lamp shall be in combination with one of the tail lamps.
7. Interior Lamps
    - a. Interior lamps shall include two (2) rows of dome lamps installed on two circuits so that lamps in front half and lamps in rear half of bus are on separate circuits.
    - b. A stepwell lamp which adequately illuminates stepwell shall be provided. It shall be connected in the clearance light circuit and activated when the service door is opened.
8. School Bus Alternately Flashing Signal Lamps
    - Definition: School bus red signal lamps are alternately flashing lamps mounted horizontally both front and rear, intended to identify a vehicle as a school bus and to inform other users of the highway that such vehicle is stopped on highway to take on or discharge school children.
    - School bus yellow signal lamps are alternately flashing lamps

mounted horizontally both front and rear, intended to identify a vehicle as a school bus and to inform other users of the highway that such vehicle is about to stop on highway to take on or discharge school children.

- a. Each school bus shall be equipped with a system consisting of four (4) red signal lamps designed to conform to SAE Standard J887, and four (4) amber signal lamps designed to that standard except for color, and except that their candlepower shall be at least 2 1/2 times that specified for red signal lamps. Systems shall be wired through a master switch, but NOT through vehicle ignition switch.
- b. Both red and amber signal lamps shall be installed in accordance with SAE Standard J887, except that each amber signal lamp shall be located near each red signal lamp, at the same level, but closer to the vertical centerline of the bus. Shields over lights, painted black, with a minimum depth of four (4) inches shall be furnished.
- c. The system shall be wired so that the amber signal lamps are activated only by hand operation and, if activated, are automatically deactivated, and red signal lamps are automatically activated when the bus entrance door is opened.
- d. The flashing mechanism shall be capable of carrying the full current load of the signal system in continuous operation.
- e. Right and left signal lamps shall flash alternately. Each signal lamp shall flash not less than 60, nor more than 120 flashes per minute. The "on" period shall be long enough to permit bulb filament to come up to full brightness.
- f. There shall be a red pilot lamp which shall go on when the respective amber or red systems are actuated. The pilot shall either go out or flash at an altered rate in the event the system is not functioning normally.
- g. Signal lamp system shall require a separate control panel. Panel shall be constructed as small as practicable. Switches and red pilot lamp shall be located in conformance with the diagram below:



CONTROL PANEL

The panel shall be mounted above the door control on belt bar within easy unobstructed reach of the driver. The red pilot light shall be readily visible to the driver.

h. Signal lamp system shall operate as follows:

- (1) With master switch on, entrance door closed, depress hand switch. Red pilot light and amber signals shall go on.
- (2) Open entrance door. Red pilot light and amber signal lamps shall go off, and red pilot light and red signal lamps shall go on. Stop arm, if air, vacuum, or electrically powered, shall automatically extend.
- (3) Close entrance door. Red pilot and signal lamps shall go off, and stop arm, if air, vacuum, or electrically powered, shall retract immediately.
- (4) Open entrance door without depressing hand switch. Red pilot light and red signal lamps shall go on. Stop arm, if air, vacuum, or electrically powered, shall automatically extend.
- (5) With master switch off, depressing hand switch shall not actuate the amber signal system, nor shall opening entrance door actuate the red signal system and stop arm.

i. Installation Requirements

- (1) Each flashing signal lamp shall be mounted with its axis substantially parallel to longitudinal axis of vehicle.
- (2) Front and rear alternately flashing signal lamps shall be spaced as far apart laterally as practicable.
- (3) Alternately flashing signal lamps shall be mounted at the front above the windshield and at the rear so that the lower edge of lens is not lower than top line of the side window.
- (4) Vertical and lateral vision of the front and rear alternately flashing warning lights shall not be obstructed by any part of the body or lamphouse insofar as standard bus body construction shall permit.
- (5) Area around each lamp, extending approximately three (3) inches outward shall be painted black.
- (6) A separate fuse or circuit breaker, adequate to prevent damage to the system in the event of a dead short, shall be provided between the power source and the master switch.
- (7) All wiring from alternately flashing signal lamps to the door switch shall be at least 14 gauge and must meet SAE requirements.

9. Automatic Warning Device:

- a. Use of visual warning device, commonly known as "Ohio Backing Light", is permissible.

10. Turn Signal Lamps

- a. Bus body shall be equipped with Class A turn signal lamps that meet SAE J588C. They shall have a seven (7) inch diameter, arrow-faced lens. These signal lamps shall be independent units and be connected to chassis hazard warning switch to cause simultaneous flashing of turn signal lamps when needed as vehicular traffic hazard warning.
- b. Type B, C and D vehicles shall have a light with a protective rim, mounted on right side behind service door and on left side behind stop arm signal, wired in the turn signal circuit.

11. Emergency Warning Device

- a. Each school bus shall contain at least three (3) reflectorized triangle road warning devices mounted in an accessible place. Mounting bracket shall be heavy duty type.
- b. Electronic sensors for detecting persons or objects in "blind spots" are permissible for test purposes with approval from the State Director of School Transportation.

METAL TREATMENT

1. All metal used in construction of bus body shall be zinc- or aluminum-coated or treated by equivalent process before bus is constructed. Excluded are such items as door handles, grab handles, interior decorative parts, and other interior plated parts.
2. All metal parts that will be painted shall be (in addition to above requirements) chemically cleaned, etched, zinc-phosphate-coated, and zinc-chromate or epoxy primed or conditioned by equivalent process.
3. In providing for these requirements, particular attention shall be given lapped surfaces, welded connections of structural members, cut edges, punched or drilled hole areas in sheet metal, closed or box sections, unvented or undrained areas, and surfaces subjected to abrasion during vehicle operation.
4. As evidence that above requirements have been met, samples of materials and sections used in construction of bus body, when subjected to 1000-hour salt spray test as provided for in latest revision of ASTM designation; B-117 "Standard Method of Salt Spray (Fog) Testing", shall not lose more than 10 percent of material by weight.

MIRRORS

1. Interior Mirror

- a. Interior mirror shall be either clear view laminated glass or clear view glass bonded to a backing which retains the glass in the event of breakage. Mirror shall be a minimum of 6" X 30".  
EXCEPTION: Type A vehicle may be 6" X 16".

## 2. Exterior Mirrors

- a. Each bus shall have two (2) exterior clear view, rear view mirrors, one to the left and one to the right of driver. Mirror on left must be viewed through window directly to left of driver. Must be adjustable to include rear wheels in driver's line of vision. Must be heated without applying heat directly to glass. Mirrors are to be case heated and have a lifetime warranty on case and glass. Heating element shall have a one (1) year warranty.

- b. Type A vehicle - may be manufacturer's standard.

Type B vehicle - shall have minimum of 50 square inches of mirror surface for each mirror.

Type C and D vehicles - shall have minimum of 90 square inches of mirror surface for each mirror. EXCEPTION: Type D vehicle may use low mount Greyhound type mirrors.

- c. Two (2) exterior 10 inch, hemispherical mirrors shall be provided. Mirrors shall be appropriately mounted on firm stainless steel support brackets, on each side at the extreme front of the bus, adjustable to afford visibility, from the bus operator's seated position, of the entire front and sides of the bus and the pavement immediately adjacent to same. Mirrors shall be constructed of stainless steel originating in the United States. These mirrors shall be warranted, by the mirror manufacturer, for the life of the bus.
- d. All mirrors shall be mounted forward of service door, in a manner that minimizes attendant "blind spots", firmly supported and readily adjustable to meet rear vision needs of driver to see along sides and to the rear of bus. EXCEPTION: Type A vehicle mirror may be mounted on service door.
- e. All mirrors shall be mounted on fully adjustable brackets. All hemispherical mirrors shall have extendable and retractable main arm and brace.

### MOUNTING

1. Body to chassis mounting shall:

- a. provide adequate body to chassis insulation with permanently installed insulators.
- b. attach body to chassis with 7/16 inch u-bolts, in addition to the manufacturer's standard means of attachment. The u-bolts shall be fitted with lock washers and nuts and, after the nuts have been securely tightened, threads shall extend at least 1/2 inch past the nuts. The u-bolts shall be spaced along the length of the mating surfaces for maximum support and efficiency. EXCEPTION: Type A vehicle.

c. have u-bolts for body sizes as follows:

- (1) Up to 35 passenger, four (4).
- (2) 47 through 59 passenger, six (6).
- (3) 65 through 89 passenger, eight (8).

#### MUD FLAPS

1. Mud flaps or guards are required and shall be provided by the body manufacturer for both front and rear wheels.
2. Front mud flaps or guards shall be of adequate size to protect body areas vulnerable to road debris from wheels, and mounted to be free of wheel movement at all times.
3. Rear mud flaps or guards shall be comparable in size to width of rear wheel housing, and shall reach within approximately nine (9) inches of the ground when bus is empty. They shall be mounted at a distance from the wheels that will permit free access to spring hangers for lubrication and maintenance, and to prevent their being pulled off while vehicle is in reverse motion, or damaged by tire chains.  
EXCEPTION: Type A vehicle exempt from mud flap requirement.

#### OVERALL LENGTH

1. Overall length of bus shall not exceed 40 feet.

#### OVERALL WIDTH

1. Overall width of bus shall not exceed 102 inches, excluding authorized safety equipment.

#### PUBLIC ADDRESS SYSTEMS

1. Public address systems and combination radio and tape players on school buses are permissible for directing and disciplining passengers. Inside speakers shall be recessed.

#### RADIO SYSTEMS

1. Two-way radio communication is recommended.
  - a. Mobile Unit Recommendations
    - (1) FM-UHF 450-470 MHz with capability of transmitting and receiving on at least three (3) channels.
    - (2) Units should be equipped with tone squelch (CTCSS).
    - (3) Transmit power should be no less than 25 watts and transmitter should meet EIA RS-152B standards.
    - (4) Receiver sensitivity should be no less than .25uV (12dB SINAD) and receiver should meet EIA RS-204C standards.

b. Base/Control Station Configuration

- (1) Should be compatible with recommended equipment and designed as required to cover specified service area.

RUB RAILS

1. There shall be at least three (3) rub rails located as follows:
  - a. One at seat level.
  - b. One at floor level.
  - c. One at bottom of body skirt. EXCEPTION: Type A vehicle.
2. Rub rails shall extend from the rear of the entrance door completely around the bus to point of curvature near outside cowl on left side. At least one rub rail will extend around rear of bus.
3. Rub rails shall be one piece except where broken by emergency door, wheel housings, battery box, corner of bus, etc. All ends shall be capped. —
4. Rub rails shall be overlapped at body corners and securely attached at least twice to each body post and upright structural member within their length.
5. Rub rails shall be four (4) inches or more in width, of 16 gauge steel or suitable material of equivalent strength, and constructed in corrugated or ribbed fashion.
6. Rub rails shall be applied outside body or outside body posts. Pressed-in or snap-on rails do not satisfy this requirement.

SANDERS

1. Sanders, if used, shall:
  - a. be of hopper-cartridge valve type.
  - b. have metal hopper with interior surfaces treated to prevent condensation of moisture.
  - c. be of at least 100 pound (grit) capacity.
  - d. have cover on filler opening of hopper, which screws into place, sealing unit airtight.
  - e. have discharge tubes extending appropriately to front of each rear wheel.
  - f. have no-clogging discharge tubes with slush-proof, non-freezing rubber nozzles.
  - g. be operated by electric switch with telltale light mounted on instrument panel.

- n. be exclusively driver-controlled.
- i. have gauge to indicate hoppers need refilling when they are down to one-quarter full.

#### SEAT BELT FOR DRIVER

1. A locking retractor type seat belt shall be provided for the driver. Each belt section shall be booted so as to keep the buckle and button-type latch off the floor and within easy reach of the driver. Belt shall be anchored in such a manner or guided at the seat frame so as to prevent the driver from sliding sideways from under the belt.

#### SEATS

1. All seats shall have minimum depth of fifteen (15) inches.
2. In determining seating capacity of bus, allowable rump width shall be:
  - a. thirteen (13) inches where 3-3 seating plan is used.
  - b. fifteen (15) inches where 3-2 seating plan is used.
  - c. thirteen (13) inches where 3-2 seating plan is used on vehicles 84 inches to 90 inches inside.
3. All seats shall be forward-facing and anchorage shall comply with Federal Motor Vehicle Safety Standards 207 and 222.
4. All passenger seat cushions shall be attached positively to front rail of seat frame so that seat may be tilted forward for cleaning bus, but seat will not be loose from frame rail.
5. Rear-most seat shall retain maximum allowable rump room.
6. No bus shall be equipped with jump seats or portable seats.
7. Forward-most pupil seat on right side of bus shall be located to not interfere with driver's vision, not farther forward than guard rail behind driver, or rear of driver's seat when adjusted to its rear-most position.
8. Seat, seat back cushion and crash barrier shall be covered with a material having 42-ounce finished weight, 54 inches width, and finished vinyl coating of 1.06 broken twill or other material with equal tensile strength, tear strength, seam strength, adhesion strength, resistance to abrasion, resistance to cold and flex separation.

Seat covering will take advantage of fire suppressing glass barrier when technology resolves bonding problem.

- a. Seat cushions shall be a thickness that will not depress more than 80 percent when a pupil weight of 360 pounds is applied, and it shall have rapid and adequate recovery. These cushions

shall be high enough in the back to provide the proper joint with the seat back. These cushions shall have a mid-cushion height of approximately five (5) inches.

- b. The seat cushion shall have a 1/2 inch thick moisture-resistant plywood base or approved equal.
9. Minimum distance between steering wheel and back rest of driver's seat shall be 11 inches. Driver's seat shall be bolted to floor and shall have vertical adjustments, with fore-and-aft adjustment of not less than four (4) inches.

#### STEPS

- 1. First step at service door shall be not less than 12 inches and not more than 16 inches from ground, based on standard chassis specifications.
- 2. Service door entrance may be equipped with two-step or three-step stepwell. Risers in each case shall be approximately equal. When plywood floor is used on steel, differential may be increased by thickness of plywood used.
  - a. When three-step stepwell is specified, the first step at service door shall be approximately 10 to 14 inches from the ground when bus is empty, based on standard chassis specifications. See Regular Service Entrance Door, 2, page 44.
- 3. Steps shall be enclosed to prevent accumulation of ice and snow.
- 4. All steps, including floor line platform area, shall be covered with 3/16 inch rubber floor covering or other material equal in wear resistance and abrasion resistance to top grade rubber.
  - a. Metal back of tread, minimum 24 gauge cold roll steel, shall be permanently bonded to ribbed rubber; grooved design shall be such that said grooves run at 90 degree angle to long dimension of step tread.
  - b. Three-sixteenth inch ribbed step tread shall have a 1 1/2 inch white nosing as integral piece without any joint.
  - c. Rubber portion of step treads shall have following characteristics:
    - (1) Special compounding for good abrasion resistance and high coefficient of friction.
    - (2) Flexibility so that it can be bent around a 1/2 inch mandrel both at 130 degrees F and 20 degrees F without breaking, cracking, or crazing.
    - (3) Show a durometer hardness 85 to 95.
- 5. Steps shall not protrude beyond side body line when entrance door is closed.

6. Stainless steel clad grab handle, not less than 16 inches, designed with smooth contour to prevent catching of belts or articles of clothing shall be provided. EXCEPTION: Type A vehicle.

#### STIRRUP STEPS

1. There shall be at least one (1) folding stirrup step or recessed foothold and suitably located handles on each side of the front of the body for easy accessibility for cleaning the windshield and lamps, except when windshield and lamps are easily accessible from the ground. EXCEPTION: Type A vehicle. A step, in lieu of the stirrup steps, is permitted in or on the front bumper.

#### STOP SIGNAL ARM / CROSSING CONTROL ARM

1. There shall be a stop signal arm installed on the left outside of the body. It shall meet the applicable requirements of Society of Automotive Engineers J1133. Arm shall be of an octagonal shape with white letters and border and a red background. Flashing lamps in stop arm shall be connected to the alternately red flashing signal lamp circuits. The stop signal arm shall be vacuum, electric or air operated.
2. Crossing control arm is permissible.

#### STORAGE COMPARTMENT

1. Metal compartment of adequate strength and capacity for storage of tire chains, tow chains, and such tools as may be necessary for minor repairs shall be provided. Such storage compartment shall be located outside passenger compartment. The dimensions of this compartment shall be approximately 25 inches long, 16 inches wide and 12 inches high, mounted in right side of body skirt below floor. EXCEPTION: Type A vehicle, van conversion, for size and location.

A door with hasp for lock, as well as a proper latch, shall be provided. Such compartment shall be constructed of highly non-corrosive metal, and provision for drainage of water resulting from snow and ice on tire chains shall be provided. EXCEPTION: Special Education bus compartment may be on left or right.

#### SUN SHIELD

1. Interior adjustable, transparent, tinted sun shield approximately 6" X 30" shall be provided. Installation must enable turning up to an angle of 180 degrees when not in use. EXCEPTION: Type A vehicle size may be 6" X 17".

#### TAILPIPE

1. Tailpipe shall not extend beyond rear bumper. See Exhaust System, page 7.

### TOW HOOKS

1. Chassis manufacturer shall provide front tow hooks on Type C vehicle.
2. Body manufacturers shall provide rear tow hooks on Type C vehicle, and both front and rear tow hooks on Type A, B and D vehicles.
3. Tow hooks shall be at least 200 degrees spiral, have an inside diameter of approximately 2 1/2 inches, and be mounted parallel to frame rail. EXCEPTION: Type A vehicle shall be equipped with tow hooks adequate for towing vehicle.

### UNDERCOATING

1. Entire underside of bus body, including floor sections, cross member, and below floor line side panels, shall be coated with rust-proofing compound for which compound manufacturer has issued notarized certification of compliance to bus body builder that compound meets or exceeds all performance requirements of Federal Specification TT-C-520a using modified test procedures\* for following requirements:

- a. Salt spray resistance - pass test modified to 5% salt and 1000 hours.
- b. Abrasion resistance - pass.
- c. Fire resistance - pass.

\*Test panels are to be prepared in accordance with paragraph 4-6.12 of TT-C-520a with modified procedure requiring that tests be made on a 48 hour air cured film at thickness recommended by compound manufacturer.

2. Undercoating compound shall be applied with suitable airless or conventional spray equipment to recommended film thickness and shall show no evidence of voids in cured film.

### VENTILATION

1. Body shall be equipped with Transpec Safety Vents, or equivalent, that combines the following functions in each unit.
  - a. Multi-position, fresh air ventilation.
  - b. Static-type, non-closable exhaust ventilation.
  - c. Release handle(s) permitting operation as emergency exit(s), accessible inside and outside the vehicle.
2. One unit shall be installed in vehicles of less than 53 passenger capacity.
3. Two units shall be installed in vehicles of 53 passenger capacity and above. One unit shall be installed behind the rear axle.

#### WHEEL HOUSINGS

1. Wheel housings shall be of full open type.
2. Wheel house openings shall allow for easy tire removal and service.
3. Wheel housings shall be designed to support seat and passenger loads, and shall be attached to floor sheets in such manner to prevent any dust or water from entering the body.
4. Inside height of wheel housings above floor line shall not exceed 12 inches.
5. Wheel housing shall provide clearance for dual wheels as established by National Association of Chain Manufacturers.
6. Rubber fenders that adequately protect sides of body from tire spray shall be provided.

#### WIDTH

See Overall Width, page 31.

#### WINDSHIELD AND WINDOWS

1. All glass in windshield, windows, and doors shall be of approved safety glass (current Safety Code for Safety Glazing Motor Vehicles Operating on Land Highways Z-26.1) so mounted that permanent mark is visible, and of sufficient quality to prevent distortion of view in any direction. All glazing materials shall comply with FMVSS-205 and FMVSS-219.
2. Windshield shall have horizontal gradient band starting slightly above driver's line of vision and gradually decreasing in light transmission to 20 percent or less at top of windshield. EXCEPTION: Type A, B and D vehicles may use tinted windshield if gradient band is not available.
3. All buses are required to be equipped with split-sash windows.
4. Glass in all side and rear windows shall be of AS-2 grade or better, as specified by American Standards Association, Code Z-26.1.
5. Each full window shall provide unobstructed emergency opening of nine (9) inches high and 22 inches wide, obtained by lowering of window.
6. All exposed edges of glass shall be banded.
7. Each side of bus shall be equipped with at least one (1) full hinged push-out type split-sash window, approximately midway between front and rear passenger compartment. Emergency push-out windows shall have a positive latch and shall be so constructed and equipped as to actuate an audible signal when latch is moved. Words, "EMERGENCY EXIT," in letters at least two (2) inches high, shall be affixed on, or directly above emergency window on the inside and outside.

(Decals not acceptable.) A decal "HANDLE INSIDE" may be affixed to the outside of emergency windows.

8. Latch shall be designed to latch positively and securely, with ease of release that would enable pupils to open in an emergency.
9. Window drip rail which does not interfere with size of window opening shall be furnished.
10. The driver's window shall be of sliding type. Double glazing is strongly recommended. EXCEPTION: Type A vehicle - Manufacturer's standard.

#### WINDSHIELD WASHERS

1. A windshield washer reservoir shall be furnished, and shall be at least three (3) quart capacity unless space restrictions limit size of container. A collapsible bag is not acceptable, except on Type A vehicle.
2. Solvent shall be directed onto windshield through jets in the wiper arm. EXCEPTION: Type A vehicle.

#### WINDSHIELD WIPERS

1. Bus shall be equipped with two (2) variable-speed wipers. Windshield wipers shall be powered by electric motors on all vehicles.

#### WIRING

1. All wiring and lights shall conform to current SAE standards and FMVSS 108.
2. Chassis to body current shall be controlled through a continuous duty solenoid of at least 105 ampere capacity.
3. Circuits
  - a. Wiring shall be arranged into at least the following circuits:
    - (1) Head, tail, stop (brake) and instrument panel lamps.
    - (2) Clearance, stepwell and body control panel. Stepwell lamp shall be activated when service door handle is in the unlatched position. Control panel lamps shall be on separate rheostat from instrument panel lights.
    - (3) Dome lamps.
    - (4) Starter motor.
    - (5) Ignition, emergency door signal and continuous duty solenoid.

- (6) Turn signal lamps.
  - (7) Alternately flashing red signal lamps.
  - (8) Horns.
  - (9) Heater number 1.
  - (10) Heater number 2.
  - (11) Heater number 3.
  - (12) Electric wipers.
- b. Any of the above combination circuits may be subdivided into additional independent circuits.
  - c. Heaters and defrosters shall require at least one (1) additional independent circuit for each heater motor.
  - d. Whenever possible, all other electrical functions (such as sanders and electric-type windshield wipers) shall be provided with independent and properly protected circuits.
  - e. Each body circuit shall be color coded, and a diagram of the circuits shall be attached to the body in a readily accessible location.
  - f. All accessories, excluding lights, such as heaters, defrosters, sanders, etc., shall be wired to a continuous heavy duty solenoid (minimum 105 ampere) activated or energized through the ignition switch.
4. A separate circuit breaker shall be provided for each circuit except starter motor and ignition circuits.
  5. All wires within body shall be insulated and protected by covering of fibrous loom (or equivalent) which will protect them from external damage and minimize danger from short circuits. Wires shall be properly held in place by appropriate fasteners at intervals necessary to avoid possible damage to wire insulation. Whenever wires pass through body member, additional protection in form of appropriate type of insert shall be provided.
  6. All wiring, switches and electrical connections shall be capable of carrying 10 percent more current than required in the circuit without evidence of overheating or damage.

NOTE: All available warranty information must be provided to the purchaser.

## TRAINING REQUIREMENTS

IN THE EVENT MAJOR CHANGES ARE MADE IN SYSTEMS OR SUB-SYSTEMS, THE SUCCESSFUL BIDDER MAY BE REQUIRED TO PROVIDE TRAINING FOR COUNTY SCHOOL BUS MECHANICS AND SUPERVISORS.

SUCH TRAINING, IF REQUIRED, WILL BE SPECIFIED IN INVITATIONS TO BID, AND WILL INDICATE THE TYPE, EXTENT AND LOCATION OF CLASSES TO BE CONDUCTED.

## SPECIAL EDUCATION VEHICLE

### INTRODUCTION TO SPECIAL EDUCATION

#### SCHOOL BUS OR MPV

The specifications in this section are intended to be supplementary to specifications in the chassis and body sections. In general, special education buses should meet all the requirements of the preceding sections, plus those listed in this section. Since it is recognized by the entire industry that the field of transportation for special education passengers is characterized by special needs for individual cases, and by a rapidly emerging technology for meeting those needs, a flexible, common-sense approach to the adoption and enforcement of specifications for these vehicles is prudent.

By federal regulations, buses, including school buses, are defined as vehicles designed to carry ten or more passengers. Vehicles with less than ten passenger positions (including the driver) cannot be certified as buses. For this reason, the federal vehicle classification Multipurpose Passenger Vehicle, or MPV, must be used by manufacturers in some cases for these vehicles in lieu of the classification School Bus. In determining passenger capacity, wheelchair positions are counted as passenger positions. This classification system for school buses does not preclude the use of National School Bus Yellow paint or school bus warning lamp systems.

#### GENERAL REQUIREMENTS

I. Vehicles constructed for transporting children with special transportation needs shall comply with current West Virginia Minimum Requirements for Design and Equipment of School Buses, except for modifications necessary for the installation of special equipment. Such modifications or exceptions are set forth in this section.

II. Bodies may, at the option of the manufacturer, incorporate a section approximately 35 inches, or nine (9) inches in addition to the standard 28 inch section if necessary to provide maximum utilization of space for seats and wheelchairs. Proper bracing shall be added as specified in the body standards.

III. Any school bus that is used specifically for the transportation of children who are confined to a wheelchair and/or other mechanical restraining devices prohibiting their use of the regular service entrance, shall be equipped with a power lift.

IV. Lift shall be located on the right side of the body, in no way attached to the exterior sides of the bus but confined within the perimeter of the school bus body when not extended. (Rear emergency door lift may be installed only with written permission from the State Director of School Transportation.)

#### AISLE

1. Aisle leading to emergency door from wheelchair area shall be of sufficient width to permit passage of wheelchairs (30 inches minimum).

#### FASTENING DEVICES

1. Positive fastening devices shall be provided and attached to the floor or floor and wall to insure that occupied wheelchairs, or any other occupied types of ambulatory devices, can be securely fastened in position.
2. Device(s) shall be equivalent to or "Aeroquip Wheelchair Securement Systems" in simplicity, security and adaptability and provide a four-point securement. Passenger shall have suitable restraint attached to wheelchair, etc.
3. Wheelchairs, etc., shall be forward facing or be protected by a seat barrier on each side of the chair.
4. Automobile type safety seats shall be provided as appropriate for the very young.

#### GLAZING

1. Tinted glass may be installed in all doors, windows and windshield. Tinted plastic, that complies with all applicable standards, may be installed in windows to the rear of the driver's compartment.

#### HEATERS

1. Bus bodies shall have an underseat heater in rear section of bus.

#### POWER LIFT

1. Lifting mechanism shall be able to lift minimum payload of eight hundred (800) pounds.
2. When the platform is in the fully up position, it shall be locked in position mechanically by means other than a support, or lug in the door.
3. Lift structure must have adequate padding or barriers for passenger protection.
4. Controls shall be provided that enable the operator to activate the lift mechanism from either inside or outside of the bus. There shall be a means of preventing the lift platform from falling while in operation due to a power failure.
5. Power lifts shall be so equipped that they may be manually operated in the event of power failure or failure of the power lift mechanism.
6. Lift travel shall allow the lift platform to rest securely on the ground.

7. All edges of the platform shall be designed to restrain wheelchair and prevent operator's feet from being entangled during the raising and lowering process.
8. Platform shall be fitted on both sides, and rear, if necessary, with full width shields which extend above the floor line of the lift platform.
9. A restraining device shall be affixed to the outer edge (curb end) of the platform that will prohibit the wheelchair from rolling off the platform when the lift is in any position other than fully extended to ground level.
10. A self-adjusting, skid-resistant plate shall be installed on the outer edge of the platform to minimize the incline from the lift platform to the ground level. This plate, if so designed, may also suffice as the restraining device described in item 9 above. The lift platform must be skid-resistant.
11. A circuit breaker or fuse shall be installed between power source and lift motor if electrical power is used.
12. The lift mechanism shall be equipped with switches or by-pass valves to prevent excessive pressure from building in the system when the platform reaches the full up or down position. If lift is not powered down, mechanism shall be designed to cause a slow descent of platform to ground level. (A rapid descent or "drop" is not acceptable.) A sensor device shall be installed to stop lift when platform hits any object or obstruction.
13. An actuating switch shall be installed in the circuit to prevent the lift mechanism from operating when doors are closed.
14. When floor section is cut away for lift, a covered chain shall be installed to protect lift opening when lift is in lowered position.
15. A swing-out type lift, that meets all applicable standards and/or requirements, is permissible.

EXCEPTION: Type A vehicles used for special education transportation.

1. A ramp device may be installed in lieu of a power lift.
2. Ramp, if used, shall be self-adjusting, have a non-skid surface and be securely stored when not in use.

REGULAR SERVICE ENTRANCE DOOR

1. Stainless steel-clad grab rails shall be placed on each side of this entrance in a manner to afford the greatest advantage to small pupils.

2. Entrance shall have three (3) step risers of equal height, with the first no more than 14 inches above ground level. (Outward opening doors are permissible, if necessary to meet this requirement.)  
EXCEPTION: Type A and B vehicles may use two (2) step risers if riser does not exceed nine (9) inches in height.

#### RESTRAINING DEVICES

1. Seat frames shall be equipped with attachments or devices to which belts, restraining harnesses, or other devices may be attached.

#### SEATING ARRANGEMENTS

1. Flexibility in seat size and spacing to accommodate special devices shall be permitted due to the constant changing of passenger requirements.

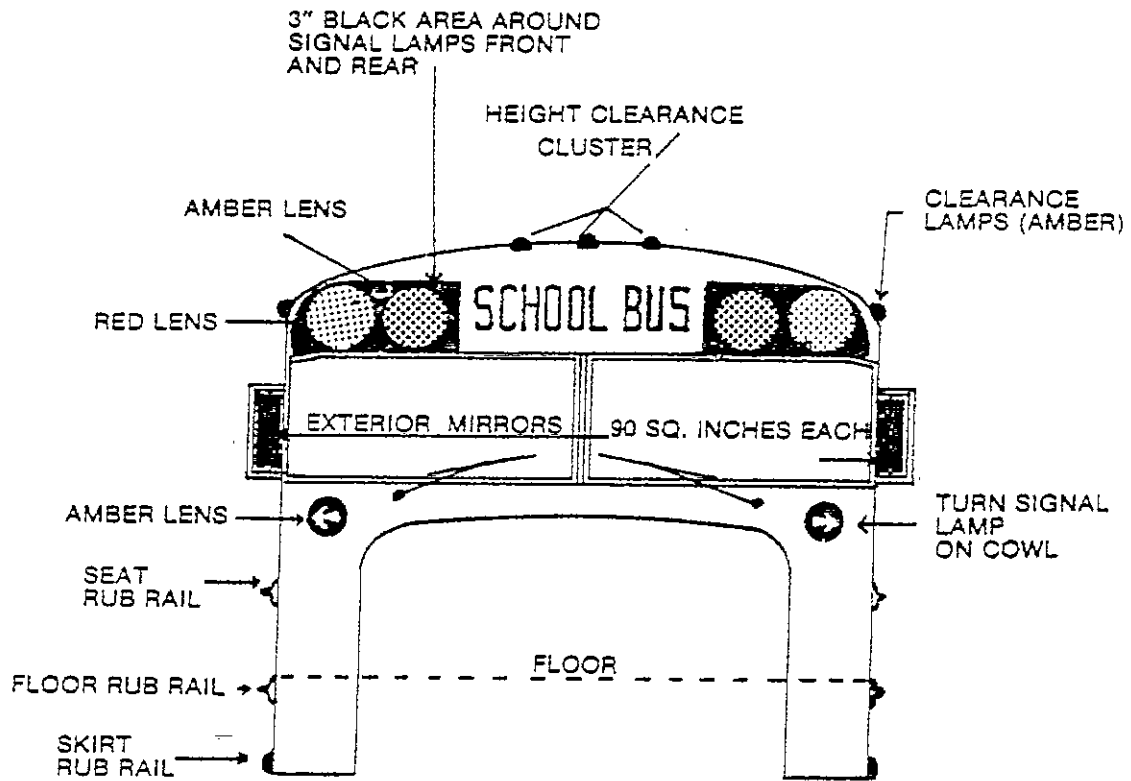
#### SPECIAL SERVICE ENTRANCE

1. Bus bodies may have a special service entrance constructed in the body to accommodate a wheelchair lift for the loading and unloading of passengers.
2. The opening, to accommodate the special service 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 (excluding a regular front service door lift).
3. The opening may extend below the floor through the bottom of the body skirt. If such opening is used, reinforcements shall be installed at the front and rear of the floor opening to support the floor and give it the same strength as the floor throughout the bus.
4. The opening, with doors open, shall be of sufficient width to allow the passage of wheelchairs. The minimum clear opening shall be thirty (30) inches in width.
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 for 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.

#### SPECIAL SERVICE ENTRANCE DOORS

1. A single door may be used if the width of the door opening does not exceed forty (40) inches.
2. Two doors shall be used if any single door opening would have to exceed forty (40) inches.

3. All doors shall open outwardly.
4. All doors shall have flat folding, positive fastening, devices to hold doors in the open position.
5. All doors shall be weather sealed. 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.
  - a. If optional power doors are installed, the design shall permit release of the doors for opening and closing by the attendant from the platform inside the bus.
6. When manually operated dual doors are provided, the rear door shall have at least a one-point fastening device to the header.
  - a. 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.
  - b. These locking devices shall afford maximum safety when the doors are in the closed position.
  - c. 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.
7. 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.
8. Each door shall have windows set in rubber compatible within one inch of the lower line of adjacent sash.
9. Door(s) shall be equipped with a device that will actuate a green flashing visible signal located in the driver's compartment when door(s) is not securely closed and ignition is in "on" position.
10. A switch shall be installed so that the lifting mechanism will not operate when the lift platform door(s) is closed.
11. When frame mounted power lift is used, door panels shall extend to bottom of body skirt. When ramps are used, doors shall extend to cover the ramp container.
12. A light or lights shall be located in the special service door area to illuminate the platform and approach area when lift is in the "full-down" position.

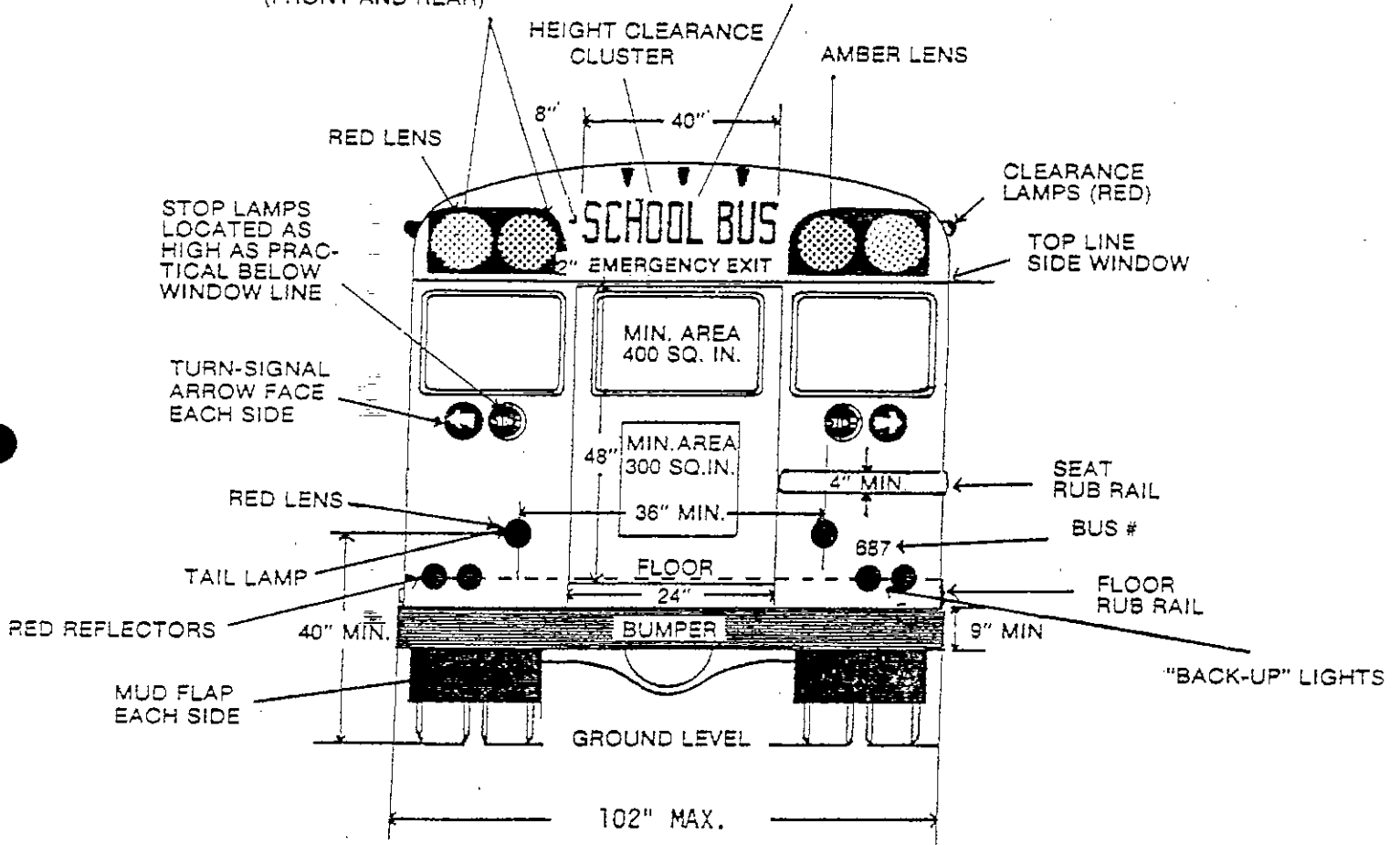


**FRONT ELEVATION**

Fig. No. 1

SIGNAL LAMPS AND TURN SIGNAL LAMPS SPACED AS FAR APART LATERALLY AS PRACTICAL BUT NOT LESS THAN 40 INCHES (FRONT AND REAR)

SERIES "B" LETTERING STANDARD ALPHABET FOR HIGHWAY SIGNS- BLACK (FRONT AND REAR)



REAR ELEVATION

## APPENDIX A

### HIGHWAY SAFETY PROGRAM STANDARD NO. 17

#### Pupil Transportation Safety

I. *Scope.* This standard establishes minimum requirements for a State highway safety program for pupil transportation safety; including the identification, operation, and maintenance of schoolbuses; training of personnel; and administration.

II. *Purpose.* The purpose of this standard is to reduce, to the greatest extent possible, the danger of death or injury to schoolchildren while they are being transported to and from school.

III. *Definitions.* "Type I school vehicle" means any motor vehicle with motive power, except a trailer, used to carry more than 16 pupils to and from school. This definition includes vehicles that are at any time used to carry schoolchildren and school personnel exclusively, and does not include vehicles that only carry schoolchildren along with other passengers as part of the operations of a common carrier.

"Type II school vehicle" means any motor vehicle used to carry 16 or less pupils to or from school. This does not include private motor vehicles used to carry members of the owner's household.

IV. *Requirements.* Each State, in cooperation with its school districts and its political subdivisions, shall have a comprehensive pupil transportation safety program to assure that school vehicles are operated and maintained so as to achieve the highest possible level of safety.

A. *Administration.* 1. There shall be a single State agency having primary administrative responsibility for pupil transportation, and employing at least one full-time professional to carry out its responsibilities for pupil transportation.

2. The responsible State agency shall develop an operating system for collecting and reporting information needed to improve the safety of school vehicle operations, in accordance with Safety Program Standard No. 10, "Traffic Records," § 204.4.

B. *Identification and equipment of school vehicles.* Each State shall establish and maintain compliance with the following requirements for identification and equipment of school vehicles. The use of stop arms is at the option of the State.

1. Type I school vehicles shall:

a. Be identified with the words, "School Bus," printed in letters not less than 8 inches high, located between the warning signal lamps as high

as possible without impairing visibility of the lettering from both front and rear, and have no other lettering on the front or rear of the vehicle;

b. Be painted National School Bus Glossy Yellow, in accordance with the colorimetric specification of Federal Standard No. 595a, Color 13432, except that the hood shall be either that color or lusterless black, matching Federal Standard No. 595a, Color 37038;

c. Have bumpers of glossy black, matching Federal Standard No. 595a, Color 17038; unless, for increased night visibility, they are covered with a retroreflective material.

d. Be equipped with a system of signal lamps that conforms to the schoolbus requirements of Federal Motor Vehicle Safety Standard 108, 49 CFR 571.21; and

e. Have a system of mirrors that will give the seated driver a view of the roadway to each side of the bus, and of the area immediately in front of the front bumper, in accordance with the following procedure:

When a rod, 30 inches long, is placed upright on the ground at any point along a traverse line 1 foot forward of the forwardmost point of a schoolbus, and extending the width of the bus, at least 7½ inches of the length of the rod shall be visible to the driver, either by direct view or by means of an indirect visibility system.

2. Any school vehicle meeting the identification requirements of 1.a-d above that is permanently converted for use wholly for purposes other than transporting pupils to or from school shall be painted a color other than National School Bus Glossy Yellow, and shall have the stop arms, and equipment required by section IV.B.1.d, removed.

3. Type I school vehicles being operated on a public highway and transporting primarily passengers other than school pupils shall have the words, "School Bus," covered, removed, or otherwise concealed, and the stop arms and equipment required by section IV.B.1.d shall not be operable through the usual controls.

4. a. Type II school vehicles shall either:

(1) Comply with all the requirements for Type I school vehicles; or

(2) Be of a color other than National School Bus Glossy Yellow, have none of the equipment specified in IV.B.1.d, and not have the words,

"School Bus," in any location on the exterior of the vehicle, or in any interior location visible to a motorist.

b. The State shall establish conditions under which one or the other of the above two specifications for Type II vehicles shall apply.

C. *Operation.* Each State shall establish and maintain compliance with the following requirements for operating school vehicles:

1. *Personnel.* a. Each State shall develop a plan for selecting, training, and supervising persons whose primary duties involve transporting school pupils, in order to assure that such persons will attain a high degree of competence in, and knowledge of, their duties.

b. Every person who drives a Type I or Type II school vehicle occupied by school pupils shall, as a minimum:

(1) Have a valid State driver's license to operate such a vehicle(s);

(2) Meet all special physical, mental, and moral requirements established by the State agency having primary responsibility for pupil transportation; and

(3) Be qualified as a driver under the Motor Carrier Safety Regulations of the Federal Highway Administration 49 CFR 391, if he or his employer is subject to those regulations.

2. *Pupil instruction.* At least twice during each school year, each pupil who is transported in a school vehicle shall be instructed in safe riding practices, and participate in emergency evacuation drills.

3. *Vehicle operation.* a. Each State shall develop plans for minimizing highway use hazards to school vehicle occupants, other highway users, pedestrians, and property, including but not limited to:

(1) Careful planning and annual review of routes for safety hazards;

(2) Planning routes to assure maximum use of buses, and avoid standees;

(3) Providing loading and unloading zones off the main traveled part of highways, wherever it is practicable to do so;

(4) Establishing restricted loading and unloading areas for schoolbuses at, or near schools;

(5) Requiring the driver of a vehicle meeting or overtaking a schoolbus that is stopped on a highway to take on or discharge pupils, and on which the red warning signals specified in IV.B.1.d are in operation, to stop his vehicle before it reaches the schoolbus and not proceed until the warning signals are deactivated; and

(6) Prohibiting, by legislation or regulation, operation of any vehicle displaying the words, "School Bus," unless it meets the equipment and identification requirements of this standard.

b. Use of flashing warning signal lamps while

loading or unloading pupils shall be at the option of the State. Use of red warning signal lamps for any other purpose, and at any time other than when the school vehicle is stopped to load or discharge passengers shall be prohibited.

c. When vehicles are equipped with stop arms, such devices shall be operated only in conjunction with red signal lamps.

d. *Seating.* (1) Seating shall be provided that will permit each occupant to sit in a seat in a plan view lateral location, intended by the manufacturers to provide seating accommodation for a person at least as large as a 5th percentile adult female, as defined in 49 CFR 571.3.

(2) Bus routing and seating plans shall be coordinated so as to eliminate standees when a school vehicle is in motion.

(3) There shall be no auxiliary seating accommodations such as temporary or folding jump seats in school vehicles.

(4) Drivers of school vehicles equipped with lap belts shall be required to wear them whenever the vehicle is in motion.

(5) Passengers in Type II school vehicles equipped with lap belts shall be required to wear them whenever the vehicle is in motion.

D. *Vehicle maintenance.* Each State shall establish and maintain compliance with the following requirements for vehicle maintenance:

1. School vehicles shall be maintained in safe operating conditions through a systematic preventive maintenance program.

2. All school vehicles shall be inspected at least semiannually, in accordance with Highway Safety Program Manual Vol. 1, published by the Department of Transportation January 1969. School vehicles subject to the Motor Carrier Safety Regulations of the Federal Highway Administration shall be inspected and maintained in accordance with those regulations (49 CFR Parts 393 and 396).

3. School vehicle drivers shall be required to perform daily pretrip inspections of their vehicles, and to report promptly and in writing any defects or deficiencies discovered that may affect the safety of the vehicle's operation or result in its mechanical breakdown. Pretrip inspection and condition reports for school vehicles subject to the Motor Carrier Safety Regulations of the Federal Highway Administration shall be performed in accordance with those regulations (49 CFR 392.7, 392.8, and 396.7).

V. *Program evaluation.* The pupil transportation safety program shall be evaluated at least annually by the State agency having primary administrative responsibility for pupil transportation. The National Highway Traffic Safety Administration shall be furnished a summary of each evaluation.

## APPENDIX B

SBMI CURRENT DRAW TABLE  
FOR TYPE B, C AND D BUSES

<u>CONSTANT LOADS</u>	<u>ACTUAL CURRENT DRAW (AMPS.) PER UNIT</u>	<u>NO. OF UNITS</u>			<u>TOTAL CURRENT DRAW (AMPS.)</u>
1. Chassis-Mounted Components (Industry Average)	15.0	X	1	=	15.0
2. Tail Lights	1.0	X	2	=	2.0
3. Clearance Lights	0.6	X	4	=	2.4
4. Identification (Cluster)	0.6	X	6	=	3.6
5. Intermediate Marker Lamps	0.6	X	2	=	1.2
6. Body Instrument Panel	0.3	X	1	=	0.3
7. Illuminated School Bus (Destination) Sign	4.1	X	1	=	4.1
8. Radio and/or P.A. System	1.0	X	1	=	1.0
9. Windshield Wiper Motor	12.0	X	1	=	12.0
10. Primary Front Heater	24.0	X	1	=	24.0
11. Primary Windshield Defroster	9.5	X	1	=	9.5
12. Supplementary Front Heater	9.5	X	1	=	9.5
13. Supplementary Windshield Defroster	9.5	X	1	=	9.5
14. Underseat Heater, Large	12.2	X	1	=	12.2
15. Underseat Heater, Small	6.1	X	1	=	6.1
16. Defroster Fan	3.0	X	1	=	3.0
<u>INTERMITTENT LOADS</u>					
(Values of Current Draw Shown are 35% of Actual)					
17. Flashing Warning Signal System (Lamps and Motor)	4.3	X	1	=	4.3
18. Stepwell and Dome Lights	0.3	X	7	=	2.1
19. Stop (brake) Lamps	0.7	X	4	=	2.8
20. Directional Signals	0.4	X	6	=	2.4
<u>SBMI APPROVED MINIMUM ELECTRICAL LOADS VALUE</u>				=	127.0

APPENDIX B

ELECTRICAL CURRENT DRAW

SECTION 1 PROCEDURE FOR DETERMINING  
VEHICLE ELECTRICAL LOAD VALUE

The vehicle electrical load shall be the minimum electrical load value as determined from the applicable SBMI Current Draw Table included in this Appendix, with the following exceptions.

- \*1. The SBMI minimum electrical load value shall increase by a total of the current draw (in amperes) of all components ordered in excess of the SBMI current draw table.
  - \*2. The SBMI approved minimum electrical load value may be reduced by a total of the current draw (in amperes) for any item omitted from the vehicles ordered.
- \* A chassis supplier shall consider these options only when annotations for bids (or quotations) indicate a revised minimum electrical load value.

APPENDIX B

SBMI CURRENT DRAW TABLE  
FOR TYPE A BUSES

<u>CONSTANT LOADS</u>	<u>ACTUAL CURRENT DRAW (AMPS.) PER UNIT</u>		<u>NO. OF UNITS</u>		<u>TOTAL CURRENT DRAW (AMPS.)</u>
1. Chassis-mounted Components	40.0	X	1	=	40.0
2. Tail Lights	1.0	X	2	=	2.0
3. Clearance Lights	.24	X	4	=	.96
4. Identification (cluster)	.24	X	6	=	1.44
5. Body Instrument Panel	.36	X	1	=	.36
6. Underseat Heater, Large	15.0	X	1	=	15.0
7. Underseat Heater, Small	7.5	X	1	=	7.5
 <u>INTERMITTENT LOADS</u>					
(Values of current draw shown are 35% of actual)					
8. Flashing Warning Signal System (lamps and motor)	5.8	X	2	=	11.6
9. Stepwell and Dome Lights	.57	X	5	=	2.85
10. Stop (brake) Lamps	0.7	X	2	=	1.4
11. Directional Signals	0.7	X	3	=	2.1
12. Emergency Door Buzzer	.03	X	2	=	.06
<u>SBMI APPROVED MINIMUM ELECTRICAL LOADS VALUE</u>					66.06

APPENDIX C

WEST VIRGINIA

SCHOOL BUSES EQUIPPED AND/OR CONVERTED TO  
OPERATE ON PROPANE FUEL

All liquefied petroleum gas (LPG) installations shall meet all applicable federal and state laws, standards and requirements, National Fire Protection Association (NFPA) standards, American Society of Mechanical Engineers (ASME) and American Society for Testing and Materials (ASTM) codes and industry safety requirements. (Further reference to a product or organization listed above will be by initials, as indicated.)

Every LPG installation or conversion shall meet the following minimum requirements:

I. GENERAL

- A. Installation and maintenance shall be by persons who have satisfactorily completed a State approved training program. The training program shall include the necessary equipment, tools, mechanics of installation, maintenance, repair, trouble shooting, and safety procedures. Completed installations shall be properly tested by an HC/CO gauge analyzer.
- B. Training is required of county personnel in the installation, operation and maintenance of conversion equipment and converted vehicles. Training shall be the joint responsibility of conversion equipment manufacturers and/or propane fuel suppliers and the county school system. It shall be the responsibility of county school administrators to permit only properly trained persons to fuel, operate, maintain or handle the conversion equipment and/or converted vehicles.
- C. Disconnect gasoline supply lines from tank to carburetor and properly seal openings. Drain and purge tank to remove combustible fumes. Add at least one gallon of ethylene glycol antifreeze to the tank to minimize deterioration from condensation. (Tank may be removed from vehicle, if desirable.)
- D. Documentation of need, and written approval from the State Director of School Transportation will be required:
  1. prior to converting any school bus to dual fuel operation.
  2. annually to continue operating any school bus equipped for dual fuel operation.
- E. Conversion of any Type A school bus to LPG must have written approval from the State Director of School Transportation.

- F. Require propane fuel supplier(s) to supply propane of at least HD5 quality.

## II. FUEL STORAGE AND HANDLING FACILITIES

- A. Meet all applicable requirements of NFPA 58, State Fire Code and local ordinances and regulations.
- B. Protect metering pump and/or equipment from vehicular traffic.
- C. Affix readily visible decal(s) stating operating procedures and/or cautions to appropriate connections, controls, etc.

## III. VEHICLE CONVERSION EQUIPMENT AND INSTALLATION

### A. Fuel tank shall:

1. have a minimum capacity of 60 gallons of LPG at 80% fill on all Type D school buses and all Type C school buses of 47 passenger or greater capacity.
2. have a minimum capacity of 30 gallons on all Type C school buses of less than 47 passenger capacity and all Type B school buses.
3. be ASME certified with a minimum safe working pressure of 312 P.S.I.
4. have a double check filler valve.
5. have a liquid withdrawal valve with an internal excess flow valve.
6. have an internal type spring-loaded safety relief valve.
7. have a manual 80% fixed liquid level gauge. Gauge shall indicate correctly the maximum permitted filling level.
8. have an automatic 80% liquid fill shut-off valve. (However, filling shall be by proper reference to the 80% fixed liquid gauge.)
9. have a protected visible float valve.
10. have a safety valve to automatically stop the flow of gas in the event of fuel line rupture.
11. be securely mounted directly to vehicle main frame rail in such a manner as to prevent jarring loose, slipping or rotating. Fastening shall be adequate to withstand static loading in any direction equal to four (4) times the weight of the filled tank without permanent visible deformation.
12. have a minimum of three (3) cradle-type steel brackets bolted directly to the vehicle main frame rail. Brackets shall be supplied by the tank manufacturer and conform to the contour of the tank. Steel

straps, of at least 3/8" thickness, adequate for holding tank firmly and securely in the brackets shall attach to the brackets with at least two (2) 5/8" bolts per strap.

13. use only grade eight (8) bolts in tank mounting.
14. have brackets that are permanently welded to the tank, welded by the tank manufacturer, and meet the above requirements.
15. have holes "drilled" if bolts through the main frame rail are used for tank mounting. (Holes shall not be cut with a torch.) No holes shall be made in the top or bottom flange of the frame rail.
16. be mounted on right side of vehicle unless wheelbase is of insufficient length.
17. require relocation of storage (chain/tool) compartment behind rear wheel if mounting tank requires any part of storage compartment space.
18. not appreciably diminish road clearance of vehicle.
19. have any part of the installation that is within eight (8) inches of the vehicle exhaust system appropriately shielded.
20. use only Underwriters Laboratories, Inc. (UL) approved valves, lines, fittings, etc.

B. Fuel lines shall:

1. be approved stainless steel, wire braid reinforced, with a minimum working pressure of 350 p.s.i., and a minimum burst pressure of 1,750 p.s.i.
2. be labeled LP Gas or LPG at intervals no greater than 10 feet.
3. follow the main frame channel wherever possible.
4. be placed in such a manner as to minimize the possibility of damage from vibration, strain or wear.
5. be permanently secured at intervals of not more than two (2) feet.
6. be adequately protected by bulkhead fittings or rubber grommets, as appropriate, at every location when passing through structural members, walls, shields or partitions.

(Electrical wiring and control cables shall be protected in the same manner. Each electrical circuit will be protected by a fuse or circuit breaker.)

7. be equipped with an approved lock-off or solenoid valve, with filter, at a point ahead of the inlet to the propane converter, designed to prevent the flow of fuel to the converter when the engine is not running. This device shall be controlled by engine vacuum or engine oil pressure.
8. be equipped with a solenoid primer for cold weather starting.
9. be equipped with automatic lock-offs or solenoids in both fuel supply lines when dual fuel systems are permitted (see I., C.). These devices shall be designed to prevent one fuel from entering the carburetor while the engine is operating on the other fuel.
10. have hydrostatic relief valve(s) appropriately installed to prevent excessive pressure build-up in fuel lines.

C. Valves, appurtenances and connections shall:

1. protect all valves, appurtenances and connections from damage due to accidental contact with stationary or loose objects, stones, mud or ice; and as far as reasonably possible from damage due to vehicular accident.
2. protect filler valves and 80% fixed liquid level gauges, at the tank and/or remote-fill locations, against tampering by means of key-lock, hinged door panel.
3. provide double back-pressure check valves, both at the tank and at the remote-fill location where remote-fill connections are used; and a shut-off valve or fitting with a No. 54 drill size hole in the 80% tank outage connection, in addition to the fixed liquid level gauge at the remote-fill location.
4. provide safety relief valve discharge lines of a metal other than aluminum, sized, located and secured so as to permit sufficient discharge capacity when the valve is in the full open position.
5. provide for safety relief valve port to discharge into a specially constructed and adequately vented metal compartment, mounted in the lower part of the body skirt, in compliance with all the requirements of NFPA 3814. Design and construction shall prevent any possibility of fuel being discharged on any person in close proximity to the vehicle.

IV. CARBURETION

- A. Use carburetion devices and liquid converters designed to minimize the possibility of fire in the air cleaner due to backfire.
- B. Provide a solid vibration free mounting for the carburetion system. The converter shall not be mounted on fender inner panels or radiator supports.

- C. Provide a vaporizer and any device used with it which may be subjected to tank pressure, with a minimum design pressure of 250 p.s.i. Device(s) shall be permanently marked accordingly at a readily visible point.
- D. Use the original air filter system or guarantee that the volume of filtered air to the carburetor meets engine needs, as specified by engine manufacturer.

V. FUELING

- A. Provide a decal with instructions for fueling affixed to the vehicle within two (2) inches of the fill door.