SCHOOL BUS

Minimum Standards for Construction of School Transportation Equipment

(Legal Requirements and Regulations)

TR-B-3R (Revised) **IOWA** **1974**

State of Iowa
DEPARTMENT OF PUBLIC INSTRUCTION
Grimes State Office Building
Des Moines, Iowa 50319

STATE BOARD OF PUBLIC INSTRUCTION

Mrs. Virgil E. Shepard, President, Allison
T. J. Heronimus, Vice-President, Grundy Center
Robert J. Beecher, Creston
Mrs. Richard G. Cole, Decorah
Mrs. Jolly Ann Davidson, Clarinda
Ronald P. Hallock, West Des Moines
Miss Virginia Harper, Fort Madison
Mrs. Earl G. Sievers, Avoca
John E. van der Linden, Sibley

ADMINISTRATION

Robert D. Benton, State Superintendent, and Executive Officer
of the State Board of Public Instruction
David H. Bechtel, Administrative Assistant
Richard N. Smith, Deputy State Superintendent

<u>Administration</u> <u>Branch</u>

L. N. Jensen, Associate Superintendent
Arthur Roberts, Director, Transportation Division
William A. Boland, Consultant, Transportation Division
Robert G. Roush, Consultant, Transportation Division

F O R E W O R D

Under the provisions of Section 285.8, Code of Iowa, the Department of Public Instruction is given the responsibility to prescribe standards to govern the construction of equipment used in the transportation of school children.

Contained herein are the minimum standards for school buses as recommended by the Transportation Advisory Committee and adopted by the State Board of Public Instruction. These specifications have been developed for the purpose of providing maximum safety for Iowa pupils who ride the buses to and from school.

School officials and others concerned with transportation equipment should familiarize themselves with these standards. All purchases should be made with the understanding and guarantee that both chassis and bodies meet these new standards on the effective date of same and are subject to inspection and approval by the State Department of Public Instruction.

The State Board of Public Instruction is extremely grateful to the members of the Advisory Committee who gave so freely of their time in developing these standards and to others who have assisted in the formulation of them by making practical suggestions.

ROBERT D. BENTON, Ed. D.
State Superintendent of Public Instruction

ADVISORY COMMITTEE
for
SCHOOL BUS CONSTRUCTION STANDARDS

Lyle Blum
Supervisor of Transportation
Newton Community Schools

William A. Boland
Consultant
Transportation Division

Neil J. Boyle
Superintendent of Schools
Bennett Community Schools

Jack Cooney
Ford Motor Company
Omaha, Nebraska

Rev. Thomas Donahoe
Superintendent
Kuemper High School
Carroll, Iowa

Joe Felske
Supervisor of Transportation
Bettendorf Community Schools

Dean Filloon
United School Equipment Co.
Manson, Iowa

Dan Gray
President
School Bus Sales, Inc.
Waterloo, Iowa

John Hicks
Chevrolet Motor Division
Des Moines, Iowa

Marv Hildreth
International Harvester Co.
Des Moines, Iowa

Tom Horn
Supervisor of Transportation
Winterset Community Schools

Lt. Col. James Machholz
Assistant Chief
Iowa Highway Safety Patrol

Lou Negus
President
Iowa City Coach Co.
Iowa City, Iowa

Arthur Roberts
Director
Transportation Division

Bob Roush
Consultant
Transportation Division

J. Ira Ryan
Superintendent of Schools
Eddyville Community Schools

A. E. (Bud) Wall
Director of Transportation
Marshalltown Community Schools

Alternate Member:
Dave Arrasmith
Supervisor of Transportation
Cedar Falls Community Schools

TABLE OF CONTENTS

THE IOWA SCHOOL BUS

STATUTORY PROVISIONS - CODE OF IOWA

Section 321.1 (27) "School bus" means every vehicle operated for the transportation of children to or from school, except vehicles which are: (a) Privately owned and not operated for compensation, (b) Used exclusively in the transportation of the children in the immediate family of the driver, (c) Operated by a municipally or privately owned urban transit company for the transportation of children as part of or in addition to their regularly scheduled service, or (d) Designed to carry not more than nine persons as passengers, either school owned or privately owned, which are used to transport pupils to activity events in which the pupils are participants or used to transport pupils to their homes in case of illness of other emergency situations. The vehicles operated under the provisions of paragraph "d" of this section shall be operated by employees of the school district who are specifically approved by the local superintendent of schools for the assignment.

Section 321.373 Required Construction - Rules Adopted.

1. Every school bus except private passenger vehicles used as school buses shall be constructed and equipped to meet safety standards prescribed in rules adopted by the state board of public instruction. Such rules shall conform to safety standards set forth in federal laws and regulations and shall conform, insofar as practicable, to the minimum standards for school buses recommended by the national conference on school transportation administered by the national commission on safety education and published by the national education association.

2. Rules prescribed for school buses shall provide standards for structural strength, materials, and insulation of the school bus body; color; seat and aisle arrangement; dimension and construction of service door; control of the front door or doors; emergency door and its location and construction; windows; roof ventilators; heaters; location, filling, and draining of the fuel tank; bumpers and how they shall be attached to the bus; lettering and identification of the bus; stop signal arm; warning lights and flashing lights.

3. The rules prescribed for school buses shall include special rules for passenger automobiles, and other vehicles designed to carry eight or fewer pupils, when used as school buses.

4. Every school bus shall be equipped with a comfortable seat for each child.

5. Vehicles owned by private parties and used as school buses shall have reversed or covered the words "school bus" wherever they appear on the vehicle when the vehicle is not in use as a school bus. It shall be unlawful to operate flashing stop warning signals on such privately-owned vehicles except as provided in section 321.372.

6. No vehicle except school buses shall be operated on any public highway if the vehicle is painted the color known as national school bus chrome. This subsection shall not apply to any vehicle owned by a school corporation, church, or camp organization regularly transporting children; or by a manufacturer of, distributor of, or dealer in school buses; and any person purchasing a vehicle formerly used as a school bus shall have ten days after such purchase to repaint the vehicle.

Section 321.379 Violations. No school board, individual, or organization shall purchase, construct, or contract for use, to transport pupils to or from school, any school bus which does not comply with the minimum requirements of section 321.373 and any individual, or any member or officer of such board or organization who authorizes, the purchase, construction, or contract for any such bus not complying with these minimum requirements shall be guilty of a misdemeanor punishable as provided in section 321.482.

Section 321.381 Scope and effect of regulations. It is a misdemeanor, punishable as provided in section 321.482, for any person to drive or move or for the owner to cause or knowingly permit to be driven or moved on any highway any vehicle or combination of vehicles which is in such unsafe condition as to endanger any person, or which does not contain those parts or is not at all times equipped with such lamps and other equipment in proper condition and adjustment as required in this chapter, or which is equipped with one or more unsafe tires, or which is equipped in any manner in violation of this chapter.

Section 321.424 Sale of lights - approval. On and after July 4, 1955, no person shall have for sale, sell, or offer for sale for use upon or as a part of the equipment of a motor vehicle, trailer, or semitrailer, or use upon any such vehicle any headlamp, auxiliary, or fog lamp, rear lamp, signal lamp, or reflector, which reflector is required hereunder, or parts of any of the foregoing which tend to change the original design or performance, unless of a type which has been submitted to the commissioner and approved by him.

The foregoing provisions of this section shall not apply to equipment in actual use when this section is adopted or replacement parts therefor.

No person shall have for sale, sell, or offer for sale for use upon or as a part of the equipment of a motor vehicle, trailer, or semitrailer any lamp or device mentioned in this section which has been approved by the commissioner unless such lamp or device bears thereon the trade-mark or name under which it is approved so as to be legible when installed.

No person shall use upon any motor vehicle, trailer, or semi-trailer any lamps mentioned in this section unless said lamps are mounted, adjusted and aimed in accordance with instructions of the commissioner.

Section 321.428 Approval by commissioner. The commissioner is hereby authorized to approve or disapprove lighting devices and to issue and enforce regulations establishing standards and specifications for the approval of such lighting devices, their installation, adjustment and aiming, and adjustment when in use on motor vehicles. Such regulations shall correlate with and, so far as practicable, conform to the then current standards and specifications of the society of automotive engineers applicable to such equipment.

1. The commissioner is hereby required to approve or disapprove any lighting device, of a type on which approval is specifically required in this chapter, within a reasonable time after such device has been submitted.

2. The commissioner is further authorized to set up the procedure which shall be followed when any device is submitted for approval.

3. The commissioner upon approving any such lamp or device shall issue to the applicant a certificate of approval together with any instructions determined by him.

4. The commissioner shall publish lists of all lamps and devices by name and type which have been approved by him.

Section 321.444 Safety glass.

1. No person shall sell any new motor vehicle nor shall any motor vehicle, manufactured since July 1, 1935, be registered, or operated unless such vehicle is equipped with safety glass wherever glass is used in doors, windows, and windshields. Replacements of glass in doors, windows, or windshields shall be of safety glass.

2. The term "safety glass" shall mean any product composed of glass, so manufactured, fabricated, or treated as substantially to prevent shattering and flying of the glass when struck or broken or such other or similar product as may be approved by the commissioner.

3. The commissioner shall compile and publish a list of types of glass by name approved by him as meeting the requirements of subsection 2 and the commissioner shall not register any motor vehicle which is subject to the provisions of subsection 1 unless it is equipped with an approved type of safety glass, and he shall suspend the registration of any motor vehicle so subject to said section which he finds is not so equipped until it is made to conform to the requirements of said section.

Section 285.14 "Nonstandard buses - penalties. Any person who operates or permits to be operated as a school bus to transport pupils, any vehicle which does not comply with the requirements provided by law or by the rules and regulations of the state department of public instruction, or for which there is not a valid temporary certificate for operation, shall be punished by a fine of not to exceed one hundred dollars or by imprisonment in the county jail not to exceed thirty days."

RESPONSIBILITY OF DEALERS AND MANUFACTURERS

The responsibility for compliance with these school bus specifications rests with the dealers and manufacturers. If any dealer or manufacturer sells school transportation equipment which does not conform to all these specifications, a general notice will be mailed to all schools advising that equipment supplied by such dealer or manufacturer will be disapproved for school transportation purposes until further notice. A copy of the notice will be sent to said dealer or manufacturer and will remain in effect until full compliance is assured.

Each school bus chassis manufacturer and each school bus body manufacturer shall submit specifications and related information to the Iowa Department of Public Instruction if requested.

EFFECTIVE DATE OF SPECIFICATIONS

These standards shall apply to all new school buses purchased for use in Iowa after JANUARY 1, 1974.

Used School Buses:

Any used school bus purchased outside of the State of Iowa for use in Iowa shall meet all of the legal requirements of Iowa law and the Iowa standards for school buses for the particular type vehicle that were in effect on the date that the vehicle was purchased new, plus certain mandatory safety requirements.

THE SCHOOL BUS CHASSIS

(17 Capacity and Over)
(* - Denotes change from previous standard.)

1. AIR CLEANER

The bus shall be equipped with an adequate oil-bath or dry-element type air cleaner mounted outside of the passenger compartment.

2. ALTERNATOR

All chassis of 17 capacity and greater shall be equipped with an alternator with rectifier having at least an output of 100 amperes with a minimum charging rate of 40 amperes at the manufacturer's recommended engine idle speed (12-volt system) and shall be ventilated and voltage controlled. A dual belt drive shall be used with the alternator. (Refer to Appendix for guidance in selecting alternator of adequate capacity.)

3. *AXLES

a. Front axle or other type of suspension assembly shall be of sufficient capacity at ground to support such load on front axle as would be imposed by actual average gross vehicle weight.

b. Rear axle shall be full-floating type. Rear axle or other type of suspension assembly shall have gross weight rating at ground equal to or exceeding that portion of total load which is supported by rear suspension assembly.

Exceptions - transit and metropolitan vehicles

a. Front axle shall be wide-track, heavy-duty bus type or shall have gross weight rating at ground equal to or exceeding that portion of total load which is supported by front axle.

b. Rear axle shall be full-floating, heavy-duty bus type and shall have gross weight rating at ground equal to or exceeding that portion of total load which is supported by rear axle.

(See Power and Gradeability Table in the Appendix.)

4. BATTERY

a. The storage battery as established by the manufacturer's rating shall be of sufficient capacity to efficiently care for the starting, lighting, signal devices, heating, defrosting, and other electrical equipment. The battery shall be mounted on a sliding battery tray in a special compartment located in the body skirt, or in the engine compartment under the hood in an accessible place.

b. When the battery is mounted in a special compartment located in the body skirt is shall have a rating of not less than 150 ampere hours at 12 volts measured at 20-hour rate. (This type and size battery is strongly recommended because of its strong cranking power, durability, and other desirable characteristics.)

c. The battery, when mounted in the engine compartment under the hood, shall have a minimum ampere-hour rating of 85 amperes. The battery rack shall be of such size that it will accommodate a 90-ampere hour battery of maximum size.

The use of two 6-volt batteries is permissible, but not recommended. When two 6-volt batteries are used, they shall be rated at a minimum of 150-ampere hours.

d. When the battery is to be mounted outside of the engine compartment, it may be temporarily mounted to the chassis. The body company will permanently mount the battery on a sliding tray located so that the center line of the battery is 52 inches back of the cowl. One-piece battery cables shall be provided by the chassis manufacturer; such cables are to be at least 36 inches longer than normally required to accommodate the battery when located 52 inches to the rear of the cowl. The battery cable, if passed through holes in the metal, shall be protected by non-metallic grommets. All retaining clips or fastening devices for the battery cables must be insulated. (See also page 15.)

5. *BRAKES

a. Four-wheel brakes, adequate at all times to control bus when fully loaded, shall be provided in accordance with Federal Motor Vehicle Safety Standards.[1]

(1) Stopping ability of service brake system. Service brake system shall be designed and constructed so that by application of single control unit vehicle can be stopped within distances specified in (a) and (b) below. Stopping distance requirement tests shall be conducted in accordance with SAE J658[2] and with vehicle loaded (MGVW - manufacturer's gross vehicle weight.)

(a) Brakes shall be designed to have capability of developing deceleration of 14 fpsps (feet per second per second) from speed of 20 mph at pedal effort of not more than 75 pounds.

---

[1]Issued by National Highway Safety Bureau, Federal Highway Administration, U. S. Department of Transportation, Washington, D. C. 20591

[2]Service Brake Performance, recommended practice of Society of Automotive Engineers.

(b) Stopping distance test with brakes cold shall be conducted after proper conditioning according to SAE J880[3] and vehicle shall stop, from speed of 20 mph, within following distances at pedal effort of not more than 200 pounds:

(1) 10,000 pounds GVW and under --- 25 feet

(2) Over 10,000 pounds GVW -------- 35 feet

(c) Brake balance shall be such that, when tested at speed of 20 mph under any normal condition of loading within MGVW (manufacturer's gross vehicle weight) deceleration of 12 fpsps (feet per second per second) can be achieved without locking wheels on any axle.

(2) Energy absorption - horsepower rating. Energy absorption capability of brakes, when tested in accordance with procedure established by SAE J880 or equivalent, shall be not less than $12 + \frac{1.4\ GVW}{1000}$.

(3) Travel reserve of air brake actuator or hydraulic brake pedal. Brake actuator travel, when measured statically at actuating force required for compliance with Item a(1)(b) above, shall be not more than 60 percent of available travel.

(4) Reservoirs required. Every brake system which employs air or vacuum shall include following reservoir capacity:

(a) Air brake system shall have reservoir capacity which is equal to or greater than 12 times total volume of all brake actuators at full travel.

(b) Vacuum brake system shall have reservoir used exclusively for brakes, with capacity of not less than 1,000 cubic inches, and shall be adequate to insure loss in pressure at full stroke application of not more than 30 percent.

(c) Brake system shall include suitable and convenient connection for installation of separate vacuum reservoir with capacity of not less than 1,000 cubic inches, furnished and installed by body manufacturer and protected by check valve, for actuation of other vacuum-powered accessories. Engine shall be protected by proper filters.

---

[3]Brake Rating System Test Code - Commercial Vehicles, recommended practice of Society of Automotive Engineers.

(5) Lines supplying power to air or vacuum system reservoirs shall be safeguarded through proper design and bracing to protect from excessive heat and vibration. Brake system reservoir shall be "so 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 air or vacuum shall not be depleted by the lack or failure."[4] Means shall be provided to establish air check valve to be in working order.[5]

(6) Gauges. A vehicle using air with illuminated gauge, accurate to within 10 percent of actual reservoir pressure, which will indicate to driver, in case of

(a) air brakes: pressure in psi (pounds per square inch) which is available for operation of brakes; or

(b) vacuum brakes: vacuum in inches of mercury which is available for operation of brakes.

(7) Warning devices. In addition to gauges in (6) above, vehicle shall be equipped with warning signal, readily audible or visible to driver, which will give continuous warning to driver when, in case of

(a) air brakes: air pressure in system available for braking is 60 psi (pounds per square inch) and less; or

(b) vacuum brakes: vacuum in system available for braking is 8 inches of mercury and less.

b. Emergency stopping system:

(1) General. Brake system(s) shall perform emergency stopping function and be so designed and constructed that single failure anywhere in brake system which performs service brake function, excepting mechanical parts of wheel brake assemblies and brake and brake pedal attachment to brake valve(s) or master cylinder(s) will not leave vehicle without operative brakes capable of stopping vehicle when loaded up to and including manufacturer's rated GVW (gross vehicle weight) at any legal speed and in accordance with requirements of (2) and (3) below.

(2) Emergency stopping performance requirements. Following performance shall be obtained under road and test conditions outlined in a(1) above:

---

[4]Uniform Vehicle Code, 1968 revision, Section 12-301, (i), 3.

[5]Motor Carrier Safety Regulations, as amended to January 1, 1968, Paragraph 393.50, (b). Issued by Bureau of Motor Carrier Safety, U. S. Department of Transportation, Washington, D. C. 20591.

(a) Vehicle, when loaded to manufacturer's GVW (gross vehicle weight) capacity, shall be brought to stop from speed of 20 mph in measured distance of 85 feet or as may be modified by the Federal Motor Vehicle Safety Standards.

(b) Deceleration of not less than 6 fpsps (feet per second per second) shall be maintained throughout stop from 20 mph.

(3) Control requirements of emergency stopping system. Control of emergency stopping system shall be designed and constructed:

(a) to permit modulated control by driver of brake application and release; and

(b) to prevent release of brakes on air brake models by driver unless energy is available for re-application.

c. Parking brakes:

Parking brake system shall be designed and constructed to meet the following requirements:

(1) Parking brake shall hold vehicle stationary, or to limit of traction of braked wheels, on 20-percent grade under any condition of legal loading and on surface free from snow, ice, and loose material.

(2) When applied, parking brake shall remain in applied position with capability set forth in c(1) above, despite exhaustion of source of energy used for application or despite leakage of any kind.

EXCEPTION: <u>Buses with a capacity of 72 and over shall be equipped with a spring-activated emergency braking system.</u>

6. BUMPER, FRONT

a. The front bumper shall be furnished by the chassis manufacturer as part of the chassis.

b. The front bumper must extend to the outer edges of the fenders at the bumper top line (to assure maximum fender protection) and be of sufficient strength to permit the pushing of a vehicle of equal gross weight without permanent distortion to the bumper, grille, chassis or body. The bumper shall be curved or beveled at each end so as to prevent snagging and hooking.

c. The bumper shall be attached directly to chassis frame.

d. The bumper shall be "Heavy Duty" type.

*e. Bumpers that are flush mounted with the grille are not acceptable.

7. CERTIFICATION

Chassis manufacturers will, upon request, certify to the Iowa State Department of Public Instruction that their product meets minimum standards on following items unless covered by certification issued under requirements of National Traffic and Motor Vehicle Safety Act:

a. Axles

b. Brakes

c. Exhaust system noise level

d. Horn

e. Power and gradeability

f. Springs

8. *CLUTCH

All chassis of 17 through 54-pupil capacity housing mechanical type transmission shall be equipped with a clutch of not less than 12-inch diameter. All chassis of 55 and greater pupil capacity having mechanical type transmission shall be equipped with a 13-inch diameter single plate clutch or a 12-inch diameter two plate clutch.

9. *COLOR

The chassis, including wheels, grille, and front bumper shall be black.[6] The hood, cowl, and fenders shall be National School Bus Glossy Yellow.[7]

10. DRIVE SHAFT

Each segment of the drive shaft shall be protected by a metal guard or guards to prevent it from whipping through the floor or dropping to the ground if broken.

11. ELECTRICAL SYSTEM

a. Alternator - see page 1

b. Battery - see pages 1 and 15

---

[6]Federal Standard No. 595a, black enamel No. 17038. Color chips are available from General Services Administration, Specifications Sales, Building 197, Washington Navy Yard, Washington, D. C. 20407.

[7]Federal Standard No. 595a, chrome yellow enamel No. 13432. Color chips are available from source given in footnote 6.

c. Lamps and signals - see page 28

d. Wiring - see page 44

e. Chassis manufacturer shall install readily-accessible electrical terminal so that body and chassis electrical load can be recorded through chassis ammeter without dismantling or disassembling chassis component. Chassis wiring system to terminal shall have minimum 100-ampere capacity. Chassis ammeter and wiring shall be compatible with generating capacity, and ammeter shall be capable of recording continuous draw of 100 amperes.

12. EXHAUST SYSTEM

a. The exhaust pipe, muffler, and tailpipe shall be outside the bus body and attached to the chassis.

b. The tailpipe shall be constructed of seamless or electrically welded tubing of 16-gauge steel or equivalent and shall extend at least 5 inches beyond the chassis frame. (Flexible tubing is not accepted.)

c. The size of the tailpipe shall not be reduced after it leaves the muffler.

d. The exhaust system shall be properly insulated from the fuel tank and the tank connections by a securely attached metal shield at any point where it is 12 inches or less from the tank or tank connections.

e. The noise level shall not exceed 125 sones as measured by the Beranek-Armour-ATA Equivalent Tone Method.[8]

f. The muffler shall be constructed of corrosion-resistant material.

g. The tailpipe shall extend at least to the vertical line from the rear end of the body but not beyond the rear bumper. The rear end of the tailpipe must be located to the right or left of the emergency door which will prevent fumes from entering the door.

13. FENDERS, FRONT

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.

---

[8]Automobile Manufacturers Association, 320 New Center Building, Detroit, Michigan 48202.

b. Front fenders shall be properly braced and free from any body attachment.

c. Chassis sheet metal shall not extend beyond rear face of cowl.

Exception - transit and metropolitan vehicles

Standard does not apply.

14. FRAME

a. Frame or equivalent shall be of such design as to correspond at least to standard practice for trucks of same general load characteristics which are used for severe service.

b. When frame-side members are used they shall be of one-piece construction. If frame-side members are extended, such extension shall be designed and furnished by chassis or body manufacturer with his guarantee, and installation shall be made by either chassis or body manufacturer and guaranteed by company making installation. Extensions of frame lengths are permissible only when such alterations are behind rear hanger of rear spring and shall not be for purpose of extending wheelbase.

c. 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 manufacturer.

Frame lengths - To be furnished in accordance with table on Body sizes shown on page 16.

15. *FUEL TANK

a. Fuel tank shall have minimum capacity of 30 gallons and be mounted directly on right side of chassis frame, filled and vented entirely outside body.

b. Tank shall conform to Section 393.65, subsections (f) through (g)- and (j-1) of Motor Carrier Safety Regulations,[9] with reference to: material and method of construction; fitting design(s) and locations; fill-pipe design, air and safety vents; pressure relief; and drop tests, rupture, spillage restrictions, and safety vent.

c. Fuel filter with replaceable element shall be installed between fuel tank and carburetor.

---

[9]Motor Carrier Safety Regulations (as amended through September 1969) issued by Bureau of Motor Carrier Safety, U. S. Department of Transportation, Washington, D. C. 20591.

d. Fuel tank, fittings or lines, shall not extend above top of chassis frame rail.

e. If tank sizes other than 30 gallons are supplied, location of front of tank and filler spout must remain as specified below.

f. It is recommended that buses with a capacity of 48 and over be equipped with a 60-gallon fuel tank.

Note: Measurements shown below are for guidance of chassis manufacturers and serve only to prevent need for relocating the original tank. Inspectors concerned with state or local approval of vehicle need not consider them unless tank does not fit.

(1) Tank shall not extend in height above side member of chassis.

(2) Distance from center line of chassis to outside of tank shall not be more than 39 inches.

(3) Bottom of tank shall not be more than 14 inches below top of frame or below outer body panel.

(4) Distance from cowl to front of tank shall be 42 inches minimum.

(5) Distance from cowl to center of fill-pipe cap shall be 57 inches.

(6) Distance from center line of chassis to center of fill-pipe cap shall be 44 inches with plus or minus tolerance of $\frac{1}{2}$ inch permitted.

(7) Center of fill-pipe cap shall be 1 inch below top of frame with plus or minus tolerance of $\frac{1}{4}$ inch permitted.

Exceptions

a. For small vehicles, the fuel tank shall be manufacturer's standard, mounted, filled, and vented outside of body.

b. For small school bus of body-on-chassis type with manufacturer's rated seating capacity of 16 to 23 passengers inclusive, fuel tank may, due to space limitation, be mounted on left chassis rail and have capacity of less than 30 gallons.

c. On vehicles of less than 54-pupil capacity constructed for transporting handicapped children, fuel tank, meeting requirements of large vehicles, may be mounted on left chassis rail or behind rear wheels with fill pipe on right side of body.

d. On transit-type school buses, fuel tank shall be mounted on right frame rail, and measurements in notes (4) and (5) above should be from forward service door post.

16. GOVERNOR

Engine governor is permissible and where used shall be set at manufacturer's recommended maximum engine speed. When it is desired to limit road speed, road-speed governor should be installed.

Exception - transit and metropolitan vehicles

When engine is remotely located from driver, governor shall be installed to limit engine speed to maximum revolutions per minute recommended by engine manufacturer, or tachometer shall be installed so engine speed may be known to driver.

17. HEATING SYSTEM

Chassis engine shall provide inlet and outlet holes in accessible locations for attachment of bus heating system water lines.

Also see Heaters, page 26.

18. *HEADLAMPS

The chassis shall be equipped with a minimum of two sealed-beam headlamps of proper intensity and fuses or circuit breakers. The headlamp switch shall be of adequate ampere capacity to carry the load of the clearance and identification lamps in addition to the head and tail lamps since these will be activated by one and the same switch. There shall be a manually operated foot switch for selection of high or low beam distribution of the headlamps.

19. HORN

a. The chassis shall be equipped with dual horns of standard make; each horn must be capable of producing complex sound in band of audio-frequencies between approximately 250 and 2,000 cycles per second and having total sound level of 120 decibles within these frequency limits when measured at a point on axis of the horn 3 feet from exit of the horn.

b. The sound-level measurements shall be made with a meter that complies with American National Standard S1.4-1961 or current revision thereof, as promulgated by the American National Standards Institute.[10] Measurement shall be made with the meter set to flat response (C weighting network).

c. The sound-level measurements shall be made with horns installed on the bus. There shall be no reflecting walls or obstacles, other than the ground and the vehicle, closer than 100 feet from the horn during the sound-level measurements.

---

[10] American National Standards Institute, 1430 Broadway, New York, New York, 10018

20. INSTRUMENTS AND INSTRUMENT PANEL

a. Chassis shall be equipped with following instruments and gauges (lights in lieu of gauges are not acceptable):

(1) Speedometer.

(2) Odometer which will give accrued mileage.

(3) Ammeter with graduated charge and discharge, both ammeter and its wiring to be compatible with generating capacities and capable of handling continuous current draw of 100 amperes.

(4) Voltmeter with graduated scale.

(5) Oil-pressure gauge.

(6) Water-temperature gauge.

(7) Fuel gauge.

(8) Upper-beam headlamp indicator.

(9) Air-pressure or vacuum gauge, where air or vacuum brakes are used, and audible low-pressure indicator to warn driver if air pressure in air-brake system falls below 60 pounds per square inch. See Brakes, page 2.

b. All instruments shall be easily accessible for maintenance and repair.

c. Above instruments and gauges shall be mounted on instrument panel in such manner that each is clearly visible to driver in normal seated position.

d. Instrument panel shall have lamps of sufficient candlepower to illuminate all instruments and gauges.

21. OIL FILTER

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 oil capacity of at least 1 quart.

22. OPENINGS

All openings in floorboard or firewall between chassis and passenger-carrying compartment, such as for gearshift lever and auxiliary brake lever, shall be sealed unless altered by body manufacturer. (See Item i under Construction, page 20.)

23. PASSENGER LOAD

a. Average actual GVW (gross vehicle weight) is sum of average chassis weight, plus average body weight, plus 150 pounds for driver's weight, plus total seated pupil weight (based on 120 pounds per pupil.)

b. Recommended chassis manufacturer's rated GVW (gross vehicle weight) is weight assigned to complete vehicle. (Weights assigned for each pupil capacity classification are shown in table for Power and Grade-ability in the Appendix.)

c. Manufacturer's gross vehicle weight-rating shall be furnished in duplicate by the manufacturer to the Iowa State Department of Public Instruction.

24. POWER AND GRADEABILITY (See Appendix for Table and Formula)

a. Chassis must be so geared and powered as to be capable of surmounting 3.7 percent grade at speed of 20 miles per hour with full load. (See Passenger Load above.)

b. Following figures are based on achieving 3.7 percent grade at 20 mph in direct drive using 1.5 rolling resistance (1.2 for buses having seating capacity of 68 or more pupils), 150-pound driver, 120-pound pupil, and 7.17:1 to 7.2:1 rear axle ratio.[11] For 36-pupil capacity, rear axle ratio is 6.16:1 or higher.

25. SHOCK ABSORBERS

Bus shall be equipped with front and rear double-acting shock absorbers compatible with manufacturer's rated axle capacity.

26. SPRINGS

a. Springs or suspension assemblies shall be of ample resiliency under all load conditions and of adequate strength to sustain loaded bus without evidence of overload.

b. Springs or suspension assemblies shall be designed to carry their proportional share of gross vehicle weight in accordance with requirements for Weight Distribution as shown on page 14.

c. Rear springs shall be of progressive or variable rate type.

---

[11]Best performance level will be obtained with slowest available axle ratio (for instance, 7.17:1 or 7.2:1). If conditions permit higher-geared top road speed, changing to faster axle ratio (for instance, 6.2:1) will reduce engine r.p.m. and therefore reduce available h.p. at any given road speed. Result will be reduced level of performance.

d. If leaf-type front springs are used, stationary eyes shall be protected by full wrapper leaf in addition to main leaf.

27. *STEERING GEAR

a. All school bus chassis shall be equipped with heavy-duty, truck-type power steering. Power steering components shall be compatible with the GVW rating for each capacity as shown in the chassis manufacturer's literature.

b. Steering mechanism shall be approved by chassis manufacturer and designed to assure safe and accurate performance when vehicle is operated with maximum load and at maximum speed.

c. Steering mechanism shall provide for easy adjustment for lost motion.

d. No changes shall be made in steering apparatus which are not approved by chassis manufacturer. (Spinners or knobs on steering wheel are prohibited.)

e. There shall be clearance of at least 2 inches between steering wheel and cowl instrument panel, windshield, or any other surface.

28. TIRES AND RIMS

a. Tire sizes shall be as shown in Table for Power and Gradeability. (See Appendix.)

b. Rim sizes shall be based upon current standards of Tire and Rim Association.[12]

c. Total weight imposed on any tire shall not be greater than the current standard of Tire and Rim Association.[12]

d. Dual rear tires or wide single equivalents shall be provided on all vehicles.

e. All tires on given vehicle shall be of same size and ply rating except where wide single equivalents are used.

f. Spare tire, if required, shall be suitably mounted in accessible location outside passenger compartment.

g. Recapped tires are permissible as replacements on equipment now in operation for use on rear wheels only providing tires are guaranteed by the seller.

---

[12]Current standards may be obtained from Tire and Rim Association, Comand Building, 34 North Hawkins Avenue, Akron, Ohio 44313, or from tire manufacturer.

29. TOW HOOKS

The chassis shall be equipped with one front heavy duty center-mounted tow hook adequately secured to the frame rails with braces, or two tow hooks fastened securely to the front end of the frame.

30. TRANSMISSION

a. Automatic transmissions are not required but are recommended. If used, however, the chassis must be equipped with a parking brake which will secure the vehicle under conditions set forth in the parking brake section.

b. If a mechanical type transmission is used, it shall be synchromesh except the first and reverse gears. Its design shall provide not less than four forward and one reverse speeds.

c. If automatic transmissions are not used, it is recommended that 54 and larger capacity buses be equipped with 5-speed transmission with a single rear axle, or a 4 or 5-speed transmission with a 2-speed rear axle. Where five speed transmission is required, the fifth speed shall be direct drive.

31. UNDERCOATING

Chassis manufacturer shall coat undersides of front fenders with compound to prevent rust which meets or exceeds federal specification TT-C-520a using modified test procedures as outlined on page 41.

32. VOLTAGE REGULATOR

The bus electrical system shall include a voltage regulator of a repairable type. Such regulator shall be of the full-transistor variety except for the field relay which may be either a solid state or controlled contact unit.

33. WEIGHT DISTRIBUTION

Weight distribution of fully loaded bus on level surface shall be such that not more than 75 percent of gross vehicle weight is on rear tires and not more than 35 percent is on front tires.

Exception - transit and metropolitan vehicles

With engine inside front of body: If entrance door is ahead of front wheels, not more than 75 percent of gross vehicle weight shall be on rear tires nor more than 50 percent on front tires. If entrance door is behind front wheels, not more than 75 percent of gross vehicle weight shall be on rear tires nor more than 40 percent on front tires. With engine in rear: Not more than 75 percent of gross vehicle weight shall be on rear tires nor more than 40 percent on front tires.

THE SCHOOL BUS BODY

(17 Capacity and Over)
(* - Denotes change from previous standard.)

1. AISLE

a. Minimum clearance of all aisles, including aisle (or passageway between seats) leading to emergency door, shall be 12 inches. See Item b (11) under Doors, page 22.

b. Aisle supports of seat backs shall be slanted away from aisle sufficiently to give aisle clearance of 15 inches at tops of seat backs.

Exception - transit and metropolitan vehicles

With engine inside front of body: Minimum distance between stanchion at rear of entrance step-well and engine cover shall be 14 inches measured at floor level.

2. *AXE

A hand axe is permissible but is not required. If bus is equipped with one, the axe shall have approximately a two pound head and an 18-inch shaft, mounted in a position accessible to the driver.

3. BATTERY

a. The battery is to be furnished by the chassis manufacturer.

b. When the battery is mounted outside of the engine compartment by the chassis manufacturer, the body manufacturer shall securely attach the battery on a slide-out tray in a closed, vented compartment in the body skirt whereby the battery may be exposed to the outside for convenient servicing. The battery compartment door or cover shall be secured by an adequate and conveniently operated latch or other type fastener to prevent free leakage of the battery contents into the passenger compartment, if vehicle is overturned. (See also page 1.)

4. BODY SIZES

Bodies for conventional body-on-chassis type vehicles shall be limited to lengths shown in table below. Sizes are based on 27-inch center-to-center spacing between rows of forward-facing seats, over-all width of 96 inches, center aisle width of 12 inches, and average rump width of (a) 13 inches for 3-3 seating plan and (b) 15 inches for 3-2 seating plan. Body lengths are measured from back of cowl to rear of body at floor level.

Number of rows of seats	Pupil Capacity: 3-3 plan; rump width of 13 inches	Pupil Capacity: 3-2 plan; rump width of 15 inches	Maximum body length (in inches)	Minimum measurement, cowl to center line of rear axle (in inches)	Minimum measurement, cowl to end of frame* (in inches)
4	24	20	178	102	173
5	30	25	196	123	187
6	36	30	222	125	210
7	42	35	250	142	241
8	48	40	277	160	268
9	54	45	304	192	295
10	60	50	332	211	323
11	66	55	355	229	349

*This column refers to frame lengths as produced by chassis manufacturer and may be altered, plus or minus, by body manufacturer.

Exceptions - Measurements in preceding table do not apply to transit and metropolitan vehicles nor to vehicles of less than 24-pupil capacity.

5. BUMPER, REAR

a. Rear bumper shall be of pressed steel channel at least 3/16 inch thick and 8 inches wide (high).

b. It shall be wrapped around back corners of bus. It shall extend forward at least 12 inches, measured from rear-most point of body at floor line.

c. Bumper shall be attached to chassis frame in such manner that it may be easily removed, shall be so braced as to develop full strength of bumper section from rear or side impact, and shall be so attached as to prevent hitching of rides.

d. Rear bumper shall extend beyond rear-most part of body surface at least 1 inch, measured at floor line.

6. CEILING

(See Insulation and Interior.)

7. CHAINS

(See item d under Wheel housings, page 42.)

8. COLOR

(Also, see Color under chassis section.)

a. School bus body including hood, cowl, and fenders shall be painted uniform color, national school bus glossy yellow,[13] according to specifications available from General Services Administration.

b. Rear bumper and lettering shall be black.[14]

c. Body trim, if used, shall be black.[14]

9. CONSTRUCTION

a. Construction shall be of prime commercial quality steel or other metal or other material with strength at least equivalent to all-steel as certified by bus body manufacturer. All such construction materials shall be fire-resistant.

b. Construction shall provide reasonably dustproof and watertight unit.

c. Bus body (including roof bows, body posts, strainers, stringers, floor, inner linings, outer panels, rub rails, and other reinforcements) shall be of sufficient strength to support entire weight of fully loaded vehicle on its top or side if overturned. Bus body, as unit, shall be designed and built to provide impact and penetration resistance.

As evidence that bus body meets this standard, all body manufacturers shall furnish, for each current body model, certification in duplicate (unless more are requested by Iowa State Department of Public Instruction) that bus body meets Static Load Test Code for School Bus Body Structure.[15] Copies of Code will be furnished by School Bus Manufacturers Institute to the Iowa State Department of Public Instruction.

Details involved in testing body structure will remain as shown in Code; to qualify under Code, however, deflections of body structure must not exceed following measurements:

---

[13]See footnote 7, page 6.
[14]See footnote 6, page 6.
[15]Obtainable from School Bus Manufacturers Institute, an Industry Division of Truck and Body and Equipment Association, Inc., 5530 Wisconsin Avenue, N. W., Washington, D. C. 20015.

(1) deflection at center of roof bow . . . . . 3.00 inches

(2) deflection of each side pillar at window sill level . . . . . 1.00 inch

(3) deflection at center of floor . . . . . .40 inch

d. Floor shall be of prime commercial quality steel of at least 14-gauge or other metal or other material at least equal in strength to 14-gauge steel. If plywood is used, it shall be 5-ply, at least 5/8 inch thick and it shall be equal or exceed properties of exterior-type softwood plywood, B-B Grade as specified in standard issued by U. S. Department of Commerce.[16] Floor shall be level from front to back and from side to side except in wheel housing, toeboard, and driver's seat platform areas.

e. Roof strainers: Two or more roof strainers or longitudinal members shall be provided to connect roof bows, to reinforce flattest portion of roof skin, and to space roof bows. These strainers may be installed between roof bows or applied externally. They shall extend from windshield header and, when combined with rear emergency door post, are to function as longitudinal members extending from windshield header to rear floor body cross member. At all points of contact between strainers or longitudinal members and other structural material, attachment shall be made by means of welding, riveting, or bolting.

After load as called for in Static Load Test Code has been removed, none of following defects shall be evident:

(1) Failure or separation at joints where strainers are fastened to roof bows.

(2) Appreciable difference in deflection between adjacent strainers and roof bows.

(3) Twisting, buckling, or deformation of strainer cross section.

f. Side strainer(s): There shall be one or more side strainers or longitudinal members to connect vertical structural members and to provide impact and penetration resistance in event of contact with other vehicles or objects. Such strainer(s) shall be formed (not in flat strip) from metal of at least 16-gauge and 3-inches wide.

Side strainer(s) shall be installed in area between bottom of window and bottom of seat frame and shall extend completely around bus body except for door openings and body cowl panel. Side strainer(s) shall be fastened to each vertical structural member in any one or any combination of following methods as long as stress continuity of member(s) is maintained:

---

[16]Product Standard PS1-66, Softwood Plywood, Construction and Industrial (amended). Obtainable from Superintendent of Documents, Washington, D.C. 20401. Price, 20 cents.

(1) Installed between vertical members.

(2) Installed behind panels but attached to vertical members.

(3) Installed outside external panels.

Fastening method employed shall be such that strength of strainer(s) is fully utilized.

Side strainer(s) or longitudinal member(s) may be combined with one of required rub rails (see page) or be in form of additional rub rail, as long as separate conditions and physical requirements for rub rails are met. No portion of side strainer or longitudinal member is to occupy same vertical position as either rub rail.

g. Rear corner reinforcements: Rear corner framing of bus body between floor and window sill and between emergency door posts and last side posts shall consist of at least three structural members applied horizontally or vertically or in another combination to provide additional impact and penetration resistance equal to that provided by frame members in areas of sides of body. Such structural members shall be securely attached at each end.

h. Floor sills:

(1) There shall be one main body sill at each side post and two intermediate body sills on approximately 10-inch centers. All sills shall be of equal height not to exceed 3 inches. All sills shall extend width of body floor except where structural members or features restrict area.

Main body sill shall be equivalent to or heavier than 10-gauge and each intermediate body sill shall be equivalent to or heavier than 16-gauge, or each of all body sills shall be equivalent to or greater than 14-gauge. All sills shall be permanently attached to floor.

(2) Connections between sides and floor system shall be capable of distributing loads from vertical posts to all floor sills. As evidence that this requirement is fulfilled, none of following conditions shall occur during or after application of load as called for in Static Load Test Code:

(a) Appreciable difference in deflection between adjacent sills.

(b) Failure or separation in joints where floor, floor sills, and sides connect.

(c) Twisting, buckling, or deformation of floor sill cross sections.

i. All openings between chassis and passenger-carrying compartment made due to alteration by body manufacturer must be sealed. (See Openings, page 11.)

10. DEFROSTERS

a. The defrosters shall be of sufficient capacity to keep the windshield, window to the left of the driver, and glass in the entrance door clear of fog, frost, and snow.

b. The defrosters shall have separate all metal fans which secure air directly from the heater core and the air mixture shall be at least 60 percent fresh air.

c. Each defroster unit shall be driver controlled and regulated, operating independently through its own duct system.

d. All defrosting equipment shall meet Federal Motor Vehicle Safety Standard No. 103.

e. In addition, two adjustable 6-inch all-metal or polycarbonate resin defroster fans shall be installed. The fans shall have a minimum of 4 blades and be equipped with adequate guards. Each unit shall be independently adjustable and operated by the driver. These fans shall be on a separate circuit, with a switch for each fan, and be capable of two-speed operation.

11. DOORS

a. Service door

(1) The service door shall be power or manually operated, under control of the driver, and so designed as to afford easy release and to prevent accidental opening. When hand lever is used, no parts shall come together so as to shear or crush fingers. A power-operated door must provide for manual operation in case of power failure.

(2) The service door shall be located on the right side of the bus opposite the driver and within his direct view.

(3) Overhead door controls are preferred. If under-step type door control is used, it must be completely enclosed.

(4) The service door shall have a minimum horizontal opening of 24 inches and a minimum vertical opening of 68 inches.

(5) The service door shall be of split type, sedan type, or jackknife type. (Split-type door includes any sectioned door which divides and opens inward or outward.) If one section of the split-type door opens inward and the other opens outward, the front section shall open outward.

(6) The lower as well as upper panels shall be of approved safety glass. (See Item a under Windshield and Windows, page 43.) The bottom of lower glass panel shall not be more than 35 inches from ground when the bus is unloaded. The top of the upper glass panel shall not be more than 6 inches from the top of the door.

(7) The vertical closing edges shall be equipped with flexible material to protect children's fingers.

(8) A header pad shall be installed directly above the service door entrance on the inside. The pad shall extend horizontally to within approximately 3 inches from each vertical edge of the door opening.

(9) There shall be no door to the left of the driver. (This shall not be interpreted to conflict with the emergency door if it is located on the left side of the bus.)

*(10) The upper panels of the door shall be sealed double glass.

b. Emergency door and emergency window

*(1) The emergency door shall be located in the center of the rear end of the bus except on a bus of greater than 48 capacity, the emergency door may be located in the rear half of the left side of the bus.

*(2) The upper portion of the emergency door on the rear end shall be equipped with approved safety glass, exposed area of which shall be not less than 400 square inches. The lower portion of the rear emergency door shall be equipped with approved safety glass, exposed area of which shall not be less than 350 square inches. The upper portion of the emergency door on the left side shall be equipped with approved safety glass and the lower portion shall be of metal at least the same gauge as the body metal in the area adjacent to the door.

*(3) If the emergency door is located on the left side, there shall be a safety chain or cable extending across the inside of the opening and it shall be located not more than 6 inches above or below the horizontal centerline of the door. The chain or cable shall be covered with a suitable protective material. Eyelets shall be solidly fastened at each side of the opening. The chain or cable shall be equipped with an easily detachable snap or hook on each end.

*(4) There shall be a head bumper pad installed over the emergency door on the inside of the bus body. This pad shall extend at least the width of the door opening.

*(5) The words "Emergency Door" in lettering at least 2 inches high shall be placed directly above the header pad over the emergency door on the inside and below the top window of the emergency door on the outside. Pressure sensitive markings of vinyl material are acceptable for this lettering.

(6) A sign, including lettering and a painted arrow, showing the direction that the handle must be moved to open the emergency door latch shall be applied on the inside of the emergency door near the latch handle. Pressure sensitive markings of vinyl material are acceptable for this lettering.

(7) The emergency door shall be equipped with a heavy duty metal doorstop and hold bracket or two heavy duty straps to prevent the door from striking lamps when it is open.

(8) The emergency door shall have a minimum horizontal opening of 24 inches and a minimum vertical opening of 48 inches measured from the floor level.

(9) The emergency door shall be hinged on the right side if it is in the rear end of the bus and on the front side if located on the left side of the bus. It shall open outward.

(10) There shall be no steps leading to the emergency door.

(11) No seat or other object shall be so placed in the bus as to restrict any part of the passageway leading to either the rear or the left-side emergency door to an opening smaller than a rectangle of 12 inches in width and 48 inches in height measured from the floor level.

(12) The emergency door shall be designed to be opened from the inside and outside of the bus and shall be equipped with fastening device which may be quickly released but is designed to offer protection against accidental release. Control from driver's seat shall not be permitted. Provision for opening from outside shall consist of a non-detachable device so designed as to prevent hitching-to but to permit opening when necessary.

(13) The emergency door shall be equipped with a slide-bar, cam-operated lock. The slide bar shall have a minimum stroke of 1 inch. The emergency door lock shall be equipped with a suitable electric plunger-type switch

connected with a buzzer located in the driver's compartment. The switch shall be enclosed in a metal case, and the wires leading from the switch shall be concealed in the bus body.

The switch shall be so installed that the plunger contacts the farthest edge of the slide bar in such manner that any movement of the slide bar will immediately close the circuit on the switch and activate the buzzer.

(14) The door lock shall be equipped with an interior handle that extends approximately to center of the emergency door. It shall lift up to release the lock.

(15) Emergency window

(a) When the emergency door is located on the left side of the bus, the window at the rear shall be designed as an emergency exit and shall be no smaller than 16 inches in height and 54 inches in width on buses 80 inches or more in width; it shall be no smaller than 16 inches in height and 48 inches in width on buses less than 80 inches in width. The window shall be hinged from the top and devised and operated to insure against accidental closing in an emergency.

(b) Paneling is required to cover the space between the top of the rear divan seat and the inside surface of emergency window at the rear.

(c) The words "Emergency Exit" in letters at least 2 inches high shall be placed directly above the emergency window on inside and directly below it on the outside. (Pressure sensitive markings of vinyl material are acceptable for this lettering.)

(d) The emergency window shall be designed to be opened from inside and outside of the bus and shall be equipped with a fastening device which may be quickly released but is designed to offer protection against accidental release. Control from driver's seat shall not be permitted. A provision for opening from the outside shall consist of a nondetachable device so designed as to prevent hitching-to but to permit opening when necessary.

(e) The emergency window in rear shall be equipped with latch (or latches) on the inside, connected with an electrical buzzer that will actuate when the latch is being released.

(f) It shall also be equipped on the outside with a nondetachable fastening device so designed as to prevent hitching-to but to permit opening from the outside.

12. ELECTRICAL SYSTEM

a. Alternator - See page 1

b. Battery - See pages 1 and 15

c. Lamps and signals - See page 28

d. Wiring - See page 44

e. See also Item e under Electrical System on page 7

13. *EMERGENCY EQUIPMENT

a. The bus shall be equipped with three (3) triangular warning devices in accordance with Motor Vehicle Safety Standard No. 125. The device must have reflective and fluorescent material on both faces. Each side of the triangle shall be at least 17 inches and not more than 22 inches. The reflective material must have a minimum of 80 candlepower. The devices must be stored in a container mounted in an accessible location in the driver's compartment.

b. The bus shall be equipped with three (3) 16" red cloth flags and means for roadside mounting.

c. The bus shall be equipped with three (3) 30-minute stand-up fusees stored in a cannister with a lid and placed in the driver's compartment.

14. *FIRE EXTINGUISHER

a. The bus shall be equipped with a pressurized, dry-chemical type fire extinguisher of at least five (5) pound capacity mounted in extinguisher manufacturer's bracket of automotive type, and located in the driver's compartment in full view and readily accessible to the driver.

b. The fire extinguisher shall have a minimum rating of 10-B:C[17] and it shall be equipped with a calibrated or marked gauge to indicate the amount of pressure in the extinguisher.

c. Each extinguisher shall meet the applicable standards prescribed by a testing organization of national reputation which undertakes to test and provide standards for extinguisher equipment. The testing laboratory must be one that is recognized by the Iowa State Fire Marshal. Each extinguisher shall bear the label of the testing laboratory.

---

[17] 10-B:C denotes amount of chemical needed to extinguish 10 square-foot type B fire (flammable liquid) or type C fire (electrical).

15. FIRST-AID KIT

a. The bus shall carry a grade "A" metal first-aid kit and shall either be mounted in full view or the location of the kit labeled so any driver will know where to find it. The kit shall be accessible to the driver and mounted in such manner that it can be removed from the bus if necessary.

b. First-aid kits must be approved by the Iowa State Department of Public Instruction.

c. Sizes required for buses:

(1) Ten unit kit required in all vehicles carrying seventeen passengers or less.

(2) Sixteen unit kit required in all buses carrying eighteen to thirty passengers.

(3) Twenty-four unit kit required in all buses carrying thirty-one to forty-eight passengers.

(4) Thirty-six unit kit required in all buses carrying forty-nine or more passengers.

ITEM	10-unit	16-unit	24-unit	36-unit
1" Adhesive Compress	-	1	1	2
2" Bandage Compress	1	1	2	2
3" Bandage Compress	-	1	2	2
4" Bandage Compress	1	1	2	2
3" x 3" Plain Gauze Pads (Dressings)	1	1	1	4
Gauze Roller Bandage	1	1	2	4
Plain Absorbent Gauze 2 pieces; (18" x 36")	1	2	4	6
Plain Absorbent Gauze	1	2	3	5
Triangular Bandages	1	3	4	6
Tourniquet	1	1	1	1
Band Aids (Packet)	1	1	1	1
Wire Splint*	1	1	1	1

*Instant splints may be substituted.

16. FLOOR COVERING

a. The floor in underseat area, including tops of wheel housings, driver's compartment, and toeboard, shall be covered with fire-resistant rubber floor covering or equivalent having a minimum over-all thickness of .125 inch.

b. The floor covering in the aisle shall be of aisle-type fire-resistant rubber or equivalent, non-skid, wear-resistant, and

ribbed. Minimum over-all thickness shall be .1875 inch measured from the tops of ribs. Rubber floor covering shall meet Federal Specification ZZ-M-71b.[18]

c. The floor covering must be permanently bonded to the floor and must not crack when subjected to sudden changes in temperature. Bonding or adhesive material shall be waterproof and shall be of type recommended by the manufacturer of floor-covering material. All seams must be sealed with waterproof sealer.

d. Cove molding shall be used along the side walls and rear corners. All floor seam separations shall be covered with durable metal stripping.

17. GASOLINE FILL CAP COVER

The gasoline fill cap opening in the body skirt shall be equipped with a hinged cover held closed by a spring or other conveniently operated device.

18. HEATERS

a. Heaters are required and they shall be of hot-water or combustion type.

b. If only one heater is used, it shall be of fresh-air or combination fresh-air and recirculating type.

c. If more than one heater is used, additional heaters shall be of recirculating air type.

d. Where hot-water heaters are used, they shall bear name plate rating in accordance with Standard Code for Testing and Rating Automotive Bus Hot Water Heating and Ventilating Equipment,[19] plate to be affixed by heater manufacturer. Copies of the Code shall be furnished in duplicate (unless more are requested by the Iowa State Department of Public Instruction) by School Bus Manufacturers Institute to the Iowa State Department of Public Instruction.

e. All combustion-type heaters shall be approved by Underwriters' Laboratories, Inc.[20]

---

[18]Available from General Services Administration, Specification Sales, Building 197, Washington Navy Yard, Washington, D. C. 20407.

[19]Obtainable from School Bus Manufacturers Institute, an Industry Division of Truck Body and Equipment Association, Inc., 5530 Wisconsin Avenue, N.W., Washington, D. C. 20015.

[20]207 East Ohio Street, Chicago, Illinois 60611.

f. If combustion-type heaters are used, they shall be installed on new buses by body manufacturers and on buses now in operation by authorized dealers or by authorized garages.21

g. Heaters shall be capable of maintaining inside temperature of 50 degrees Fahrenheit at average minimum January temperatures as established by U. S. Department of Commerce, Weather Bureau,22 for area in which heater is required.

*h. Heavy duty cut-off valves shall be installed in locations accessible to the driver and all heater lines in the interior of the bus shall be shrouded.

Also see Heating system, page 10.

19. IDENTIFICATION

a. The body shall bear the words "SCHOOL BUS" in black letters at least 8 inches high on both front and rear of the body or on signs attached thereto. The lettering shall be placed as high as possible without impairment of its visibility. The lettering shall conform to "Series B" of Standard Alphabets for Highway Signs. 23

b. The bus, whether school owned or privately owned, shall bear the official name of the school on each side in black standard unshaded letters at least five inches but not more than seven inches high.

Examples:
1. Blank Community School District
2. Blank Independent School District
3. Blank Consolidated School District

If there is insufficient space due to the length of the name of the school district, the words community, independent, consolidated, and district may be abbreviated.

c. The rated pupil seating capacity of the bus shall be printed to the left of the entrance door, approximately six inches below the name of the school district in two inch characters. (The word capacity may be abbreviated. For example: Rated Cap. 48)

d. The number of the bus shall be printed in not less than five inch nor more than eight inch characters. The location of the number is at the discretion of the local district except that the number of the bus shall not be on the same line as the name of the school district nor in a location that will interfere with the words "School Bus."

---

21 See requirements for combustion-type heaters in current Motor Carrier Safety Regulations, issued by Bureau of Motor Carrier Safety, U. S. Department of Transportation, Washington, D. C. 20591.

22 Washington, D. C. 20235.

23 Designed by U. S. Bureau of Public Roads for Joint Committee on Uniform Traffic Control Devices.

e. Privately owned buses shall also bear the name of the owner followed by the word "OWNER" in one and one-half inch characters printed approximately six inches below the bus capacity on the right side of the bus.

f. The rated seating capacity of the bus shall also be printed above the right windshield inside of the bus.

*g. Pressure sensitive markings of vinyl material may be used for the above lettering in lieu of painting.

20. INSIDE HEIGHT

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.

21. INSULATION

a. The ceiling and walls shall be insulated with proper material to deaden sounds and to reduce vibrations to a minimum. All insulation shall be so firmly installed that it will retain its original position.

b. The insulation shall be fire-resistant material of type approved by Underwriters' Laboratories, Inc.[24]

c. Plywood may be used for floor insulation. (See paragraph d under Construction, page 18.)

22. *INTERIOR

a. Interior of bus shall be free of all unnecessary projections likely to cause injury. This includes book racks, radio speakers, coat hooks, and coat railings. (Radio speakers are permissible if flush mounted.)

b. This standard requires inner lining on ceilings and walls. If ceiling is constructed so as to contain lap joints, forward panel shall be lapped by rear panel and exposed edges shall be beaded, hemmed, flanged, or otherwise treated to minimize sharp edges.

23. LAMPS AND SIGNALS

a. General. All lamps and reflectors on exterior of vehicle shall conform with and be installed as required by Federal Motor Vehicle Safety Standard No. 108.

---

[24] 207 East Ohio Street, Chicago, Illinois 60611.

b. Clearance lamps. The body shall be equipped with two amber clearance lamps at the front and two red clearance lamps at the rear mounted at the highest and widest portion of the body.

c. Identification lamps. The bus shall be equipped with three amber identification lamps on the front and three red identification lamps on the rear. Each such group shall be evenly spaced not less than six nor more than twelve inches apart along a horizontal line near the top of the vehicle.

d. Intermediate side marker lamps. On all buses over 30 feet long, one amber side lamp is required on each side, located midway between the front and rear clearance lamps and connected to the headlamp switch.

e. Reflectors

(1) The bus shall be equipped with two amber reflectors, one on each side at the lower front and corner of the body approximately at floor level and back of the door on the right side, and at a similar location on the left side. On all buses over 30 feet long, an additional amber reflector is required on each side at or near the midpoint between the front and rear side reflectors.

(2) The bus shall be equipped with four red reflectors; one at each side at or near the rear; and two on the rear, one at each side.

(3) The reflectors are to be mounted at a height not to exceed forty-two inches nor less than thirty inches above the ground on which the vehicle stands.

f. Back-up lamps. The school bus body manufacturer shall install the back-up lamps required by Federal Motor Vehicle Safety Standard No. 108. The candlepower shall be the maximum permitted by said standard.

g. Interior lamps. Interior lamps shall be provided which adequately illuminate the interior aisle and the step-well.

h. License-plate lamp. The bus shall be equipped with a rear license plate illuminator. This lamp may be combined with one of the tail lamps.

i. Stop (brake) lamps. The bus shall be equipped with two stop (brake) lamps, not in combination with the tail lamps, emitting red lights plainly visible from a distance of 500 feet to the rear. These lamps shall be as high as practicable but below the window line and spaced as far apart laterally as practicable but not less than three (3) feet. Measurements shall be taken from lamp

centers. These lamps are to have a single contact bulb and a red lens with a minimum diameter or width of seven inches. The lens shall be free of lettering except for the manufacturer's markings. The stop lights are to be activated by the brake switch.

j. Combination stop and tail lamps. The bus shall be equipped with two combination stop and tail lamps mounted not less than 40 inches from the surface on which the vehicle stands. These shall have double filament lamp bulbs and shall be connected to the headlamps and the brake operated stop lamp circuits. The candlepower shall be the maximum permitted by Federal Motor Vehicle Safety Standard No. 108.

k. Warning signal lamps. School bus warning signal lamps are alternately-flashing lamps at the same horizontal level intended to identify the vehicle as a school bus and to inform other users of the highway that such vehicle is about to stop or is stopped to take on or discharge school children. Requirements for such lights, as used on school buses, shall be as follows:

(1) All school buses shall be equipped with four alternately-flashing warning lamps at the front and four alternately-flashing warning lamps at the rear of the bus. Two of each of said sets of four lamps shall be amber in color and two shall be red in color. Said lamps shall conform to the Society of Automotive Engineers' Standard 'J887, July, 1964' except that the candlepower requirement for the amber lamps shall be two and one-half times that specified for the red signal lamps. Strobe lights are permissible.

(2) Installation of said lamps shall conform to said standard except that an amber signal lamp shall be located adjacent to each red signal lamp, at the same level, and at the side of the red signal lamp nearer the vertical center line of the bus. As a further exception to said standard, the system of red and amber signal lamps shall be so wired that the amber signal lamps are energized manually; and the red signal lamps are energized automatically and the amber signal lamps are de-energized automatically when the bus entrance door is opened.

(3) The area of the bus body around the lens of each flashing warning signal lamp and extending outward for approximately three inches shall be painted black.

*(4) The switch to activate the amber flashing warning lamps shall be hand operated and located to the left and forward of the driver near the front of the control panel in a manner and in a position enabling the driver to operate it while looking straight ahead. There shall be two pilot lights, one

of which shall display an amber light when the amber warning lamps are flashing and the other which shall display a red light when the red warning lamps are flashing. The lens for the pilot lights shall be approximately one-half inch in diameter. These pilot lights shall be located in a position where they can be readily observed by the driver while looking straight ahead. The switch and pilot lights are to be properly labeled.

*(5) Operation of warning light system

(a) With entrance door closed, depress manual push button. Amber pilot light and amber warning lights flash.

(b) Open entrance door. Amber pilot and amber warning lights go off and red pilot and red warning lights flash. Stop arm is automatically extended.

(c) Close entrance door. All lights go out and stop arm retracts automatically.

(d) Open entrance door without depressing manual push button. No lights flash nor does stop arm extend.

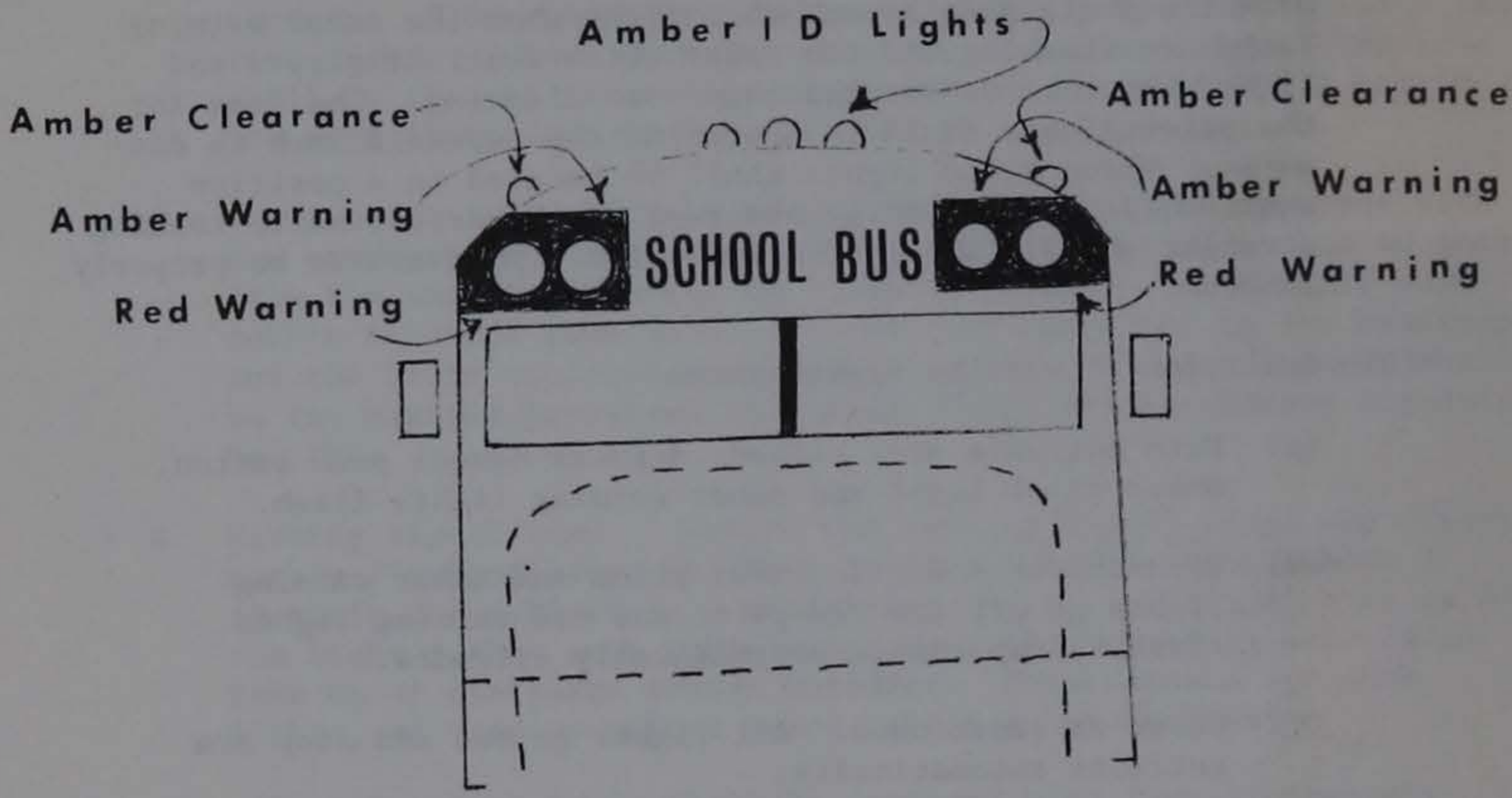
(e) With entrance door open, depress manual push button. Red pilot and red warning lights flash. Stop arm is automatically extended.

(6) There shall be a cancelling switch easily accessible to the driver which will de-activate the amber lamps if they are accidentally activated or if the driver discovers he does not need to make a stop.

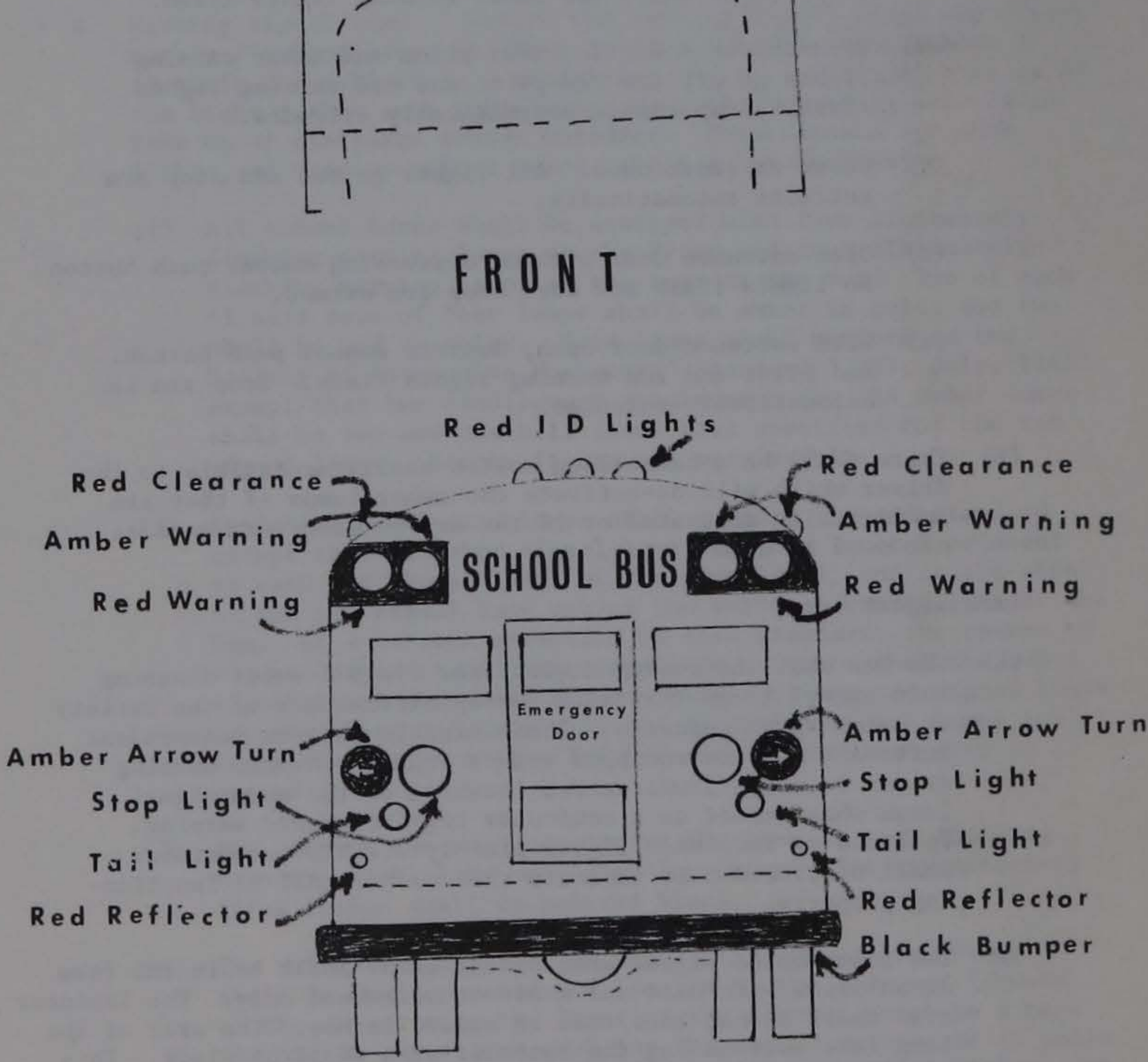
1. Turn signal lamps

(1) The bus shall be equipped with four Class A amber flashing turn signal lamps that meet the specifications of the Society of Automotive Engineers. These signals must be independent units and must be equipped with a four-way hazard warning switch to cause simultaneous flashing of the turn signal lamps when needed as a vehicular traffic hazard warning. Telltale or indicator lights plainly visible to operator shall be provided to indicate that each signal is functioning properly.

(2) The illuminated signal area of the lamps shall be in the form of an arrow with head and shaft or arrowhead only. The luminous area shall be not less than 12 square inches. The area of the lamp face surrounding the luminous area shall be black. This may be a metal shield painted dull black or a vitreous black enamel applied to the lens itself.


Amber I D Lights
Amber Clearance
Amber Warning
Red Warning
Amber Clearance
Amber Warning
Red Warning
SCHOOL BUS

FRONT


Red I D Lights
Red Clearance
Amber Warning
Red Warning
Red Clearance
Amber Warning
Red Warning
SCHOOL BUS
Emergency Door
Amber Arrow Turn
Stop Light
Tail Light
Red Reflector
Amber Arrow Turn
Stop Light
Tail Light
Red Reflector
Black Bumper

REAR

(3) The lens coloring and wiring must conform to SAE specifications.

(4) The flashing rate for turn signal lamps shall be no slower than 60 and no faster than 120 times per minute under normal operating conditions. The "on" period of flasher shall be long enough to permit bulb filament to come to full brightness.

(5) The entire lamp assembly must meet SAE specifications and successfully pass vibration and shock, moisture, dust, corrosion and photometric tests.

(6) Each turn signal lamp shall be mounted with its axis substantially parallel to longitudinal axis of vehicle. Rear lamps shall be mounted as near to the right and left side of the bus as possible but in no case shall outer edge of lamps be more than 10 inches from outer body width line. They shall be mounted below rear windows but in no case shall distance from top edge of lamp to lower edge of window exceed 5 inches. Front lamps shall be mounted either on top of each front fender or on cowl. If mounted on cowl, distance from top edge of lamp to lower windshield line shall not exceed 5 inches. Mounting brackets or hooks for both front and rear lamps shall be of sufficient strength to withstand normal vibration. Those for rear lamps shall be streamlined to body to prevent hitching of rides.

*(7) On transit type vehicles, an amber clearance lamp with a minimum of four candlepower shall be mounted on the side of the body at approximately seat level rub rail height just to the rear of the service door on the right side and another one at approximately opposite the driver's seat on the left side. These lamps are to be connected to operate with the regular turn signal lamps.

m. Supervisor's light. The rearmost ceiling light or a separate light may be used as a supervisor's light. This light shall have a separate switch controlled by the driver so he may have this light on when traveling after sunset.

24. METAL TREATMENT

All metal used in construction of bus body shall be zinc- or aluminum-coated or treated by equivalent process before bus is constructed. (Included are such items as structural members, inside and outside panels, floor panels, and floor sills; excluded are door handles, grab handles, stanchions, interior decorative parts, and other interior plated parts.)

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.

In providing for these requirements, particular attention shall be given to lapped surfaces, welded connections of structural members, cut edges, punched or drilled hole areas in sheet metal, closed or box sections unvented or undrained areas, and surfaces subjected to abrasion during vehicle operation.

As evidence that above requirements have been met, samples of materials and sections used in construction of bus body, when subjected to 1,000 hour salt spray test as provided for in latest revision of ASTM Designation: B 117, "Standard Method of Salt Spray (Fog) Testing,"[25] shall not lose more than 10 percent of material by weight.

25. MIRRORS

a. Interior mirror shall be clear view safety glass at least 6 by 30 inches overall to afford good view of pupils and roadway to rear. Mirror shall be metal-backed and framed; it shall have rounded corners and protected edges.

b. Two exterior clear-view, rearview mirrors shall be provided, one to left and one to right of driver. Area of each mirror shall be not less than 50 square inches overall. Each mirror shall be firmly supported and adjustable to give driver clear views past left rear and right rear of bus.

c. Exterior convex mirror at least 7½ inches in diameter shall be located either on left or on right side of bus in such manner that seated driver may observe, through its use, areas to front or side of bus where direct observation is not possible. This same type mirror may be installed at other locations on bus to enable seated bus driver to observe areas alongside bus where direct observation is not possible.

26. MOUNTING

a. Chassis frame shall extend to rear edge of rear body cross member. Bus body shall be attached to chassis frame in such manner as to prevent shifting or separation of body from chassis under severe operating conditions.

b. Body front shall be attached and sealed to chassis cowl in such manner as to prevent entry of water, dust, and fumes through joint between chassis cowl and body.

c. Insulating material shall be placed at all contact points between body and chassis frame. Insulating material shall be approximately ¼-inch thick, shall have quality of sidewall of automobile tire, and shall be so attached to chassis frame or body member that it will not move under severe operating conditions.

---

[25] American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

27. OVER-ALL LENGTH

The over-all length of the bus shall not exceed 35 feet.

28. OVER-ALL WIDTH

The over-all width of the bus shall not exceed 96 inches. 8'11"

29. POSTS

See Construction, page 17.

30. RUB RAILS

a. There shall be one rub rail located on each side of bus approximately at seat level which shall extend from rear side of entrance door completely around bus body (except for emergency door) to point of curvature near outside cowl on left side.

b. There shall be one rub rail located approximately at floor line which shall cover same longitudinal area as upper rub rail, except at wheel housings, and shall extend only to radii of right and left rear corners.

c. Both rub rails shall be attached at each body post and all other upright structural members.

d. Both rub rails shall be 4 inches or more in width, shall be of 16-gauge steel, and shall be constructed in corrugated or ribbed fashion.

e. Both rub rails shall be applied outside body or outside body posts. Pressed-in or snap-on rub rails do not satisfy this requirement.

31. SANDERS

Where required or used, sanders shall:

a. Be of hopper cartridge-valve type.

b. Have metal hopper with all 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 to front of each rear wheel under fender.

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.

h. Be exclusively driver-controlled.

i. Have gauge to indicate hoppers need refilling when they are down to one-quarter full.

32. SEAT BELT FOR DRIVER

A seat belt for the driver shall be provided which conforms to Federal Motor Vehicle Safety Standards No. 208, No. 209, and No. 210. Both the right half and the left half of the rear belt shall be equipped with a "protective" boot and a retractor attachment for keeping the belt off the bus floor. The protector boot shall be securely anchored so that it remains in an upright position at all times.

33. SEATS

a. All seats shall have a minimum depth of 15 inches.

b. In determining the rated seating capacity of the bus, allowable average rump width shall be:

(1) 13 inches where 3-3 seating plan is used

(2) 15 inches where 3-2 seating plan is used

c. All seats shall be forward facing and shall be securely fastened with Grade 5 or better bolts and nuts with lock washers on that part or parts of the bus which support them.

d. No bus shall be equipped with jump seats or portable seats.

e. The forward-most pupil seat on the right side of the bus shall be located so as not to interfere with the driver's vision, not farther forward than the guard rail behind the driver or the rear of the driver's seat when adjusted to its rear-most position.

f. The minimum center-to-center seat spacing shall be 27 inches. The distance between the driver's seat when adjusted to its rear-most position and the front face of seat-back of forward-most pupil seat on the left side of the bus shall not be less than 24 inches measured at cushion height.

*g. The seat cushion shall be constructed of polyurethane foam or equivalent material. The thickness in the cushion shall be

approximately 5 inches and it shall be depressed not more than 80 percent when distributed weight of 345 pounds is applied to it. The thickness in seat back rests shall be approximately 2 inches thick and shall not be depressed more than 80 percent when distributed weight of 300 pounds is applied to it. The upholstery fabric shall be artificial leather equal to coated fabrics, 42-ounce finished weight, 54 inches wide, reinforced backing of 1.06 broken twill. The padding and covering on all seats shall be of material that will not flash or explode upon contact with spark or open fire. The seams of seat cushions shall be made of good quality welt. Where beading is used it shall be double sewn in all seams to assure less splitting from flexing.

*h. All exposed tops, side-rails, and the complete back of the seat shall be padded extending to seat cushion level with an energy absorption material of polyurethane foam or equivalent. If reconstituted foam is used, the density of the padding on the front and rear side of the seat back shall be at least 4 pounds per cubic foot and the density of the padding over the seat back tubing shall be at least 6 pounds per cubic foot. If virgin polyurethane foam is used, the following density figures shall apply: A minimum of 1.8 pounds per cubic foot for front and rear of seat back padding and a minimum of 2.4 pounds per cubic foot over the seat back tubing. If a combination of virgin and reconstituted foam is used, the density values for each type as previously stated shall apply. The minimum thickness of the padding shall be one-half inch on the back side, 1 3/8 inches on the front side, one inch over the frame top tubing, and 3/8 inch on side of tubing against wall and aisle side. The padding may be tapered to a lesser thickness at the bottom of the padding to permit required knee clearance. Back cushions shall be constructed so as to eliminate exposed screws or bolts which contribute to vandalism of the seats.

i. A minimum of 36-inch headroom for sitting position above top of undepressed cushion line of all seats shall be provided. The measurement shall be made vertically not more than 7 inches from the side wall at cushion height and at fore-and-aft center of cushion.

j. The backs of all seats of similar size shall be of same width at top and of same height from the floor and shall slant at same angle with floor. (Backs of seats shall be free of coat rails.)

k. The tops of back rests shall be not less than 33 and not more than 45 inches above the floor level except that tops of back rests on rear seats shall not be above bottom edge of rear windows.

l. The seat cushion shall be securely attached to the seat frames with a positive type retainer to keep cushion from being completely dislodged from seat frame if the bus overturns. Each seat cushion

retention system shall be capable of withstanding vertical static load equal to minimum of 5 times weight of cushion. System shall also be capable of withstanding forward or rearward static load equal to 20 times weight of cushion. (Spring clips do not meet this requirement.)

m. The minimum distance between the steering wheel and the back rest of the driver's seat shall be 11 inches. The driver's seat shall be strongly attached, shall have vertical adjustment, and shall have fore-and-aft adjustment of not less than 4 inches. Driver's seat anchorage shall comply with acceptable installation procedures.

34. STANCHIONS AND GUARD RAILS

a. Vertical stanchion shall be installed at right rear corner of driver's seat in such position as neither to interfere with adjustment of driver's seat nor to obstruct 12-inch aisle. Guard rail shall be so placed as not to interfere with fore-and-aft adjustment of driver's seat, shall not be higher than driver's seat back adjustment to its lowest position, and shall extend from vertical stanchion to left-hand wall behind driver's seat.

b. Vertical stanchion shall be installed at rear of entrance step-well from roof to floor. Placement shall not restrict passageway at any level to less than 24 inches nor aisle to less than 12 inches.

c. Guard rail and step-well guard panel shall be installed from step-well stanchion to right-hand wall to prevent children in front seat from being thrown into step-well in case of sudden stop. Guard rail shall be approximately 30 inches above floor and its guard panel shall not restrict entrance passageway to less than 24 inches at any level. Panel shall extend from guard rail to within 2 inches of floor. If panel extends over or into step-well opening, it must be flanged at floor line so as to close any opening between panel and floor.

d. Clearance between step-well guard panel and first pupil seat shall be at least 24 inches measured from panel to front face of seat back at cushion height.

e. All stanchions and guard rails shall be of steel or equivalent strength tubing having minimum outside diameter of 1 inch. Stanchions and guard rails shall be padded with an energy-absorbing material designed to minimize injury-producing impact forces. Padding on stanchions shall extend to within 3 inches of bus ceiling and to within 3 inches of bus floor. Padding on each guard rail shall extend from bus wall to its farthest support.

35. STEERING WHEEL

See Item d under Steering Gear on page 13.

36. STEPS

a. 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.

b. Service door entrance may be equipped with two-step or three-step step-well. Risers in each case shall be approximately equal. When plywood floor is used on steel, differential may be increased by thickness of plywood used.

c. Steps shall be enclosed to prevent accumulation of ice and snow.

d. Steps shall not protrude beyond side body line.

e. A "grab handle" or "grab rail" shall be provided in an unobstructed location inside the doorway and it shall extend down into and be anchored in the step-well so that it may be reached by small children boarding the bus.

37. STEP TREADS

a. All steps, including floorline platform area, shall be covered with 3/16-inch rubber metal-backed treads with at least 1½-inch white nosing (or 3-inch white rubber step edge with metal back of floor-line platform area).

(1) Step tread minimum overall thickness shall be 3/16-inch ribbed design, similar to ribbed design of the rubber aisle;

(2) 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;

(3) 3/16-inch ribbed step tread shall have a 1½-inch white nosing as integral piece without any joint;

(4) Rubber portion of step treads shall have following characteristics:

(a) Special compounding for good abrasion resistance and high coefficient of friction

(b) Flexibility so that it can be bent around a ½-inch mandrel both at 130 degrees F and 20 degrees F without breaking, cracking, or crazing

(c) Show a durometer hardness 85 to 95.

38. STIRRUP STEPS

There shall be one stirrup step and suitably located handle on each side of front of body for easy accessibility for cleaning windshield and lamps.

Exception - transit and metropolitan vehicles

A step, in lieu of the stirrup steps, is permitted in or on the front bumper.

39. *STOP SIGNAL ARM

a. The stop signal arm shall be a flat 18-inch octagon, exclusive of brackets for mounting.

b. The arm shall be constructed of aluminum alloy with a minimum gauge of .080 and temper of 5052-H34 or equivalent.

c. It shall have the word "STOP" printed on both sides in silver letters at least 6 inches high, with a stroke width of approximately 7/8 inch on bright red background. The border or outer edge shall be one-half inch wide silver.

d. The color shall conform to the colors specified by the "Manual on Uniform Traffic Control Devices for Streets and Highways," 1972 edition or latest issue.

e. The entire sign, including letters, shall be reflectorized and shall have the following minimum brightness values at $.2^{o}$, $.5^{o}$, and 1.5^{o} divergence angle expressed as average candlepower per footcandle per square foot of material. Measurements shall be conducted in accordance with standard photometric testing for reflex-reflectors paragraph 4.47 of Federal Specifications LS 300A "sheeting and tape, reflective; Non-exposed lens adhesive backing" or as amended.

Silver-White

Div. Angle Inc. Angle	$.2^{0}$	$.5^{0}$	1.5^{0}
- $.4^{0}$	250.0	95.0	4.0
40^{0}	120.0	54.0	2.0

Wet performance measurements shall be conducted in accordance with standard rainfall test specified in Federal Specification LS 300A and the brightness of the reflective sheeting totally wet by rain shall not be less than 90% of the above values.

Before mounting on the substrate, the reflective sign face shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. All copy shall be sharply defined and clean cut.

The reflective sign face shall be mechanically applied in a manner recommended by the sheeting manufacturer.

The manufacturer shall certify that all signs conform to this specification and will replace without cost all signs that fail to meet these requirements.

f. The sign shall be mounted outside the bus on the left side opposite the driver and immediately below the window. Rubber spacers shall be so installed on either the side of the bus or the stop arm so as to prevent sign from making abrasive contact with side of bus.

g. The stop arm shall be vacuum or air operated and the system must positively hold the sign in extended or retracted position to prevent whipping in the wind.

h. The school bus body manufacturer shall install a separate vacuum tank as a stop arm reservoir on all chassis equipped with vacuum-over-hydraulic brakes. This tank is to be connected to the stop arm only and shall have a minimum capacity of 1,000 cubic inches.

i. The air for an air-operated stop arm shall come from a connection to the air line serving the regular air brake system. Body supplier shall provide the necessary check valve and pressure reduction valve to safeguard the air supply for brake application.

j. The stop arm control valve is to be activated by a switch that makes contact when the entrance door handle is moved toward the open position provided that the eight-light flashing warning-light activating system has been switched on.

40. *STORAGE COMPARTMENTS

a. An enclosed space shall be provided in the driver's compartment for storing manuals and bus driver records.

b. A compartment for storing the fire extinguisher, first-aid kit, and other equipment under lock and key may be installed provided that the locking device is connected with an audible warning signal to notify the driver of the locked compartment when the ignition is turned on. This compartment shall be located in the driver's area of the bus and must be labeled or have a transparent cover to enable the driver to see the contents.

c. In addition, a metal container of adequate strength and capacity for storage of tire chains and/or tow chains and such tools as may

be necessary for minor emergency repairs while the bus is enroute may be provided but is not required. If provided, it may be located either inside or outside the passenger compartment but, if inside, it shall have a cover (seat cushion may not serve for this purpose) and be securely fastened to floor or seat frame. The container must have a latch to keep the cover securely fastened to it in such manner as to prevent contents from spilling in case the bus overturns.

41. SUN SHIELD

There shall be installed on the windshield header an interior sun visor which is double bracketed, adjustable and not less than 6 inches wide and 30 inches long.

42. TAILPIPE

The tailpipe shall not extend beyond the rear bumper. (See item b under Exhaust System, page 7.)

43. TOW HOOKS, REAR

Tow hooks on the rear are optional. If provided, however, they shall be attached to the chassis frame and located under the rear bumper so that the hook portion is under the body.

44. *UNDERCOATING

Entire underside of bus body, including floor sections, cross members, 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 [26] using modified test procedures* for following requirements:

a. Salt spray resistance - pass test modified to 5% salt and 1,000 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[24] with modified procedure requiring that tests be made on a 48-hour air cured film at thickness recommended by compound manufacturer.

---

[26] Federal Specification TT-C-520a, titled: Coating Compound, Bituminous, and Solvent Type, Underbody, (for Motor Vehicles). Available from General Services Administration, Specification Sales, Bldg. 197, Washington Navy Yard, Washington, D. C. 20407.

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. Undercoating is expected to prevent rust under all bus service conditions for minimum of five years.

45. *VANDAL LOCK

A vandal locking system on the bus is permissible in accordance with the following requirements:

a. The entrance door is to be locked by an exterior key with a dead bolt or a remote control (cable) type of device. The system must prevent the door from being accidentally locked by any motion the bus may encounter during its normal operation.

b. The emergency door is to be locked by an interior slide bolt which shall activate a buzzer when the door is locked and the ignition of the bus is turned on to warn the driver that the emergency door is locked. It shall not have an ignition interlock whereby a locked emergency door would prevent the driver from starting the bus.

46. VENTILATION

a. Body shall be equipped with suitable, controlled ventilating system of sufficient capacity to maintain proper quantity of air under operating conditions without opening of windows except in extremely warm weather.

b. Static-type non-closable exhaust ventilator shall be installed in low-pressure area of roof.

47. WHEEL HOUSINGS

a. Wheel house openings shall allow for easy tire removal and service.

b. Wheel housings shall be designed to support seat and passenger loads and shall be attached to floor sheets in such manner as to prevent any dust or water from entering the body.

c. Inside height of wheel housings above floor line shall not exceed 10 inches.

d. Wheel housings shall provide clearance for chains on dual wheels as established by National Association of Chain Manufacturers.[27]

---

[27] 111 West Washington Street, Chicago, Illinois 60602.

48. WINDSHIELD AND WINDOWS

a. All glass in windshield, windows, and doors shall be of approved safety glass,[28] so mounted that permanent mark is visible, and of sufficient quality to prevent distortion of view in any direction.

b. Glass in windshield may be heat-absorbing and may contain a shaded band across top. Location of "fade out" shall be above upper limit for minimum visibility.

c. Glass in all side windows, doors, and rear windows shall be AS-2 or better grade, as specified in Z26.1-1966. [28]

*d. All full side windows are to be "split-sash" type. Minimum window width shall be 22 inches. The amount of window travel shall not be less than 9 inches and not more than 10 inches. All exposed edges of glass shall be banded. (This prohibits single sash windows.)

*e. Sealed double glass is required in the window adjacent to the service door on the right side of the bus, the driver's window, and the window adjacent to it on the left side of the body.

49. WINDSHIELD WASHERS

The bus shall be equipped with electric windshield washers which shall conform to the body manufacturer's recommendation as to type and size for the bus on which they are to be used.

50. WINDSHIELD WIPERS

a. The bus shall be equipped with two positive-action, variable-speed windshield wipers of air or electric type. All wipers by design and installation shall provide desirable vision for the driver and shall meet the requirements of Federal Motor Vehicle Safety Standard No. 104.

b. Two separate heavy-duty motors, with separate switches, shall be provided and equipped with blades of sufficient length to clear windshield glass in driver's direct view.

c. The windshield wiper blades and arms shall be of the heavy-duty type. The blades must be at least 14 inches in length.

d. All wiper controls shall be located within easy reach of the driver and designed, when in stop position, to move blades from the driver's direct view.

---

[28] Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways (Z26.1-1966) obtainable from American National Standards Institute, 1430 Broadway, New York, New York 10018.

51. WIRING

a. All wiring shall conform to current standards of the Society of Automotive Engineers.[29]

b. Circuits:

(1) The wiring shall be arranged in at least nine regular circuits, as follows:

(a) head, tail, stop (brake), clearance, identification, and instrument panel lamps

(b) step-well lamp (Step-well lamp shall be activated when service door is opened.)

(c) dome lamps

(d) starter motor

(e) ignition and emergency door signal

(f) turn signal lamps

(g) alternately flashing warning signal lamps

(h) horn

(i) heaters, defrosters

(2) Any of the above combination circuits may be subdivided into additional independent circuits.

(3) Whenever possible, all other electrical functions (such as sanders and electric-type windshield wipers) shall be provided with independent and properly protected circuits.

(4) Each body circuit shall be color coded and a diagram of the circuits shall be attached to the body in a readily accessible location.

c. A separate fuse or circuit breaker shall be provided for each circuit except starter motor and ignition circuits.

d. All wires within the body shall be insulated and protected by a covering of fibrous loom (or equivalent) which will protect them from external damage and minimize dangers from short circuits. Whenever wires pass through a body member, additional protection in form of appropriate type of insert shall be provided.

---

[29]485 Lexington Avenue, New York, New York 10017.

SMALL VEHICLES (Type II)

(* - Denotes change from previous standard.)

1. *Capacity 10-16

Must meet the same requirements for school buses of 17 capacity and over with the following exceptions:

a. The output of the alternator shall be at least 85 amperes with a minimum charging rate of 40 amperes at the manufacturer's recommended engine idle speed and shall be ventilated and voltage controlled.

b. The battery shall have an ampere hour rating of at least 70 at 12 volts, measured at the 20-hour rate.

c. The clutch shall have a minimum diameter of 11 inches.

d. The gasoline tank shall have a capacity of at least 22 gallons.

e. The first-aid kit shall be of a ten (10) unit size.

f. The axles, springs, and tires are to be commensurate with the manufacturer's maximum gross vehicle weight rating.

2. *Capacity less than 10

Family type passenger vehicles with manufacturer's rated capacity of less than ten (10) may be used in accordance with the following:

a. The vehicle must be painted a color other than National School Bus Glossy Yellow.

b. The vehicle shall not be equipped with a stop signal arm or flashing warning signal lamps.

c. The vehicle may display the words, "SCHOOL BUS," but it is not required. If used, however, the signs shall be national school bus glossy yellow in color with black letters 6 inches high. The sign shall be of a type that can be dismounted, turned down, or covered when the vehicle is not transporting pupils to and from school.

d. The vehicle shall carry a ten (10) unit first-aid kit. (See page 25.)

e. The vehicle shall carry a dry chemical fire extinguisher of at least 2½ pound capacity with a rating of 10-B:C. The extinguisher shall be equipped with a calibrated or marked gauge.

NOTE: Van type conversion units are not acceptable.

VEHICLES FOR TRANSPORTING HANDICAPPED CHILDREN

1. General Requirements

Vehicles constructed for transporting handicapped children shall comply generally with the minimum standards for school buses, but because of the use of special equipment, certain modifications in these minimum standards must be made. This section lists, with respect to vehicles constructed or modified for transportation of handicapped children (a) standards for special equipment, and (b) exceptions required in minimum standards for school buses.

2. Special Equipment

a. Special service door

(1) A special door opening shall be located on the right side of the bus and far enough to the rear to prevent the door, when opened, from obstructing front right service door. The door opening shall be not less than 48 inches in width.

(2) The door shall be made of two panels of approximately equal width, equipped with hinges and hinged to the side of the bus, and each panel shall open outward. The forward panel shall be provided with an overlapping flange to close space where door panels meet and weather seal shall be provided to close all door edges.

(3) The door shall be equipped with at least one-point fastening device on rear panel to the floor or header and at least two-point fastening device to the floor and header on forward door panel, both manually operated.

(4) The door shall be equipped with a device that will actuate audible or visible signal located in driver's compartment when doors are not securely closed.

(5) Each door shall contain fixed or movable window aligned with the lower line of other windows of the bus and as nearly as practical of same size as other bus windows.

(6) Each door panel shall open outward and a positive fastening device shall be installed to hold the door in an open position.

(7) The door panels shall be constructed to be equivalent in strength and materials to other school bus doors.

(8) When ramps are used, the door panels shall extend below the floor line to cover ramp container opening. When power lifts are used, the door panels shall extend below to full length of the skirt.

(9) The door posts and headers shall be reinforced sufficiently to provide support and strength equivalent to areas of side of bus not used for service doors. Outriggers from chassis shall be installed at front and rear of door opening to support the floor with same strength as other floor portions.

3. Ramp

a. If ramp is used, it shall be of sufficient strength and rigidity to support wheel chair, occupant, and attendant. It shall be equipped with protective flange on each longitudinal side to keep the wheel chair on ramp. A flexible rubber skirting shall be installed on the edges of the ramp.

b. The floor of ramp shall be covered with non-skid material.

c. The ramp shall be of weight, and equipped with handle or handles, to permit one person to put the ramp in place and to return it to storage place.

d. Provisions shall be made to secure the ramp to side of the bus for use without danger of detachment, and the ramp shall be connected to the bus at floor level in such manner as to permit easy access of the wheels of wheel chair to the floor of the bus.

e. The ramp shall be at least 88 inches in length and the width of the ramp shall conform generally to the width of the door opening.

f. A dustproof and waterproof enclosed container shall be provided if the ramp is stored under the floor.

4. Power Lift

a. If a power lift is used, it shall be of sufficient capacity to lift the wheel chair, occupant, and attendant.

b. The power lift shall be mounted to the chassis frame.

c. The power lift platform shall be not less than 26 inches in width nor less than 45 inches long including guard panels or rails.

d. The power lift platform shall be covered with non-skid material.

e. A self-adjusting steel or equivalent ramp of sufficient width to minimize incline to lift the platform shall be attached to the lift platform. The ramp shall be equipped with skid-resistant surface.

f. The power lift unit shall be controlled from panel within the bus and adjacent to the left and be capable of operation by attendant standing upon the left is in any position.

g. A device shall be installed which will be used to prevent operation of a lift until the doors are opened.

5. Stanchions

A stanchion, guard rail, and guard panel shall be installed at both the rear and front edges of the special service door opening extending into the bus. If power lift is used, a chain shall be installed between stanchion posts to enclose area of power lift.

6. Fastening Devices for Wheel Chairs

Positive fastening devices shall be provided, attached to the floor or walls or both, that will securely hold wheel chairs in position when in the bus.

7. Seats

Seats do not have to be forward facing if seat belts are used.

8. Seat Restraining Devices

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

9. Aisles

All aisles, including aisles leading to emergency door shall be wide enough to permit passage of a wheel chair.

10. Special Light

A light shall be placed inside the bus over special service door and shall be operated from the door area.

11. Grab Handles

Grab handles shall be provided on each side of the front right service door on buses constructed for transportation of handicapped children.

12. Fuel Tank

The fuel tank may be located behind the rear wheels, inside or outside of the chassis frame, with the fill-pipe located on the right side of the body.

A P P E N D I X

Suggested Method for Estimating Generator or Alternator Capacity

Constant Load

Equipment	Number of Units	Current Draw (Amperes)
Ignition . . . . . (Average)		2.50
Headlamps (Type 2 dual lower beam)	2	8.40
Tail lights	2	1.18
Clearance lights	4	2.36
Cluster lights	6	3.54
Body instrument panel		.80
Primary front heater motors	2	24.00
Primary defroster motor	1	12.00
Supplementary front heater motor	1	12.00
Underseat heater motors	2	10.50
Underseat heater motor	1	8.50
Defroster fan motor	1	3.50
Windshield wipers		14.00
Fuel pump		3.00

Intermittent Load

Emergency door buzzer		1.00
Flasher motor		2.90
Alternately flashing signal lamps	2	11.60
Step-well and 6 interior dome lights		5.64
Individual additional dome lights		.94
Stop (brake) lights	4	6.60
Turn signals	2	2.36

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

Constant Load + 35% of Intermittent Load = Total Load

FORMULA FOR CALCULATING POWER AND GRADEABILITY

$$G = \frac{33750 \times H.P.}{G.V.W. \times M.P.H.} - 1.5$$

(For buses having seating capacity up to and including 67 pupils)

Or

$$-1.2$$

(For buses having seating capacity of 68 or more pupils)

Where G = Grade in percent
H.P. = Certified net horsepower delivered at road speed (M.P.H.)
G.V.W. = Gross vehicle weight
M.P.H. = Miles per hour vehicle is driven
Rolling Resistance = 1.5 or 1.2 (depending on seating capacity of bus)

WEIGHT
FEDERAL CERTIFICATION REQUIREMENTS

A Federal Law, Part 568, requires the school bus body manufacturer to certify the Front and Rear "Gross Axle Weight Rating" and Total "Gross Vehicle Weight Rating" of completed buses.

When the body company receives a chassis equipped with axles, springs, or tires of insufficient size to support the required pupil capacity rating, the company cannot legally supply the capacity size of body requested. It is important, therefore, that careful attention be given to these items in the bid purchase proposal.

On the following page are data from "Minimum Standards for School Buses" which will serve as a guide for the average GVW, the load distribution, and tire size. These are minimum requirements and the added weights of optional equipment such as plywood flooring, automatic transmission, air brakes, etc. have not been considered in establishing these ratings.

Body weights vary widely from one bus manufacturer to another. Also, special body models may vary in weight and require larger axle or tires. Therefore, it is advisable to check with the body company representatives to be certain that you are specifying axles and tires of adequate size. In fact, some districts purchase the school bus body prior to asking for bids on the chassis. This enables the chassis dealer to bid on a specific bus body model.

DEFINITION OF TERMS

Front GAWR - Front Gross Axle Weight Rating. This is the maximum value in pounds that can be placed on the front wheels. It is based on the capacity of the front tires or front axle, whichever is least.

Rear GAWR - Rear Gross Axle Weight Rating. This is the maximum value in pounds that can be placed on the rear wheels. It is based on the capacity of the rear tires or rear axle, whichever is least.

GVWR - Gross Vehicle Weight Rating. This is the maximum total value in pounds that a fully loaded vehicle may weigh. This value is determined in different ways by the various chassis manufacturers.

GVW - Gross Vehicle Weight. This is the estimated value in pounds which a vehicle will weigh when filled to rated seating capacity with 120 pound passengers and with a 150 pound driver.

DATA FROM "MINIMUM STANDARDS FOR SCHOOL BUSES"

Chassis size/capacity	36	42	48	54	60	66	73
1. Recommended manufacturer's rated GVW	15,000	17,000	17,000	19,000	21,000	22,000	27,000***
Calculated avg. GVW (120 lbs. per pupil)	13,800	15,800	16,700	18,000	20,100	21,600	26,500***
2. a) Est. part of GVW front axle **	3,698	5,056	4,625	4,860	5,680	5,724	8,650
b) % Est. weight, front axle	26.8	32	27.7	27	26.3	26.5	32.6
c) Est. part of GVW rear axle**	10,102	10,744	12,074	13,140	14,420	15,836	17,850
d) % Est. weight, rear axle	73.2	68	72.3	73	73.7	73.7	67.4
3. Recommended tire size (w/tube)	7.50-20	7.50-20	8.25-20	8.25-20	9.00-20	9.00-20	10.00-20***
Ply rating	8 or 10	8 or 10	10	10	10	10	12
Rim size (w/tube)							
Preferred	6.0	6.0	6.5	6.5	7.0	7.0	7.5
Alternate			6.0	6.0	6.5	6.5	7.0

School bus operators should follow current recommended tire inflation tables of Tire & Rim Association.

**Approximate weights on axles are calculated by formula which does not provide for reserve capacity.

***The calculations in this column are for the 73-pupil capacity pusher school bus, but are not intended to limit the use of a forward control transit school bus.